Curriculum of Diploma Programme

in

Computer Science and Information Technology

**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	CourseTitles	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
2400102B	**ASC**	**Applied Physics -B** (CSE, AIML, EE, ELX, ELX (R))	03	-	04	02	09	06
2420103	**BEC**	**Fundamentals of Electrical and Electronic Engg.** (CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)	03	-	04	02	09	06
2418104	**BCC**	**Fundamental of IT System** (CSE, AIML)	03	-	04	02	09	06
2420105	**BEC**	**Electrical & Electronics Workshop** (EE, ELX, CSE, AIML)	-	-	04	02	06	03
2418107	**BCC**	**ICT Tools** (CE, ME, ME (Auto), FTS, CSE, AIML, MIE, CRE, CHE, FPP, TE, CACDDM, GT)	-	-	04	02	06	03
2400007	**NRC**	**Indian Constitution** (Common for All Programmes)	01	-	-	-	01	01
2400009	**NRC**	**Open Educational Resources** (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)	01	-	-	-	01	01
Total			**13**	**1**	**20**	**12**	**46**	**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. to deliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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 = (1 x 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	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
			Theory Assessment (TA)		Term work & Self-Learning Assessment (TWA)		Lab Assessment (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
2400102B	**ASC**	**Applied Physics –B** (CSE, AIML, EE, ELX, ELX (R))	30	70	20	30	20	30	200
2420103	**BEC**	**Fundamentals of Electrical and Electronic Engg.** (CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)	30	70	20	30	20	30	200
2418104	**BCC**	**Fundamental of IT System** (CSE, AIML)	30	70	20	30	20	30	200
2420105	**BEC**	**Electrical & Electronics Workshop** (EE, ELX, CSE, AIML)	-	-	20	30	20	30	100
2418107	**BCC**	**ICT Tools** (CE, ME, ME (Auto), FTS, CSE, AIML, MIE, CRE, CHE, FPP, TE, CACDDM, GT)	-	-	20	30	20	30	100
2400007	**NRC**	**Indian Constitution** (Common for All Programmes)	25	-	-	-	-	-	25
2400009	**NRC**	**Open Educational Resources** (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)	25	-	-	-	-	-	25
Total			**170**	**280**	**120**	**180**	**100**	**150**	**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 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.

A) Course Code : 2400101(T2400101/S2400101)

B) Course Title : Basic Engg. Mathematics
(CE, ME, ME (Auto), CSE, EE, ELX, ELX (R), AIML, MIE, CRE, CHE)

C) Pre-requisite Course(s) :

D) Rationale :

This course is an extension of the course based on Mathematics of the first semester namely Basic Engineering Mathematics. The course is designed to inculcate its application in relevant branches of engineering and technology. With calculus, we can find how the changing conditions of a system affect us, and we can control a system. Definite integral is a powerful tool that helps us realize and model the world around us. Differential equations are widely applied to modern natural phenomena, engineering systems, and many other situations. Numerical methods offer approximate but credible accurate solutions to problems that are not readily or possibly solved by closed-form solution methods. On the other hand, Numerical integration is a computational (approximate) approach to evaluating definite integrals. It has a lot of applications in engineering such as in the computation of areas, volumes, and surfaces. It also has the advantage of being easily programmable in computer software. Probability distributions are useful for modeling, simulation, analysis, and inference on varieties of natural processes and physical phenomena. A situation in which an experiment is repeated a fixed number of times can be modeled, engineers need to apply existing knowledge of success and failure to a specific analytical scenario.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of the following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor, and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

- **CO-1** Demonstrate the ability to solve engineering-related problems based on applications of algebra.
- **CO-2** Use the concept of derivative as a tool to solve engineering-related problems.
- **CO-3** Apply differential calculus to solve branch-specific problems.
- **CO-4** Use the concept of Coordinate geometry to solve branch-specific engineering-related problems.
- **CO-5** Apply techniques and methods of probability and statistics to crack branch-specific problems.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Program Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	-	-	-	-	-	-		
CO-2	3	1	-	-	-	-	-		
CO-3	3	1	1	-	-	-	1		
CO-4	3	1	-	-	-	-	-		
CO-5	3	2	1	1	-	-	1		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400101	Basic Engg. Mathematics	02	01	-	02	05	04

Legend:

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

LI: Laboratory Instruction (Includes experiments/ practical performances / problem-based experiences in laboratory, workshop, 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= (1xCIhours) + (0.5xLIhours) + (0.5xNotionalhours)

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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work& Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400101	Basic Engg. Mathematics	30	70	20	30	-	-	150

Legend:

PTA: Progressive Theory Assessment in the classroom (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 assignments, micro-projects, seminars, 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 for internal as well as external assessment may vary as per the requirement of the respective course. For valid and reliable assessment, the internal faculty should prepare a 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 the 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: 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, tanx, 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. *TSO 3b.* Solve simple problems based on Rolle's Theorem and Mean Value Theorem.	**Unit-3.0 Application of Differential Calculus** 3.1 Successive differentiation up to second order. 3.2 Rolle's Theorem and Mean Value Theorem (without proof) with examples.	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
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.	3.3 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 open source 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
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.
5. Prepare a chart consisting of 8-10 engineering-related functions whose derivative does not exist.
6. Prepare a model showing the application of Rolle's Theorem to determine the projectile trajectories of maximum height.
7. Prepare a chart consisting of any 10 applications of the Mean value theorem related to real-world problems.
8. Model to maximize the volume of a box made of a rectangular tin sheet by cutting off squares of the same size from each corner and folding them up. Also, design models for at least 5 similar situations and prepare a soft file with animation.
9. Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
10. Prepare models using the concept of the radius of curvature to bending of railway track.

11. Make a short video of duration 5-7 minutes for the use of Derivative to calculate the profit and loss in business using graphs.
12. Download 5-7 videos based on applications of Derivative to check the temperature variation, find the range of magnitudes of the earthquake, etc. Watch them and write a report to detail the mathematical steps involved.
13. Prepare the Charts of formulae showing different forms of straight lines for engineering applications.
14. Draw the graph for the standard equations of Circle, Parabola, Ellipse, and Hyperbola on the Chart paper using any open-source software and make a file.
15. Prepare the Charts consisting tree diagram to find the probability of a given event.
16. Collect the data of World of Work and find the mean, mean deviation, and standard deviation for that data using any open-source software of Statistics and make a soft copy.
17. Download 5-7 videos based on applications of probability for the weather forecast, watch them, and write a report to detail the mathematical steps involved.

c. Other Activities:

1. Seminar Topics:
    - Applications of Integral calculus in control systems, dynamics, and vibrations.
    - Applications of determinants and matrices in graphic design to make digital images.
    - Application of determinants and matrices for calculating the battery power outputs.
    - Application of Vector algebra in engineering mechanics.
    - Application of limit and continuity to measure the strength of the magnetic field and electric field.
    - Applications of Derivatives for engineering & technology.
    - Application of radius of curvature for Engineering and Science.
    - Applications of Derivatives in the economy to compute the level of output at which the total revenue is the highest, the profit is the highest, and (or) the lowest, etc.
    - Applications of Coordinate geometry to design of athletic tracks, recreational parks, building plans, roundabouts, Ferris wheels.
    - Application of ellipses to be used to orbits of planets, satellites, moons comets, etc.
    - Probability and statistics: Civil engineering, estimation of model uncertainties, identification of probability distribution.
2. Visits: Visiting the following places would provide students an opportunity to see the application of various branches of mathematics in different fields. This will also help students to comprehend the career opportunities available in the field of mathematics.
    - Visit to a mathematics museum.
    - Visit a mathematics research institute.
    - Visit to a mathematics laboratory.
    - Visit to a Data Science Center.
    - Visit the mathematics department of a college or university.
    - Visit a mathematics software company.
    - Visit to a Cryptography Company.
    - Visit to a Space Agency.
    - Visit to a Game Studio.
    - Visit to a mathematics library.
    - Attend Mathematical conferences on real-world problem-solving.
    - Participation in mathematics competitions.

3. Self-Learning Topics:
    - Participate in MOOCs based Course on Matrix offered by Foreign University: Methods and Applications.
    - Participate in an MOOCs-based Course on Differential Calculus: Methods and Applications.
    - Participate in MOOC-based Courses on Probability and its Engineering applications.
    - Participate in MOOC-based Courses on Statistics and its Engineering applications.
    - Watching videos on applications of coordinate geometry to Real-world problems.

M) **Suggested Course Evaluation Matrix:** The course teacher has to decide and use the 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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	20%	20%	15%	15%	25%	-	-
CO-2	15%	20%	20%	20%	15%	-	-
CO-3	20%	15%	15%	15%	10%	-	-
CO-4	20%	20%	25%	25%	25%	-	-
CO-5	25%	25%	25%	25%	25%	-	-
Total Marks	**30**	**70**	**20**	**20**	**10**	**-**	**-**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

- The percentages given are approximate
- In the case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided among all those COs mapped with total experiments.
- For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises questions related to the achievement of each CO.

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

Unit Title and Number	Total Classroom Instruction (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Algebra	8	CO1	12	4	4	4
Unit-2.0 Differential Calculus	10	CO2	14	4	8	2
Unit-3.0 Application of Differential Calculus	8	CO3	12	4	4	4
Unit-4.0 Co-ordinate Geometry	10	CO4	14	4	6	4
Unit-5.0 Probability and Statistics	12	CO5	18	4	6	8
Total	**48**	**-**	**70**	**20**	**28**	**22**

Note: A similar table can also be used to design class/mid-term/ internal question papers for progressive assessment.

O) Suggested AssessmentTable for Laboratory (Practical): (Not Applicable)

P) Suggested Instructional/ Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lectures, Tutorial, Case Methods, Group Discussions, Industrial visits, Industrial Training, Field Trips, Portfolios, Learning, Role Play, Live Demonstrations in Classrooms, Labs, Field Information, and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	High-end computers	Processor Intel Core i7 with Compilers and Programming Languages; RAM 32 GB, DDR3/DDR4, HDD 500 GB, OS Windows 10.	All
2.	Software	Scientific Calculators, Graphing Calculator, SCILAB, GraphEq^2.13, Microsoft Mathematics, GeoGebra, Math3D	1,2,3,4,5
3.	Printer	High-Speed Duplex Printer	
4.	Scanner	Handheld 3D scanner, Accuracy up to 0.1 mm, Resolution up to 0.2 mm, Wireless technology with an inbuilt touch screen and battery, Extended field of view for capturing both large and small objects.	

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Elementary Engineering Mathematics	B. S. Grewal	Khanna Publishers,15th Edition. ISBN: 978-81-7409-257-1
2.	Engineering Mathematics (Third edition)	Croft, Anthony	Pearson Education, New Delhi, 2014. ISBN 978-81-317-2605-1
3.	Calculus and Its Applications	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
4.	Calculus and Analytic Geometry	G. B. Thomas, R. L. Finney	Addison Wesley, 9th Edition, 1995. ISBN 978-8174906168
5.	Understanding Engineering Mathematics	John Bird	Routledge; First Edition ISBN 978-0415662840
6.	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publ., New Delhi,2014, ISBN: 978-0-470-45836-5
7.	Indian Mathematics Engaging with the World from Ancient to Modern Times	George Gheverghese Joseph	World Scientific Publishing Europe Ltd. 57ISBN 978-17-86340-61-0
8.	A Modern Introduction to Ancient Indian Mathematics	T.S. Bhanumurthy	New Age International Private Limited, 1 January 2008 ISBN- 10. 812242600X, ISBN- 13. 978-8122426007
9.	Mathematics-I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
10.	Mathematics-II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3

11.	Consider Dimension and Replace Pi	M.P. Trivedi and P.Y. Trivedi	Notion Press; 1st edition (2018), ISBN: 978-1644291795
12.	Sansar Ke Mahan Ganitagya	Gunakar Muley	First Edition, Rajkamal Prakashan, ISBN-10. 8126703571, ISBN-13. 978-8126703579.

(b) Online Educational Resources:

1. https://ocw.mit.edu/
2. https://tutorial.math.lamar.edu/
3. https://www.khanacademy.org/
4. https://www.feynmanlectures.caltech.edu/
5. https://www.wolframalpha.com/
6. https://www.dplot.com/
7. https://www.geogebra.org/
8. https://www.easycalculation.com/
9. https://www.scilab.org/
10. https://www.desmos.com/
11. https://nptel.ac.in/
12. https://swayam.gov.in/
13. https://ndl.iitkgp.ac.in/
14. https://parakh.aicte-india.org/
15. https://ekumbh.aicte-india.org/
16. https://learnengg.com/LE/Index
17. https://ncert.nic.in/textbook.php
18. https://nios.ac.in/online-course-material/sr-secondary-courses/mathematics-(311).aspx

Note: Teachers are requested to check the Creative Commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others:

1. Online Mathematics Courses.
2. Mathematics Communities and Forums.
3. Mathematics Journals.
4. Mathematics Podcast.
5. Mathematics Tutorials.
6. Mathematics Quizzes.
7. Mathematics Animation.
8. Mathematics Simulations.
9. Mathematics Games.
10. Mathematics Puzzles.
11. Mathematics Brain Teasers.
12. Mathematics Apps.
13. Mathematics Blog.
14. Mathematics Challenges.

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A) Course Code **: 2400102B (T2400102B/P2400102B/S2400102B)**

B) Course Title **:** Applied Physics – B (CSE, AIML, EE, ELX, ELX (R))

C) Pre- requisite Course(s) **:**

D) Rationale **:**

Physics is the natural science that studies the fundamental principles governing matter, energy, space, and time. Engineering physics is a branch of applied physics that focuses on the application of physics principles to engineering problems. Graduates of diploma engineering programs are expected to have a solid foundation in physics that they can apply to real-world problems, including in industrial settings. This curriculum aims to prepare students to be successful in the workforce by providing them with a deep understanding of physics concepts and their practical applications, including in industrial settings. This curriculum also includes examples of industrial applications of physics principles in areas such as robotics, electrical power generation and transmission, digital electronics and communication, and semiconductor technology. This course will help the diploma engineers to apply the basic concepts and principles of physics for solving various broad-based engineering problems and comprehend different state of art technology-based applications.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

CO-1 Estimate the errors in measurements of physical quantity with precision.

CO-2 Apply the concept of waves for various engineering applications involving wave dynamics.

CO-3 Apply the concepts of electromagnetics in engineering applications.

CO-4 Use semiconductor devices for various electronics related applications.

CO-5 Apply the basic concepts of modern physics for solving engineering problems.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	-	-	1	-	1	1		
CO-2	3	1	1	1	-	1	1		
CO-3	3	2	1	1	1	1	1		
CO-4	3	2	1	1	1	1	1		
CO-5	3	1	1	1	1	1	2		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400102B	Applied Physics- B	03	-	04	02	09	06

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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 = (1 x 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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400102B	Applied Physics- B	30	70	20	30	20	30	200

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 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: T2400102B

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Distinguish between fundamental and derived physical quantity. *TSO 1b.* Estimate the errors in the measurement of given physical quantity. *TSO 1c.* Derive dimensional formula of given physical quantity. *TSO 1d.* Apply dimensional analysis for inter conversion of units. *TSO 1e.* Establish relation among physical quantities using dimensional analysis. *TSO 1f.* Use dimensional analysis to check the correctness of a given equation.	**Unit-1.0 Unit and Measurements** 1.1 Physical quantities, fundamentals and derived units and system of units 1.2 Accuracy, precision and errors (systematic and random) in measurements, Method of estimation of errors (absolute and relative) in measurement, propagation of errors, significant figures 1.3 Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimension in an equation 1.4 Applications of dimensions: conversion from one system of units to other, corrections of equations and derivation of simple equations. 1.5 Ancient astronomical instruments: Chakra, Dhanuryatra , Yasti and Phalaka yantra .	**CO1**
TSO 2a. Explain the various terms related to SHM. *TSO 2b.* Distinguish between mechanical and electromagnetic waves with examples. *TSO 2c.* Differentiate between longitudinal and transverse waves with examples. *TSO 2d.* Find the relation between the terms used to describe wave motion. *TSO 2e.* Explain the principle of Superposition of waves	**Unit-2.0 Simple Harmonic and Wave Motion** 2.1 Periodic and Oscillatory Motion 2.2 Simple Harmonic Motion (SHM): Displacement, velocity, acceleration, time period, frequency and their interrelation 2.3 Types of waves: Mechanical and Electromagnetic, Transverse and longitudinal waves, wave velocity, frequency and wave length and their relationship, wave equation, amplitude, phase, phase difference, Superposition of waves	**CO2**
TSO 3a. Derive an expression for electric field experienced by electric charge in the vicinity of another electric charge(s). *TSO 3b.* Differentiate between electric potential and potential difference. *TSO 3c.* Apply Gauss' law to find the electric field intensity due to charge bodies. *TSO 3d.* Describe factors affecting the capacitance of a given capacitor. *TSO 3e.* Find the expression for magnetic field caused by current carrying circular wire at the center. *TSO 3f.* Explain Faraday's law of electromagnetic induction and Lenz's with applications. *TSO 3g.* Explain the terms required to describe the AC current	**Unit-3.0 Electrostatics, Electromagnetism and Electric Current** 3.1 Electric Charge, Coulomb's law, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Electric dipole 3.2 Gauss' law, electric field intensity due to straight charged conductor, charged plane sheet and charged sphere 3.3 Dielectric, Capacitance of capacitor (parallel plate), Factor affecting capacitance of capacitors 3.4 Magnetic field and its units, Biot Savart Law Magnetic field due to current caring wire: straight and circular wire, Lorentz force (force on moving charge in magnetic field) 3.5 Magnetic flux, Faraday's law of electromagnetic induction, Lenz's law, Self and Mutual induction, eddy current, motional emf 3.6 DC and AC currents, Average, rms and Peak value of AC current	**CO3**
TSO 4a. Distinguish material on the basis of band gap.	**Unit-4.0 Semiconductor Physics**	**CO4**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 4b. Explain the various terms related to movement of charge carrier inside the semiconductors. *TSO 4c.* Explain the formation of depletion layer in a given pin junction. *TSO 4d.* Use V-I characteristic of explain the working of given p-n junction device.	4.1 Energy band and band gap, insulator, semi-conductor, conductor 4.2 Intrinsic and Extrinsic semiconductors, Drift velocity, drift and diffusion current, Mobility, current density, law of mass action. 4.3 Depletion layer and barrier Potential, p-n junction and V-I characteristics, Half wave and full wave rectifier 4.4 Photocells, Solar cells; working principle and engineering applications.	
TSO 5a. Apply the concept of photoelectric effect to explain the of photonic devices. *TSO 5b.* Explain Laser, components of laser and its various engineering applications. *TSO 5c.* Explain propagation of light in optical fiber and applications of optical fiber. *TSO 5d.* Describe the properties of nanomaterials and its various applications.	**Unit-5.0 Modern Physics** 5.1 Photoelectric effect; threshold frequency, work function, Stopping Potential, Einstein's photoelectric equation. 5.2 Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, types of lasers): He Ne Laser, p-n junction diode laser, engineering and medical applications of lasers. 5.3 Optical fibers: Total internal reflection, acceptance angle and numerical aperture, Optical fiber types, applications in telecommunication, medical and sensors. 5.4 Nanotechnology: Properties (optical, magnetic and dielectric properties) of Nanomaterials and its application, Bhasma (Ancient Ayurveda, IKS)	**CO5**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400102B

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use Vernier caliper to measure the known and unknown dimensions of a given small object. *LSO 1.2.* Estimate the mean absolute error up to two significant figures.	1.	Vernier caliper	CO1
LSO 2.1. Use screw gauge to measure the diameter/ thickness of a given object. *LSO 2.2.* Estimate the mean absolute, relative and percentage errors up to three significant figures.	2.	Screw gauge	CO1
LSO 3.1. Use Spherometer to measure radius of curvature of given convex and concave mirror/surface. *LSO 3.2.* Estimate errors in the measurement.	3.	Spherometer	CO1
LSO 4.1. Measure the variation of Time period with Mass of a given spring Oscillator. *LSO 4.2.* Determine the spring constant of a given spring.	4.	Spring Oscillator	CO2
LSO 5.1. Determine the time period of oscillation of given bar pendulum.	5.	Bar Pendulum	CO2
LSO 6.1. Determine the V-I characteristics of a given p-n junction device.	6.	p-n junction diode	CO4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 7.1. Determine the capacitance of a given parallel plate capacitor.	7.	Parallel Plate capacitor	CO3
LSO 8.1. Determine the inverse square law relation between the distance of photocell and light source v/s intensity of light source.	8.	Photo-electric cell	CO5
LSO 9.1. Determine the Numerical Aperture (NA) of a given step index optical fiber.	9.	Numerical Aperture of an optical fiber.	CO5
LSO 10.1. Measure wavelength of a He-Ne/diode laser by using a plane diffraction grating.	10.	He-Ne/diode laser	CO5
LSO 11.1. Determine the V-I characteristics of given solar cell under various illumination condition	11.	Solar cell (virtual experiment)	CO4
LSO 12.1. Determine the V-I characteristics of a given p-n junction device under various temperature conditions.	12.	p-n junction diode (virtual experiment)	CO4
LSO 13.1. Plot the graph between KE of Photo electron v/s frequency of incident light *LSO 13.2.* Determine the value of Plank's Constant (*h*) from the graph between KE v/s frequency of incident light. *LSO 13.3.* Determine the variation of stopping potential w.r.t frequency of incident photon	13.	Photo electric effect (virtual lab experiment)	CO5
LSO 14.1. Determine the wavelength of different spectral lines of Hydrogen spectra	14	Emission Spectra of Hydrogen (virtual lab experiment)	CO5
LSO 15.1. Find the variation in magnitude and direction of emf induced in a coil due to change in magnetic flux.	15	Electromagnetic induction (virtual lab experiment)	CO4

L) Suggested Term Work and Self Learning: S2400102B 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. Check the correctness of given equations, using dimensional analysis.
2. Find phase difference between particles executing SHM with different initial conditions.
3. Determine the magnitude and direction of the net electrostatics force acting on any one charge, when 'n' point charges of charge q are placed at the vertices of given polygon with sides 'a' cm.
4. Find the electric field intensity at point due to different type of distribution of charges.
5. Two concentric conducting spheres have radii of r1 and r2 (r1<r2). The inner sphere has charge q1 and the outer sphere has charge q2. Calculate electric field between the two spheres.
6. Explain the significance of determining the forward and reverse bias V-I characteristics of any p-n junction diode with example.
7. For a given V-I characteristic graph p-n junction diode, determine the dynamic and static resistance.
8. Apply the concept of work function in various device and instruments, such as photodiodes, solar cells and electron microscope.

b. Micro Projects:

1. Make prototype Vernier calipers and screw gauge of desired LC,
2. Fiber optics: Demonstrate the phenomenon of total internal reflection.
3. LASER: Prepare model to demonstrate the properties and applications of LASER.
4. Use physics lab mobile application for demonstration of various concepts of physics.
5. Use Arduino board and with embedded sensors to measure the physical quantities.
6. Make prototype parallel plate capacitor and measure capacitance.
7. Make working model to demonstrate Lenz Law.
8. Prepare model to demonstrate DC and AC current.
9. Demonstrate the conversion of light energy into electric energy by using LED(s).
10. Waves in string: standing waves in string using woofer loudspeaker.
11. Use smartphone to measure the different physical quantity with the sensor applications.
12. Use open source simulation software such as SCILAB and PheT to demonstrate SHM/wave, Phase difference between two waves and superposition of waves.

c. Other Activities:

1. Seminar Topics:
    - Needs of measurements in engineering and science.
    - Optical fibers: Construction and application in communication systems.
    - Synthesis and applications of nanomaterials
    - Applications of SHM/wave in daily life.
    - Ohm's Law and its applications in series and parallel circuits.
    - Kirchhoff's Laws and applications
    - Power and Energy in Electrical Circuits
    - Resistivity and Conductivity:
    - Electrical Safety and Hazard Prevention
    - Laser applications in Computer peripherals/ communications/ robotics
    - Holography.

2. Visits: Visit nearby industry with Instrumentation, production and Laser/optical fibers facilities. Prepare report of visit with special comments Instrumentation technique and material used.

3. Self-Learning Topics:
    - Vectors and its properties with applications
    - Diffraction of light
    - Newton’s Laws of motion, momentum, inertia, impulse
    - Continuous and discrete charge distribution
    - Force, work, energy, power, work-energy theorem, law of **conservation of energy**
    - Frictions and its types
    - Relation between Electric field (E)and potential (V)
    - Work done in various Processes, Adiabatic constant (Cp/Cv = ϒ), Mayer’s formula (Cp - Cv = R)
    - Ultrasonic
    - Microwave and electromagnetic wave.
    - Ruby Laser

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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	10%	10%	10%	20%	-	20%	20%
CO-2	15%	20%	10%	20%	25%	20%	20%
CO-3	25%	25%	30%	20%	25%	15%	20%
CO-4	25%	25%	30%	20%	25%	15%	20%
CO-5	20%	20%	20%	20%	25%	30%	20%
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 are 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 (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Unit and Measurements	6	CO1	8	2	2	4
Unit-2.0 Simple Harmonic and Wave motion	8	CO2	12	4	4	4
Unit-3.0 Electrostatics, Electromagnetism and Electric current	12	CO3	20	6	6	8
Unit-4.0 Semiconductor Physics	12	CO4	18	4	6	8
Unit-5.0 Modern Physics	12	CO5	12	4	4	4
Total	**48**	**-**	**70**	**20**	**22**	**28**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Vernier caliper	CO1	60	30	10
2.	Screw gauge	CO1	60	30	10
3.	Spherometer	CO1	60	30	10
4.	Spring Oscillator	CO3	50	40	10
5.	Bar Pendulum	CO2	50	40	10
6.	p-n junction diode	CO3	40	50	10
7.	Parallel Plate capacitor	CO3	50	40	10
8.	Photo-electric cell	CO5	40	50	10
9.	Numerical Aperture of an optical fiber.	CO5	50	40	10
10.	He-Ne/diode laser	CO5	60	30	10
11.	Solar cell (virtual experiment)	CO4	60	30	10
12.	p-n junction diode (virtual experiment)	CO5	60	30	10
13.	Photo electric effect (virtual lab experiment)	CO5	60	30	10
14.	Emission Spectra of Hydrogen (virtual lab experiment)	CO5	60	30	10
15.	Electromagnetic induction (virtual lab experiment)	CO5	60	30	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Field Trips, Portfolio Based, Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field Information and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Vernier-Caliper	Range: 0-15 cm, Resolution 0.01 cm.	1
2.	Micrometer screw gauge	Range 0-25 mm, Resolution 0.01 mm	2,9
3.	Spherometer	Vertical scale range -10mm to 10 mm, Graduation resolution 0.01 mm	3
4.	Spring oscillator	A spring, a measuring ruler, mass hanger and variable masses (50 gms, 100 gms).	4
5.	Bar Pendulum	Bar pendulum, meter scale a knife–edge with a platform, sprit level, precision stop watches	5
6.	p-n junction diode	A diode, batteries, connecting wires, multimeter/ ammeter voltmeter	6
7.	Parallel Plate capacitor	Parallel plate capacitor arrangement, ruler scale, DC voltmeter	7
8.	Photo-electric cell	Photo cell mounted in the metal box, Lamp holder with 60W bulb, analog meters (500μA & 1000mV), wooden bench fitted with scale and connecting wires	8
9.	Numerical Aperture of an optical fiber.	Laser Diode (2- 3 mW,632mm) Objective(10X), Optical fiber (1-meter-long), detector with BNC connector Auto arranging Multimeter, Screen with circular graduations, one circular base with linear and circular motion and optical bench	9
10.	He-Ne/diode laser	He-Ne Laser (output 0.5 –5.0mW, wavelength 632.8 nm power supply 240V, 50Hz) Or diode laser (2- 3 mW,632mm), Transmission grating 15000 lines/inch, photo detector with BNC connector and holder, screen with clamp type holder, knife edge with micrometer movement, digital multimeter, scale with mount	10
11.	Solar cell (virtual experiment)	https://vlab.amrita.edu/?sub=1&brch=195&sim=360&cnt=1	11
12.	p-n junction diode (virtual experiment)	https://amrita.olabs.edu.in/?sub=1&brch=6&sim=233&cnt=2	12
13.	Photo electric effect (virtual lab experiment)	https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1	13
14.	Emission Spectra of Hydrogen (virtual lab experiment)	https://vlab.amrita.edu/?sub=1&brch=195&sim=359&cnt=1	14
15.	Electromagnetic induction (virtual lab experiment)	https://cdac.olabs.edu.in/?sub=74&brch=9&sim=242&cnt=1	15

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Concept of physics-1	H.C. Verma	Bharti Bhawan Publications, 2021 ISBN: 8177091875, 978-8177091878
2.	Concept of physics-2	H.C. Verma	Bharti Bhawan Publications, 2021 ISBN: 8177092324, 978-8177092325
3.	Text Book of Physics for Class XI (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-508-3(Part-I) & ISBN: 81-7450-566-0 (Part-II)
4.	Text Book of Physics for Class XII (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-631-4 (Part-I) & ISBN: 81-7450-671-3 (Part II)
5.	Engineering Physics	P. V. Naik	Pearson Education Ltd., 1993 ISBN: 817758362X,978-8177583625
6.	Applied Physics-I	Dr. Mina Talati & Vinod Kumar Yadav	Khanna Book Publishing (2021) ISBN : 978-93-91505-43-1
7.	Applied Physics-II	Dr. Hussain Jeevakhan	Khanna Book Publishing (2021) ISBN: 978-93-91505-57-8
8.	Engineering Physics	D. K. Bhattacharya & Poonam Tandon	Oxford University Press, ISBN: 0199452814, 978-0199452811
9.	The Surya Siddhanta	Aryabhatta	Baptist Mission press , Calcutta

(b) Online Educational Resources:

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype
2. www.nanowerk.com
3. https://www.open2study.com/courses/basic-physics-150315/
4. https://nptel.ac.in/courses/122107035
5. https://nptel.ac.in/courses/122104016
6. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
7. https://www.physicsclassroom.com/
8. https://phys.org/
9. https://vlab.amrita.edu/?sub=1
10. https://www.olabs.edu.in/?pg=topMenu&id=40
11. https://www.khanacademy.org/science/physics

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others:

1. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker
2. Engineering Physics, R.K. Gaur and S. L. Gupta
3. University Physics with Modern Physics, Sears and Zemansky
4. Physics for Scientists and Engineers with Modern Physics by Raymond A. Serway andJohn W. Jewett
5. Physics Laboratory Manual, David H Loyd

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A) Course Code **: 2420103(T2420103/P2420103/S2420103)**

B) Course Title **:** Fundamentals of Electrical and Electronic Engg.
(CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)

C) Pre- requisite Course(s) **:** Engineering Physics, Basic Algebra and Calculus

D) Rationale :

This course is a fundamental course included in the curriculum mainly to introduce the students of Computer Science and Engineering, Artificial Intelligence and Machine Learning diploma courses to the basic concepts and basic laws of electricity, principle of magnetism and electromagnetic induction, basic electrical and electronics components and also to the basics of digital electronics so that students will be able to apply the same for solving the day to day basic electrical engineering problems in their own discipline. Diploma holders are expected to apply the fundamentals of this course while working with equipment being operated with electrical sources and while using various types of electrical equipment and instruments in their field.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

CO-1. Apply basic concepts of electricity to determine various electric parameters in a given electrical system.

CO-2. Apply the fundamental laws and concepts of DC and AC circuits to a given electrical system.

CO-3. Apply the principles of magnetism and electromagnetism to a given equipment.

CO-4. Test the functionality of a given basic electronic component.

CO-5. Use Boolean expressions and number systems to realize the basic logic circuits.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs) (if any)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2**Problem Analysis	**PO-3**Design/Development of Solutions	**PO-4**Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1.	3	2	2	2	2	-	2		
CO-2.	3	3	3	2	1	1	2		
CO-3.	3	3	3	2	2	-	2		
CO-4.	3	2	2	2	2	1	2		
CO-5.	3	2	2	2	2	1	2		

Legend: High(3),Medium (2),Low(1)andNomapping(-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Studies (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (SW+ SL)	Total Hours (CI+LI+SW+SL)	Total Credits(C)
		L	T				
2420103	Fundamentals of Electrical and Electronic Engg.	03	-	04	02	09	06

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances in laboratory, workshop, 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, open educational resources (OERs)

C: Credits = (1 x 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.

H) Assessment Scheme:

Course Code	CourseTitle	Assessment Scheme(Marks)						TotalMarks(TA+TWA+LA)
		Theory Assessment(TA)		Term Work& Self-Learning Assessment(TWA)		Lab Assessment(LA)		
		Progressive TheoryAssessment (PTA)	End TheoryAssessment (ETA)	Internal	External	Progressive LabAssessment (PLA)	End LaboratoryAssessment (ELA)	
2420103	Fundamentals of Electrical and Electronic Engg.	30	70	20	30	20	30	200

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 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: T2420103

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO.1a Apply the concept of charge, voltage and current in the given electrical circuit TSO.1b Differentiate between AC and DC currents. TSO.1c Differentiate between practical and Ideal current/voltage source TSO.1d Calculate work, power, and energy in the given circuit TSO.1e Calculate the equivalent resistance/Capacitance/ inductance in the given series and parallel electric circuit. TSO.1f Explain the heating/magnetic/chemical effect of the electric current with a relevant application. TSO.1g Calculate the energy stored in a given resistor/capacitor/inductor. TSO.1h Explain the effect of various media on capacitance TSO.1i Explain behavior of current in a resistor/capacitor/inductor.	**Unit-1.0 Basic Electrical Parameters and Concepts** 1.1 Electric charge, flow of charges, Electric Current D.C and A.C, Concept of ideal and practical current sources 1.2 Analogy of charge, potential /Voltage difference D.C and A.C, Induced emf/voltage, Terminal voltage, Concept of Ideal & Practical voltage sources 1.3 Resistor - Properties, Classification, Practical application of resistors, Effect of temperature on resistance, Series and parallel combination of resistors, Phase difference 1.4 Heating, magnetic and chemical effect of current, Electrical work, Power and energy, Open and short circuit condition of electric circuit 1.5 Capacitors – Properties, Capacitance formation, Expression for capacitance, Capacitive reactance, Energy stored in capacitor, Series & parallel combination of capacitors, Types of capacitors including super capacitors and their applications 1.6 Inductors – Properties, Self and mutual inductance, inductive reactance, Voltage and current equations of inductor, Energy stored in inductor, Inductance in A.C. and D.C. circuits, Types of Inductors including MEMS inductor and their applications	**CO-1**
TSO.2a Differentiate between- ● AC and DC current in all aspects (Generation, Waveforms and applications) ● Active and passive elements ● Linear & Non-linear circuit ● Unilateral and Bilateral circuit ● Loop and mesh in a given circuit TSO.2b Apply Ohm's law and Kirchhoff's laws to determine current and voltage in a given circuit. TSO.2c Explain various AC fundamental parameters. TSO.2d Use operator 'j' to calculate various quantities in A.C circuit	**Unit-2.0 Fundamentals of D.C. and A.C. Circuits** **DC Circuits** 2.1 AC and DC current, voltage and Power 2.2 Ohm's law, Kirchhoff's Current Law, Kirchhoff's Voltage law 2.3 Active & Passive elements, Linear & Non-linear circuit, unilateral and Bilateral circuit element, 2.4 Node, Branch, Loop, Mesh **A.C Circuits** 2.5 Frequency, Time period, Amplitude, Angular Velocity, RMS Value, Average Value, Form factor, Peak factor, Power factor 2.6 Phasor representation and transformation from Polar to rectangular form and vice versa of alternating quantities	**CO1, CO2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO.3a Explain various terms related to magnetic circuit. TSO.3b Calculate various parameters of a given magnetic circuit. TSO.3c Plot B-H curve and Hysteresis loop of a given magnetic materials TSO.3d Explain the phenomenon of induced e.m.f and current TSO.3e Apply principles of Faraday's law to calculate induced e.m.f in the given circuit TSO.3f Apply various Laws in a given magnetic circuits	**Unit-3.0Magnetic Circuits and Electromagnetic Induction** 3.1 Magnetic flux, Magnetomotive force, Magnetic field strength, Permeability, Reluctance. 3.2 Magnetic leakage, leakage coefficient 3.3 Magnetic Hysteresis, Hysteresis loop, 3.4 Magnetization (B-H) Curve 3.5 Analogy between electric and magnetic circuits 3.6 Electromagnetism 3.7 Induced e.m.f -Statically (self and mutual) and dynamically induced emf, 3.8 Faraday's Laws of electromagnetic Induction. 3.9 Lenz's Law, Fleming's R.H. rule; direction of induced E.M.F, Fleming's L.H. rule, Ampere's Law	**CO2, CO3**
TSO.4.a Describe the construction and working principle of the given type of semiconductor TSO.4.b Describe the principle of the given type of semiconductor. TSO.4.c Describe between the given type insulator, conductor and semiconductor based on energy band theory. TSO.4.d Describe working principle, characteristics and application of the given type of diode. TSO.4.e Describe working principle of the given type of Bipolar Junction Transistor. TSO.4.f Describe working principle of the given type of Field Effect Transistor.	**Unit-4.0Basic Electronic Components** 4.1 Semiconductors: Definition, types of semiconductors and their materials. Energy band theory and effect of temperature. 4.2 Diodes: Basic Concept of Diodes, N-type & p-type PN Junction Diode – Forward and Reverse Bias Characteristics i.e., PN junction Barrier voltage, depletion region, Junction Capacitance. Forward biased & reversed biased junction, Diode symbol 4.3 Bipolar Junction Transistor (BJT): NPN and PNP Transistor – Operation and characteristics. symbol 4.4 Field Effect Transistor (FET): FET – Operation and characteristics, Classification FET and advantages, FET symbol	**CO4**
TSO.5a Convert one number system to other number system. TSO.5b Use Boolean Algebra to solve expressions TSO.5c Implement Boolean expressions for given logic gates	**Unit-5.0Overview of Digital Electronics** 5.1 Introduction to different Number systems: Binary, Octal, Decimal & Hexadecimal & their Conversion from one another 5.2 Introduction to Boolean Algebra, rules and Laws of Boolean Algebra – DE Morgan's Law 5.3 Study of logic gates (NOT, OR, NOR, AND, NAND) Symbolic representation, Truth Table and Implementation of Boolean expressions	**CO4, CO5**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2420103

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1 Classify given electrical components in to Resistor, Inductor and Capacitor.	1.	Classification of electrical components	CO1
LSO 1.2 Plot the terminal voltage of a source starting from no load to different load (Current) conditions	2.	Terminal voltage of a source for different load conditions	CO1
LSO 1.3 Measure current and voltage in a branch of the given electric circuit	3.	Measurement of current and voltage in a branch of the electric circuit	CO1
LSO 1.4 Verify the zero Phase difference between current and voltage waveform for a resistor connected to an AC source with respect to time (using CRO).	4.	Phase difference between voltage and current waveform in a given resistor using CRO	CO1
LSO 1.5 Calculate the value of color-coded resistor and verify it by measuring the value of resistor using digital multimeter	5.	Value of color-coded resistor	CO1
LSO 1.6 Measure resistance inan series and parallel combination of resistors using digital multimeter	6.	Measurement of resistances in series and combination in an electric circuit.	CO1
LSO 1.7 Calculate the value of equivalent capacitance in series and parallel combination and verify by measuring the value of capacitance using digital multimeter	7.	Measurement of capacitance in series and parallel combination of Capacitors.	CO1
LSO 2.1 Apply ohm's law to calculate voltage across each element in a given circuit	8.	Measurement of voltage across each element of the given linear circuit	CO1, CO2
LSO 2.2 Determine currents using KCL in a given electric circuit and verify it by conducting experiment	9.	Measurement of current in the given electric circuit.	CO1, CO2
LSO 2.3 Determine voltages using KVL in a given electric circuit and verify it by conducting experiment	10.	Measurement of voltage in a given electric circuit	CO1, CO2
LSO 2.4 Verify the Phase difference (Lag)between current and voltage waveform for an inductor connected to an AC source with respect to time using CRO.	11.	Phase difference(lag) between voltage and current waveform in a given inductor	CO1, CO2
LSO 2.5 Verify the Phase difference(lead) between current and voltage waveform for a capacitor connected to an AC source with respect to time using CRO.	12.	Phase difference(lead) between voltage and current waveform in a given capacitor using CRO	CO1, CO2
LSO 2.6 Perform experiment to plot BH curve in a magnetic material	13.	BH curve of a given magnetic material	CO1, CO2

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 3.1. Perform experiment to demonstrate statically and dynamically induced emf.	14.	Statically and Dynamically induced emf.	CO2, CO3
LSO 3.2. Perform experiment to demonstrate self and mutual inductance.	15.	Self and Mutual inductance.	CO2, CO3
LSO 3.3. Perform experiment to demonstrate Faraday's laws of electromagnetism	16.	Faraday's laws of electromagnetism.	CO2, CO3
LSO 3.4. Perform experiment to demonstrate Flemings right hand and left-hand rules	17.	Flemings right hand and left-hand rules.	CO2, CO3
LSO 3.5. Perform experiment to demonstrate Lenz's law	18.	Lenz's law.	CO2, CO3
LSO 4.1 Test the working of a given diode, and plot the labelled V-I characteristics	19.	VI characteristics of Diode.	CO4
LSO 4.2 Test the working of a given BJT and plot the labelled V-I characteristics.	20.	VI characteristics of BJT.	CO4
LSO 4.3 Test the working of a given FET and plot the labelled V-I characteristics	21.	VI characteristics of FET	CO4
LSO 5.1 Build and verify the truth tables for all logic gates – NOT, OR, NOR, AND, NAND	22.	Logic Gates – NOT, OR, NOR, AND, NAND	CO5

L) Suggested Term Work and Self-Learning: S2420103 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.

i. Prepare a report on comparison of a physical system (containing two vertical water columns connected with a horizontal capillary tube and liquid flow due to gravity) to demonstrate the analogy of charge, potential difference and current flow in electrical system.
ii. Prepare a report on types of resistors, their power ratings and relevant applications.
iii. Calculate resistance value of a given resistor based on color codes and verify its value using multimeter.
iv. Prepare a chart showing range of resistances used for electrical insulating materials.
v. Sketch a plot of BH curve for soft and hard magnetic materials respectively.
vi. Collect the information regarding various types of inductors used in different domestic appliances.
vii. Prepare a chart of different types of capacitors used with their applications.
viii. Prepare a chart illustrating an example to differentiate between useful and leakage flux.

b. Micro Projects:

1. Demonstrate the working of resistor, Inductor and Capacitor through role play or using animation
2. Prepare detailed specifications of a typical capacitor bank used for power factor improvement in an industry.

3. Prepare a chart for commonly used capacitors used in different domestic appliances (name of appliances with type and ratings)
4. Build and test the capacitor and choke in a fluorescent lamp for its proper working.
5. Connect three chokes in series and 40 Watt lamp in series with a switch across a single phase AC supply. Analyze the effect of switching action and comment on variation of voltage and current with respect to time.
6. Search animations demonstrating Faraday's laws of electromagnetic induction and Lenz's law to understand the concepts of electromagnetic induction and develop a presentation
7. Prepare a report on the comparison of technical parameters of NPN and PNP transistor.
8. Build and test the transistor switch circuit.
9. Build the logic gates and verify the truth table

c. Other Activities:

1. Seminar Topics;
   - Types of resistors, Inductors and capacitors and their application
   - Basic laws governing DC and AC circuits
   - Applications based on principle of electromagnetic induction.
2. Surveys;
   - Carry out a market survey for availability of different types of resistors used for small projects.
   - Survey a market for availability of different types of semiconductor diodes used for small projects.
3. Visit;
   - Visit institute laboratory/workshop and prepare report about the various electrical sources available along with their specifications.
   - Visit to a nearby electrical substation and observe the capacitors installed

d. Self-Learning Topics:

- Industrial/commercial applications of AC and DC supply
- Differentiate between AC and DC in terms of generation, waveforms, and power
- Conduct a literature survey and prepare list of materials (conducting, insulating, magnetic) and their corresponding applications commonly used in electrical system.
- Applications of statically and dynamically induced emf
- Different types of CROs available in the market
- Different types of Multimeter available in the market

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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (SWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	15%	15%	20%	20%	33%	20%	20%
CO-2	20%	25%	20%	20%	33%	25%	20%
CO-3	25%	25%	20%	20%	34%	20%	20%
CO-4	25%	20%	20%	20%	--	20%	20%
CO-5	15%	15%	20%	20%	--	15%	20%
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 are 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 Basic Electrical parameters and concepts	8	CO1	11	4	4	3
Unit-.2.0 Fundamentals of DC and AC circuits	12	CO2	17	4	6	7
Unit-.3.0 Magnetic circuits and electromagnetic induction	10	CO3	17	4	6	7
Unit-.4.0 Basic electronic components	10	CO4	14	4	6	4
Unit-.5.0 Overview of Digital electronics	8	CO5	11	4	3	4
Total Marks	**48**	**-**	**70**	**20**	**25**	**25**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
1.	Classification of electrical components	CO1	50	40	10
2.	Terminal voltage of a source for different load conditions	CO1	50	40	10
3.	Measurement of current and voltage in a branch of the electric circuit	CO1	50	40	10
4.	Phase difference between voltage and current waveform in a given resistor using CRO	CO1	45	45	10
5.	Value of color-coded resistor	CO1	50	40	10
6.	Measurement of resistances in series and combination in an electric circuit.	CO1	50	40	10
7.	Measurement of capacitance in series and parallel combination of Capacitors.	CO1	50	40	10
8.	Measurement of voltage across each element of the given linear circuit	CO1, CO2	50	40	10
9.	Measurement of current in the given electric circuit.	CO1, CO2	50	40	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
10.	Measurement of voltage in a given electric circuit.	CO1, CO2	50	40	10
11.	Phase difference(lag) between voltage and current waveform in a given inductor.	CO1, CO2	50	40	10
12.	Phase difference(lead) between voltage and current waveform in a given capacitor using CRO.	CO1, CO2	50	40	10
13.	BH curve of a given magnetic material.	CO1, CO2	50	40	10
14.	Statically and Dynamically induced emf.	CO2, CO3	50	40	10
15.	Self and Mutual inductance.	CO2, CO3	50	40	10
16.	Faraday's laws of electromagnetism.	CO2, CO3	50	40	10
17.	Flemings right hand and left-hand rules.	CO2, CO3	50	40	10
18.	Lenz's law.	CO2, CO3	60	30	10
19.	VI characteristics of Diode.	CO4	60	30	10
20.	VI characteristics of BJT.	CO4	60	30	10
21.	VI characteristics of FET.	CO4	60	30	10
22.	Logic Gates – NOT, OR, NOR, AND, NAND	CO4	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

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P) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Field Trips, Portfolio Based, Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field Information and Communications Technology (ICT) Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	DC Source (Variable)	0-20/50 Volts	1-18
2.	AC Source (Variable)	0-300 Volts	1-18
3.	Voltmeter	0-300 V, 0-75 V (MI & MC)	1-18
4.	Ammeter	0-5/10/20 A (MI), 0-2 A (MC)	1-18
5.	Rheostats	0-50 Ohms, 5 Amp; 0-300 Ohms, 2 amp	1-18
6.	Resistors, Capacitors, and Inductors	Appropriate ratings and different types	1, 6
7.	Demonstration kit for demonstrating statically and dynamically induced emf	Lab experiment purpose	14
8.	Demonstration kit to demonstrate self and mutual inductance.	Lab experiment purpose	15
9.	Demonstration kit for Faraday's laws of electromagnetic induction.	Lab experiment purpose	16
10.	Demonstration kit for Flemings right hand and left hand rules.	Lab experiment purpose	17
11.	Demonstration kit for Lenz's law.	Lab experiment purpose	18
12.	Multimeter	Digital Multimeter: 3 1/2-digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000V max), A_{dc}, A_{ac} (10 amp max), Resistance: (0 - 100 M∧), Capacitance and Temperature measurement	5,7,19,20,21,22
13.	Electronic Work Bench	Bread Board 840 -1000 contact points: Positive and Negative power rails on opposite side of the board, 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO: 0-30 MHz, Digital Multimeter	19,20,21,22
14.	CRO dual trace	25 MHz,230 V AC, 50 Hz	4,12,19,20,21,22
15.	Electronic components Connecting probes	PN diode -NPN and PNP, BJT, FET, Logic gates OR, AND, NOT, NOR, NAND Connecting probes -1 set	19,20,21,22

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Basic Electrical Engineering	Mittle and Mittal	McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5
2.	Fundamentals of Electrical Engineering	Saxena, S. B. Lai	Cambridge University Press, ISBN: 9781107464353
3.	Electrical Technology Vol- I	Theraja, B. L.	S. Chand Publications, New Delhi. 2015, ISBN: 9788121924405
4.	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi, 2015, ISBN: 97881236529513
5.	Principles of Electronics	Mehta, V.K.; Mehta, Rohit	S. Chand and Company, Ram Nagar, New Delhi-110 055, 504, 2014, ISBN: 9788121924
6.	Basic Electronic Engineering	Baru V.; Kaduskar R.; Gaikwad S.T.	Dream tech Press, New Delhi, 2015, ISBN: 9789350040126

(b) Open Educational Resources (OER):

1. https://onlinecourses.nptel.ac.in/noc20_ee64/preview
2. https://archive.nptel.ac.in/courses/108/108/108108076/
3. https://nptel.ac.in/courses/122106025
4. https://www.youtube.com/watch?v=Zr2SxTiKUCM&list=PLJvKqQx2Atc61XCOHXm_ACNkOkAm3yO4 &index=4
5. https://www.youtube.com/watch?v=9LNRAwf3uqs
6. https://de-iitr.vlabs.ac.in/List%20of%20experiments.html

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others:

1. Learning Packages
2. Users'Guide
3. Manufacturers' Manual
4. Lab Manuals

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A) Course Code **: 2418104(T2418104/P2418104/S2418104)**

B) Course Title **:** Fundamental of IT System (AIML, CSE)

C) Pre-requisite Course(s) **:**

D) Rationale **:**

Information technology is a term that describes the entire range of information generation, storage, transmission, retrieval, and processing. Most organizations in the industry, business, non-profit organizations, and government departments now rely heavily on their information systems (IS) and information technology (IT). The information system collects, stores, and disseminates information from the organization's environment and internal operations to support organizational functions and decision-making, communication, coordination, control, analysis, and visualization. Therefore, the knowledge about the various applications areas of Information Technology including practical skills acquired through the laboratory will help students when he/she will be working with information systems.

At the end of the course, students will be able to comfortably work on computers, install and configure OS, connect it to external devices, and protect information and computers from basic abuses/attacks. This course is therefore so designed that the students will be able to apply the concepts of IT systems as and when required.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

- **CO-1** Appraise computer systems and its applications for various educational, business, and industrial domain.
- **CO-2** Design simple digital logic circuit function using basic universal logic gates
- **CO-3** Configure different Operating Systems.
- **CO-4** Create a physical network according to the given topology and troubleshoot it.
- **CO-5** Classify the types of cyber-attack

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline-Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability, and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	1	-	-	-	1	2	2		
CO-2	1	1	-	2	-	-	-		
CO-3	1	2	-	2	1	-	-		
CO-4	1	2	3	-	2	2	2		
CO-5	1	1	-	-	2	2	2		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2418104	Fundamental of IT System	03	-	04	02	09	06

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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 = (1 x 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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2418104	Fundamental of IT System	30	70	20	30	20	30	200

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 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 the course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Term Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to the attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020-related reforms like green skills, Sustainability, Multidisciplinary aspects, Indian Knowledge System (IKS), and others must be integrated appropriately.

J) Theory Session Outcomes (TSOs) and Units: T2418104

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Describe the anatomy of the Computer System. *TSO 1b.* List the different Input and Output devices. *TSO 1c.* Identify the different types of memory in computer systems. *TSO 1d.* Describe communication between different components of a computer. *TSO 1e.* Describe the functionalities of a computer system. *TSO 1f.* Use Internet digital Platforms	**Unit-1.0 Basics of Computer System** 1.1 Computer System and its Components. - Generation of Computer - Anatomy of Computer Systems - Input and output device - Motherboard - Peripherals - Backend and Front end of System Unit 1.2. Storage device in Computer System - Primary Storage - Secondary Storage 1.3. CPU Components - Register - Control Unit - ALU 1.4. Types of Bus - Address Bus - Data Bus - Control Bus 1.5 Search Engine - Introduction - Search Query - Applications of Internet Digital Platforms (BHIM, Digi-Locker, m-Parivahan, NPTEL etc.)	**CO1**
TSO 2a. Convert Binary numbers into different number systems *TSO 2b.* Classify Basic Logic gates and Universal Gates *TSO 2c.* Use basic universal logic gates to design simple digital logic circuit functions	**Unit 2.0 Digital Logic and Number System** 2.1 Introduction to digital computers and number system - Binary number system - Base conversions (Binary, Decimal, Hexadecimal, Octal) - Binary Coded Decimal 2.2 Basic Logic gates - AND, OR, INVERTER, XOR, XNOR - Working of Universal Gates - NAND Gate - NOR Gate	**CO2**
TSO 3a. Explain the functions and services of OS. *TSO 3b.* Explain different types of operating systems. *TSO 3c.* Write steps to Install Windows/Linux Operating System using a hypervisor. *TSO 3d.* Differentiate the licensed and freeware software.	**Unit 3.0 Computer Software and Operating System** 3.1 Different Types of Computer Software - Application Software - System Software - Utility Software 3.2 General features of OS - Introduction - Need, Functions, Services 3.2 Types of OS - Batch Operating System. - Multitasking/Time-Sharing OS. - Multiprocessing OS.	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	- Real-Time OS. - Distributed OS. - Network OS. - Mobile OS 3.3 Windows & Linux Operating Systems (Installation) - Microsoft Windows OS (History Basic Features, Current State of OS) - Linux Operating System (Architecture, Components of Linux System, Kernel Mode vs User Mode, Basic Features) 3.4 Proprietary & Open-source software	
TSO.4a Compare various computer network topologies and types of networks. *TSO.4b* Describe the functions of Networking Devices. *TSO.4c* Classify the concepts of Modulation & Multiplexing for Digital Communication. Describe various wired and wireless media for digital communications. *TSO.4d* Explain the use of IP addressing systems, DNS, and communication devices in the Internet and Intranet.	**Unit.4.0 Computer Network and Internet Tools** 4.1 Basic terminology of Computer Network - Network and its types (LAN, MAN, WAN) 4.2 Network Topology (Bus, Ring, Star, Mesh) 4.3 Networking Devices (Types and use) - Hub, Switch, Router, Bridge, Gateway, Modem, Repeater, Wireless Access Point, NIC 4.4 Transmission modes (Simplex, half-duplex, Full-duplex) 4.5 Modulation (Definition and Need) - Types of Analog Modulation - Types of Digital Modulation 4.6 Wired and Wireless media - Twisted -pair, - Coaxial, - Fiber Optics, - Radio - Infrared - Satellite 4.7 Internet & Intranet - URL - Internet - Intranet - Comparison between Intranet & Internet 4.8 Network Addressing (IPv4) - Internet Protocol (need, types) - Classful addressing scheme, Address space, notations, netid, hostid - Need of IPv6	**CO4 and CO5**
TSO 5a. Explain concepts of Information Security for Data Protection. *TSO 5b.* Classify various cyber-attacks. *TSO 5c.* Describe cyber laws for data protection and IPR	**Unit. 5.0 Information Security** 5.1 Need for Information Security - Definition of various terms of Information Security. - Cryptography - Vulnerability - Threat - Attack - Encryption - Decryption	**CO6**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	5.2The Principles of Security & Confidentiality, Integrity, Availability (CIA triad) 5.3Security services, Use of Firewall 5.3.1 Cyberattacks - Introduction of common types of attacks (Malware, Man-in-the-middle attack, Denial-of-service attack, SQL injection, Phishing, Password cracking.) 5.3.2 Cyber Law IT Amendment Act 2008 (Section 66 & 67)	

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2418104

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Install device driver. *LSO 1.2.* Install given software on your system. *LSO 1.3.* Perform Registration process on digital India platform.	1.	1.1 Identify specifications of various types of computer systems available in your institute. 1.2 Install Printer, scanner driver. 1.3 Install any two freeware or open-source software/tool by using web browser 1.4 Use Digital India Platforms: BHIM, Digi-Locker, m-parivahan, NPTEL.	CO-1
LSO 2.1. Verify truth table of basic logic gates *LSO 2.2.* Design basic logical gates with NAND and NOR gates	2.	2.1 Using Integrated circuit (IC), verify the truth table of basic logic gates. 2.2 Verify truth table and digital logic circuits of basic logic gates with the help of NAND gate using IC. 2.3 Design digital logic circuit functions of basic logic gates with the help of the universal gate-NOR Gate using IC.	CO-2
LSO 3.1 Identify different software in the PC LSO 3.2 Install different operating systems on PC. LSO 3.3 Use different Linux commands in real life.	3.	3.1 Install windows and Linux operating system 3.2 Practice of Basic UNIX Commands and various UNIX editors such as vi, ed, ex.	CO-3
LSO 4.1. Configure IPV4 addressing in the pc of a network *LSO 4.2.* Implement the cross-wired cable and straight-through cable using a clamping tool. *LSO 4.3.* Interpret Ping and Traceroute Output.	4	4.1 Identify the different networking devices. 4.2 Configure the IPv4 address in every computer in the computer network lab 4.3 Learn different LAN connections in the computer network lab. 4.4 Practically implement the cross-wired cable and straight-through cable using the clamping tool. 4.5 Interpreting Ping and Traceroute Output 4.6 Run Packet tracer tool	CO-4

L) Suggested Term Work and Self-Learning: S2418104 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. Explore case study on cybercrime and prepare a brief presentation on it.
2. Conduct a market survey to identify various types of Desktop/Laptop/printer and write a report with their brief specifications.
3. Install any flavor of the Linux Operating System.
4. Prepare a report of various Network connecting devices existing at your home/ Institute Lab.
5. Identify different possible threats in the computer and present it.
6. Study cyber laws as applicable to educational institute and present it.

c. Other Activities:

1. Seminar Topics: - "Applications in demand"
   "5G Networks ", "Mobile Networks"
2. Visit to industry for possible IT Infrastructure Installations.

d. Self-Learning Topics:

1. Internet-based various applications
2. Computer and Laptop specifications
3. Wireless Communications

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	10%	10%	10%	15%	25%	-	-
CO-2	15%	20%	20%	20%	15%	-	-
CO-3	30%	20%	10%	15%	10%	-	-
CO-4	20%	30%	30%	25%	25%	-	-
CO-5	25%	20%	30%	25%	25%	-	-
Total Marks	**20**	**70**	**20**	**20**	**10**	**-**	**-**
			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 are 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 (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-I.0 Basics of Computer System	6	CO-1	7	3	4	-
Unit 2.0 Digital Logic and Number System	10	CO-2	14	2	2	10
Unit 3.0 Computer Software and Operating System	10	CO-3	14	4	6	4
Unit.4.0 Computer Network and Internet Tools	12	CO-5	21	5	10	6
Unit. 5.0 Information Security	10	CO-6	14	6	4	4
Total	**48**	**-**	**70**	**20**	**26**	**24**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Specification Table for Laboratory (Practical) Assessment:

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA /ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Identify specifications of various types of computer systems available in your institute	CO-1	40	50	10
2.	Install any two freeware or open-source software/tool by using Google Chrome/Mozilla Firefox/Microsoft Edge web browser.	CO-1	40	50	10
3.	Demonstrate the steps to register on the following Digital India Platforms from the following to survey Digital literacy.	CO-1	40	50	10
4.	Digital India Platforms: BHIM, Digi-Locker, m-parivahan ,NPTEL.	CO-1	30	60	10
5.	Verify the truth table of basic logic gates using Integrated circuit (IC).	CO-2	40	50	10
6.	Verify truth table and digital logic circuits of basic logic gates with the help of NAND gate using IC..	CO-2	40	50	10
7.	Design digital logic circuit functions of basic logic gates with the help of the universal gate-NOR Gate using IC	CO-2	60	30	10
8.	Categorize the different software available on your PC.	CO-3	60	30	10
9.	Install windows and Linux operating system	CO-3	60	30	10
10.	Practice of Basic UNIX Commands and various UNIX editors such as vi, ed, ex.	CO-3	50	40	10
11.	Identify the different networking devices.	CO-4	50	40	10
12.	Configure the IPv4 address in every computer in the computer network lab	CO-4	50	40	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA /ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
13.	Learn different LAN connections in the computer network lab.	CO-4	50	40	10
14.	Practically implement the cross-wired cable and straight-through cable using the clamping tool.	CO-4	60	30	10
15.	Interpreting Ping and Traceroute Output	CO-4	60	30	10

Legend:
PRA*: Process Assessment
PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/ Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lectures, Tutorial, Case Methods, Group Discussions, Industrial visits, Industrial Training, Field Trips, Portfolios, Learning, Role Play, Live Demonstrations in Classrooms, Labs, Field Information, and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools, and Software	Broad Specifications	Relevant Experiment/Practical Number
1	Computer System (Desktop/Laptop) with minimum configuration: Operating System: Windows 11 or later version, Linux (Red Hat, Fedora, Ubuntu RAM:8 GB HDD: 512GB MS-Office :2010 (2016 preferable)	Computer System (Desktop/Laptop) with minimum configuration: Operating System: Windows 7 or later version, Linux (Red Hat, Fedora, Ubuntu RAM:2 GB (4 GB preferable), HDD: 250 GB (500 GB preferable) MS-Office :2010 (2016 preferable)	All
3	Crimping tool, RJ-45 connector (male-female), Twisted pair cable	Crimping tool, RJ-45 connector (male-female), Twisted pair cable	4
4	AND gate NOT gate, OR gate NAND gate, NOR gate , X-OR gate, Power supply, Digital IC trainer kit, connecting wires.	(IC 7408), (IC 7404), (IC 7432), (IC 7402), (IC 7400), (IC 7486)	2

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Computer Fundamentals Concepts Systems and Applications 8th Edition (English, Paperback,	Priti Sinha, Pradeep Sinha)	BPB Publications ISBN-13: 9788176567527 ISBN-10: 8176567523
2.	Fundamentals of Computers	E Balagurusamy	McGraw Hill Education 2009, ISBN-10 : 9780070141605 ISBN-13 : 978-0070141605
3.	Basic Principles of An Operating System	by Dr. Priyanka Rathee,	BPB Publications, 2019 ISBN-13: 9789388511711

(b) Open Educational Resources:

1. nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm
2. en.wikipedia.org/wiki/Shear_and_moment_diagram
3. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
4. www.engineerstudent.co.uk/stress_and_strain.html
5. https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others:

1. Learning Packages
2. Users' Guide
3. Manufacturers' Manual
4. Lab Manuals

*****

A) Course Code **: 2420105(P2420105/S2420105)**

B) Course Title **:** Electrical and Electronics Workshop (EE, ELX, CSE, AIML)

C) Pre- requisite Course(s) **:**

D) Rationale:

Electrical and Electronics Workshop is a basic practical engineering course which provides basic knowledge of workshop safety, measuring instruments, hand tools, equipment and machinery used in various shops like wood working shops, welding shop, electrical and electronics materials and components. Students will develop practical skills by performing a variety of operations in various shops using relevant mechanical, electrical and electronic materials as well as appropriate hand tools, equipment, tools and machinery. The knowledge, skills and attitude developed during the course enable the students to undertake industrial and field work related tasks. This course provides industrial environment in educational institutions.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course out comes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/laboratory/workshop/field/ industry.

After completion of the course, the students will be able to-

CO-1 Use measuring devices and hand tools effectively.
CO-2 Undertake wood working operations economically and safely.
CO-3 Perform various joining operations using welding, brazing and soldering methods.
CO-4 Identify basic electrical and electronics components.
CO-5 Use firefighting equipment and other safety related accessories.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Lifelong Learning	**PSO-1**	**PSO-2**
CO-1	3	2	2	3	1	-	2		
CO-2	3	2	2	3	2	-	2		
CO-3	3	2	2	3	1	-	1		
CO-4	3	1	1	3	1	-	1		
CO-5	3	3	2	1	2	1	2		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2420105	Electrical and Electronics Workshop	-	-	04	02	06	03

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, fieldorotherlocationsusingdifferentinstructional/Implementationsstrategies)

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= (1xCIhours) + (0.5xLIhours) + (0.5xNotionalhours)

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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work& Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2420105	Electrical and Electronics Workshop	-	-	20	30	20	30	100

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 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: (Not Applicable)

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2420105

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. List various measuring tools and instruments. *LSO 1.2.* Use suitable measuring unit and its conversion. *LSO 1.3.* Select suitable measuring devices in a given situation. *LSO 1.4.* Measure the given job using suitable instruments.	1.	1.1 Identify different types of measuring tools available in workshop. 1.2 Use suitable Marking and hand tools in a given situation. 1.3 Measure the given job using suitable measuring Devices.	CO-1
LSO 2.1 List various wood working tools with major specifications. *LSO 2.2* Select wood working tools as per given job. *LSO 2.3* Perform various wood working operations as per given drawing/sketch. *LSO 2.4* Follow the right procedure to prepare given type of joint.	2.	2.1 Prepare one simple job of wood working comprises of marking, cutting, plaining and finishing as per given drawing/sketch. 2.2 Prepare switch board as per given sample. 2.3 Prepare simple wooden joint as per given sketch / drawing.	CO-2
LSO 3.1 Choose appropriate joining method in a given situation. . *LSO 3.2* Select suitable welding method as per job requirement. *LSO 3.3* Carryout suitable welding procedure as per given sketch / drawing. *LSO 3.4* Perform brazing operation in a given situation.	3.	3.1 Operate gas welding apparatus to generate different types of flames. 3.2 Prepare lap joint using gas welding as per given drawing safely. 3.3 Prepare butt joint using arc welding as per given drawing safely. 3.4 Join the given sheets by using brazing.	CO-3
LSO 4.1 Select various electrical and electronic components. *LSO 4.2* Identify various given electrical tools and measuring instruments. *LSO 4.3* Describe the steps to use the given type of meters. *LSO 4.4* Test the given components using Multimeter. *LSO 4.5* Use the suitable procedure of mounting electrical and electronic components on given PCB.	4.	4.1 Categorize different active and passive components available in the workshop. 4.2 Identify different types of measuring instruments used for voltage, current and wattmeter. 4.3 Measure resistance of different types of resistors using Multimeter. 4.4 Identify terminals of diodes and transistors.	CO-4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 4.6 Identify terminals of a given transistor using suitable measuring instrument. *LSO 4.7* Perform soldering operation in a given situation.		4.5 Measure voltage and current for single and three phase Supply using multimeter and clip on meter. 4.6 Perform continuity test of given component using Multimeter. 4.7 Identify three terminals of a transistor using digital Multimeter. 4.8 Solder various resistors, capacitors and inductors and electronic components on Printed Circuit Board (PCB).	
LSO 5.1 Select the fire extinguisher to extinguish the given type of fire. *LSO 5.2* Describe the procedure to use the given firefighting equipment. *LSO 5.3* List the materials used for first Aid. *LSO 5.4* Describe the ways to maintain good housekeeping in the given situation.	5.	5.1 Conduct mock artificial respiration and first Aid exercises to learn about safety procedures of first Aid in case of electrical hazards. 5.2 Use Fire Extinguisher to extinguish the fire in a given situation.	CO-5

L) Suggested Term Work and Self Learning: S2420105 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. Assignments:

i. Select any engineering object / part / drawing and perform the measurement using suitable measuring instrument / device.
ii. Select any (Minimum 3 finished jobs) different wood working / carpentry/welding/metal joining jobs and prepare list of materials and joints used in selected objects.
iii. Select any two joining method and prepare their engineering field of application.
iv. Draw symbols of various electrical components.
v. Draw symbols of various electronic components.
vi. List specifications of various electrical and electronic components

b. Micro Projects:

1. Visit nearby mechanical/electrical workshop and collect information about operation performed by identified workshop and prepare the list of tools and equipment along with specification.
2. Make a wooden job as per given drawing and specifications of material.
3. Prepare any utility job like lab stool structure by using suitable welding process with list of tools and equipment along with specification.
4. Visit any organization /field agency and submit a report on safety practices followed in the identified organization /field agency.

c. Other Activities:

1. Seminar Topics:

- Safety practices and use of personal safety equipment in workshops.
- Different types of digital instruments and their functions used in workshops.
- Recent developments in various machines and instruments used in workshop.

2. **Visits:**
   - Visit any wood working shop / welding shops/electrical and electronics workshop and firefighting station and prepare a report.
   - Make a detailed market survey of local dealers for procurement of workshop tools, electrical and electronics equipment /components and raw materials.

3. **Self-learning topic:**
   - Causes and remedies of welding/soldering/ brazing defects.
   - Make various small electrical/electronic equipment for household purpose.
   - Repairing of defective electrical/ electronic appliances/ tools in institutes.

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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work& Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	-	-	20%	20%	20%	20%	20%
CO-2	-	-	20%	20%	20%	20%	20%
CO-3	-	-	20%	20%	20%	20%	20%
CO-4	-	-	20%	20%	20%	20%	20%
CO-5	-	-	20%	20%	20%	20%	20%
Total Marks			**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: (Not Applicable)

O) Suggested AssessmentTable for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Identify different types of measuring tools available in workshop.	CO-1	50	40	10
2.	Use suitable Marking and hand tools in a given situation.	CO-1	50	40	10
3.	Measure the given job using suitable measuring Devices.	CO-1	60	30	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
4.	Prepare one simple job of wood working comprises of marking, cutting, plaining and finishing as per given drawing/sketch.	CO-2	60	30	10
5.	Prepare switch board as per given sample.	CO-2	30	60	10
6.	Prepare simple wooden joint as per given sketch / drawing.	CO-2	50	40	10
7.	Operate gas welding apparatus to generate different types of flames.	CO-3	60	30	10
8.	Prepare lap joint using gas welding as per given drawing safely.	CO-3	40	50	10
9.	Prepare butt joint using arc welding as per given drawing safely.	CO-3	40	50	10
10.	Join the given sheets by using brazing.	CO-3	50	40	10
11.	Categorize different active and passive components available in the workshop.	CO-4	50	40	10
12.	Identify different type of meters used for voltage, current and wattmeter.	CO-4	60	30	10
13.	Measure resistance of different types of resistors using Multimeter.	CO-4	60	30	10
14.	Identify terminals of diodes and transistors.	CO-4	60	30	10
15.	Measure voltage and current for single and three phase Supply using multimeter and clip on meter.	CO-4	40	50	10
16.	Perform continuity test of given component using Multimeter.	CO-4	60	30	10
17.	Identify three terminals of a transistor using digital Multimeter.	CO-4	50	40	10
18.	Solder various resistors, capacitors and inductors and electronic components on Printed Circuit Board (PCB).	CO-4	30	60	10
19.	Conduct mock artificial respiration and first Aid exercises to learn about safety procedures of first Aid in case of electrical hazards.	CO-5	70	20	10
20.	Use Fire Extinguisher to extinguish the fire in a given situation.	CO-5	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical assess the student performance.

P) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Field Trips, Portfolio Based, Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field Information and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Measuring tools	Calipers inside and outside, micrometer, protractor, ruler, try square, scriber, laser level, depth gauge, measuring tape, Ammeter, voltmeter, multimeter, tachometer, rheostat	1,2,3
2.	Wood working tools	Marking and measuring tools, saw, claw hammer, mallet, chisels, planers, squares	4,5.
3.	Drilling machine	Up to 15 mm drill cap with 1 HP motor 1000mm height	All
4.	vice	Carpentry vice 200 mm, bench vice 100mm, pipe vice 100 mm	1,2,3,4,5,6,7,8,9
5.	Work benches	Size 2000x1000x750 mm	All
6.	Surface plate	600x900 mm grade I	All
7.	Welding machine	20 KV, 400 A Welding current, welding cable 400 amp, with all accessories	6,7,8,9
8.	Soldering and brazing equipment	Solder. Soldering iron (35 W) soldering wick, magnifying glass, wire cutters, brazing torch, aluminum brazing rod,	9
9.	Gas welding and hand tools	Welding torch, welding tip, pressure regulator, oxygen and acetylene gas cylinder and cutting kit with cylinder and regulator, spark lighter	7,8
10.	Arc welding and hand tools	Electrode holder, cable connector, chipping hammer, earthing clamp, wire brush.	6,7,8,9
11.	Electrical and electronics tools	Wire cutter, screwdriver, insulating tape, wire stripper, pilers, cable cutters, spanner, voltage tester, torch, diode, capacitor, inductor, SCR, transistor, ICs, Led, resistor, switches, plugs, circuit brakers,	10,11,12,13,14, 15,16,17,18
12.	Fire Extinguisher	A, B, C type with capacity of 5 kg and 10 kg of CO_2 type	All

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Workshop Practice	Bawa,H.S	McGraw Hill Education, Noida ISBN:978-0070671195
2.	Engineering Workshop Practice	A.K. Sarathe	Khanna Book Publishing Co.(P) LTD. New Delhi; 2021 edition ISBN:978-93-91505-51-6
3.	A textbook of workshop Technology.	R.S. Khurmi ,J.K.GUPTA	S.Chand and Co. New Delhi ISBN:9788121908689
4.	Fundamentals of electrical and electronics engineering	J.B. Gupta	S.K. Kataria & sons. New Delhi ISBN:978-81-85749-37-2
5.	Engineering Workshop practice on Electrical &Electronics Engineering	J. Glory Priyadarshini, Dr. K.S.S. Rani , Dr.M.P Maheswari, S. Gomathy	Notion Press Mumbai, ISBN-9781639203819

(b) Online Educational Resources:

1. **Wooden joints**: https://www.youtube.com/watch?v=-f7tTNRH_04
2. **Carpentry tools**: https://www.youtube.com/watch?v=ZyN9Tw9VTSo
3. **Classification of welding joints**: https://www.youtube.com/watch?v=cQEUJnMYf_U
4. **Gas welding**: https://www.youtube.com/watch?v=-SA4D098u-Q
5. **Arc welding**: https://youtu.be/5hRgwnejWPs
6. **Soldering and brazing**: https://www.youtube.com/watch?v=fnEFuzeM8cc
7. **Electrical tools**: https://www.youtube.com/watch?v=0jbFC8dvTVY
8. **Multimeter**: https://www.youtube.com/watch?v=VnL7-TbttGw
9. **Galvanometer**: https://www.youtube.com/watch?v=LdAb3hUDTRY
10. **LED**: https://www.youtube.com/watch?v=0T5ZkOEkrL8
11. **Diodes**: https://www.youtube.com/watch?v=Fwj_d3uO5g8
12. **Capacitors**: https://www.youtube.com/watch?v=X4EUwTwZ110

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others:

1. Kents Mechanical Engineering Handbook, John Wiley and Sons, New York.
2. Workshop practice Handbook.
3. Electrical and electronics handbooks
4. Lab Manuals.

******

A) Course Code : 2418107(P2418107/S2418107)

B) Course Title : ICT Tools
(CE, ME, ME (Auto), FTS, CSE, AIML, MIE, CRE, CHE, FPP, TE, CACDDM, GT)

C) Pre- requisite Course(s) :

D) Rationale :

Besides working in technical environment in their profession, diploma pass outs may also get involved in routine office task related to creating business documents, perform data analysis and its graphical representations, making presentations. In order to carry-out these works, the students need to learn various desk-top based and internet-based software tools such as- office automation applications like word processing, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations during their graduation programme. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

E) Course Outcomes (Cos): After the completion of the course, teachers are expected to ensure the accomplishment of following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

- **CO-1** Prepare business document using word processing tool.
- **CO-2** Manipulate data and represent it graphically using spreadsheet.
- **CO-3** Prepare professional slide-based presentations.
- **CO-4** Work effectively with Internet and basic web services

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	1	2	2	2	-	2	-		
CO-2	2	2	2	2	-	1	-		
CO-3	1	2	2	2	-	-	-		
CO-4	1	2	2	2	3	1	2		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2418107	ICT Tools	-	-	04	02	06	03

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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 = (1 x 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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2418107	ICT Tools	-	-	20	30	20	30	100

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 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:

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
–	**Unit-1.0** **Word Processing** **1.0 Word Processing:** Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, previewing a document, saving a document, closing a document and exiting application. **1.1 Editing a Document:** Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting Paragraphs, Line and paragraph spacing, using FIND and REPLACE, Setting line spacing, add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks **1.2 Changing the Layout of a Document:** Adjust page margins, change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs. **1.3 Inserting Elements to Word Documents**: Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture **1.4 Working with Tables:** Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells. **1.5 Working with Columned Layouts and Section Breaks:** a Columns, Section breaks, Creating columns, Newsletter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks.	**CO-1**
–	**Unit-2.0 Spreadsheets** **2.1 Working with Spreadsheets:** Overview of workbook and worksheet, Create Worksheet Entering data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook. **2.2 Editing Worksheet:** Insert data, adjust row height and column width, delete, move data, insert new rows and columns, Copy and Paste content, Find and Replace, Spell Check, sheet view Zoom In-Out, insert Special Symbols, Insert Comments, Add Text Box, Undo-redo Changes, - Freeze Panes, hiding/unhiding rows and columns. **2.3 Formatting Cells and sheet:** Setting Cell Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options, Adjust Margins, Page Orientation, insert Header and Footer, Insert Page Breaks, Set Background. **2.4 Working with Formula:** Creating Formula, absolute and relative cell references, Copying and pasting Formula, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical	**CO-2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	functions such as sqrt, power, statistical functions, applying conditions using IF. **2.5 Working with Charts:** Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using different chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet. **2.6 Advanced Operations:** Applying Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.	
–	**Unit-3.0 Presentation Tool** **3.1 Creating a Presentation:** Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Presentation, Saving work, creating new Slides, Changing a slide Layout, Applying a theme, Changing Colours, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence, **3.2 Inserting Media elements:** Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add Transitions, Add Speaker Notes, Print a Presentation. **3.3 Working with Tables:** Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications. **3.4 Working with Charts:** Insert Charts in a Slide, modify a Chart, Import Charts from Other Office Applications.	**CO-3**
–	**Unit-4.0 Basics of Internet** **4.1 World Wide Web**: Introduction, Internet, Intranet, URL, web servers, basic settings of web browsers- history, extension, default page, default search engine, privacy and security, creating and retrieving bookmarks, use search engines effectively for searching the content. **4.2 Web Services**: Cloud- software as service (SAS), Google docs, slides, sheets, Form, Web Sites, web pages, e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking	**CO-4**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2418107

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant Cos Number(s)
LSO 1.1. Perform fundamental word processing operations to create a document	1.	a) Create, edit and save document: apply formatting features on the text – line, paragraph b) Use bullets, numbering, page formatting, header, footer, margin, layout	CO-1
LSO 2.1. Work with images/shapes in a document	2.	Insert and edit images and shapes, resizing, cropping, colour, background, group/ungroup	CO-1
LSO 3.1. Organize data in tabular form in a document	3.	Insert table and apply various table formatting features on it.	CO-1
LSO 4.1. Perform Document proofing operations in a document	4.	Review features such as Spelling, grammar, Thesaurus, translate, language, word count, comments	CO-1
LSO 5.1. Organize and print Document	5.	Apply page layout features i. Print layout, web layout, show ruler, gridline, page zoom, split ii. Themes, page background, paragraph, page setup iii. Create multicolumn page iv. Use different options to print the documents	CO-1
LSO 6.1. Create batch of documents with tailored variable information using mail merge	6.	Use mail merge operation with options.	CO-1
Spreadsheets			
LSO 7.1. Create a worksheet *LSO 7.2.* Format sheet/cell	7.	Create, open and edit worksheet i. Enter data and format it, adjust row height and column width ii. Insert and delete cells, rows and columns. iii. Apply Format cell, wrap text, number format, orientation feature on cell.	CO-2
LSO 8.1. Perform fundamental calculation operations in a worksheet	8.	Insert formulas, absolute and relative cell reference, “IF” conditions, built-in functions and named ranges in worksheet.	CO-2
LSO 9.1. Filter the given data set *LSO 9.2.* Validate data based on criteria *LSO 9.3.* Sort the data in given order	9.	Apply conditional formatting, data Sorting, Data Filter and Data Validation features.	CO-2
LSO 10.1. Create various types of charts to represent data in graphical form	10.	Create different charts, apply various chart options.	CO-2
LSO 11.1. Print worksheet as per given layout	11.	Apply Page setup and print options on worksheet to print the worksheet.	CO-2
Presentation Tools			
LSO 12.1. Create electronic slide show containing text, image, shape, table, charts objects	12.	Create slide presentation i. Apply design themes to the given presentation ii. Add new slides and insert text, pictures/images, shapes iii. Add tables and charts in the slides	CO-3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant Cos Number(s)
LSO 13.1. Run slide presentation in different modes *LSO 13.2.* Print slide presentation	13.	i. Run slide presentation in customize form/modes ii. Print slide presentation as sheet, handouts using various print options	CO-3
LSO 14.1. Apply given animation effects to the text and slides.	14.	Apply different animation effects to the text and slides with given options.	CO-3
LSO 15.1. Add audio and video files in the presentation	15.	Add some sample audio and video files in the presentation and format the same with various options available.	CO-3
Internet Basics			
LSO 16.1. Configure internet and browser setting	16.	a) Configure Internet connection b) Configure browser settings and use browsers	CO-4
LSO 17.1. Use different internet services	17.	a) Use internet for different web services, such as, chat, email, video conferencing, etc.	CO-4
LSO 18.1. Work with Google Doc	18.	Work with Google Doc for creating collaborative documents on cloud	CO-4
LSO 19.1. Work with google sheet	19.	Work with google sheet for creating collaborative spreadsheets on cloud	CO-4
LSO 20.1. Work with google slides	20.	Work with google slides for creating collaborative slide presentation on cloud	CO-4
LSO 21.1. Create google form	21.	a) Create google form for a sample survey b) Through google forms collect user's response, download it in csv format, analyze it and represent data/trend through graphs and present it.	CO-4, CO3

L) Suggested Term Work and Self Learning: S2418107 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:

I. **Word documents**: prepare documents such as Time Table, Application, Notes, Reports. (Subject teacher shall assign a document to be prepared by each student)

II. **Slide Presentations:** Prepare slides with all Presentation features such as: content presentation, presentation about department, presentation of reports. (Subject teacher shall assign a presentation to be prepared by each student).

III. **Spreadsheets:** Prepare statements such as Pay bills, tax statement, student's assessment record using spreadsheet- perform statistical analysis, sorting and filtering operations, represent data through various types of charts. (Teacher shall assign a spreadsheet to be prepared by each student).

c. Other Activities: ---

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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	-	-	15%	-	-	20%	20%
CO-2	-	-	10%	25%	-	10%	20%
CO-3	-	-	15%	25%	33%	15%	20%
CO-4	-	-	30%	25%	33%	15%	20%
CO-5	-	-	30%	25%	34%	40%	20%
Total Marks	-	-	**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 are 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: (Not Applicable)

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	a) Create, edit and save document: apply formatting features on the text - line, paragraph b) Use bullets, numbering, page formatting, header, footer, margin, layout	CO-1	60	30	10
2.	Insert and edit images and shapes, resizing, cropping, colour, background, group/ungroup	CO-1	60	30	10
3.	Insert table and apply various table formatting features on it.	CO-1	60	30	10
4.	Review features such as Spelling, grammar, Thesaurus, translate, language, word count, comments	CO-1	70	20	10
5.	Apply page layout features i.Print layout, web layout, show ruler, gridline, page zoom, split ii. Themes, page background, paragraph, page setup iii. Create multicolumn page iv. Use different options to print the documents	CO-1	60	30	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
6.	Use mail merge operation with options.	CO-1	60	30	10
7.	Create, open and edit worksheet i. Enter data and format it, adjust row height and column width ii. Insert and delete cells, rows and columns. iii. Apply Format cell, wrap text, number format, orientation feature on cell.	CO-2	60	30	10
8.	Insert formulas, absolute and relative cell reference, "IF" conditions, built-in functions and named ranges in worksheet.	CO-2	60	30	10
9.	Apply conditional formatting, data Sorting, Data Filter and Data Validation features.	CO-2	60	30	10
10.	Create different charts, apply various chart options.	CO-2	30	60	10
11.	Apply Page setup and print options on worksheet to print the worksheet.	CO-2	30	60	10
12.	Create slide presentation i. Apply design themes to the given presentation ii. Add new slides and insert text, pictures/images, shapes iii. Add tables and charts in the slides	CO-3	40	50	10
13.	i. Run slide presentation in customize form/modes ii. Print slide presentation as sheet, handouts using various print options	CO-3	30	60	10
14.	Apply different animation effects to the text and slides with given options.	CO-3	60	30	10
15.	Add some sample audio and video files in the presentation and format the same with various options available.	CO-3	60	30	10
16.	a) Configure Internet connection b) Configure browser settings and use browsers	CO-4	70	20	10
17.	Use internet for different web services, such as, chat, email, video conferencing, etc.	CO-4	70	20	10
18.	Work with Google Doc for creating collaborative documents on cloud	CO-4	60	30	10
19.	Work with google sheet for creating collaborative spreadsheets on cloud	CO-4	60	30	10
20.	Work with google slides for creating collaborative slide presentation on cloud	CO-4	60	30	10
21.	i. Create google form for a sample survey ii. Through google forms collect user's response, analyze it and represent data/trend through graphs and present it.	CO-4, CO-3	60	30	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/Implementation Strategies: Different Instructional/ ImplementationStrategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Portfolio Based Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field, Information and Communications Technology (ICT) Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Sessions, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Computer system with internet connection	(Any computer system with basic configuration)	All
2.	Office application	Such as- Microsoft Office 365/ Microsoft Office 2019 or latest	All

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Microsoft Office 2019 For Dummies Paperback – 1 January 2018	Wallace Wang	Wiley (1 January 2018), ISBN-10: 8126578556 ISBN-13: 978-8126578559
2.	Office 2019 In Easy Steps	Michael Price	BPB Publications; First edition (1 January 2019) ISBN-10: 938851114X ISBN-13: 978-9388511148
3.	MS OFFICE 2016 ADVANCED LEVEL Basic Computer Concept In Hindi A Complete Book For MS OFFICE 2016 IN Hindi Language	Rakesh Sangwan	ASCENT PRIME PUBLICATION; 2022nd edition (1 January 2021)

(b) Online Educational Resources:

1. Gain essential skills in Office 2019 and 365: (https://edu.gcfglobal.org/en/topics/office/)
2. Microsoft 365 basics video training: (https://support.microsoft.com/en-us/office/microsoft-365-basics-video-training-396b8d9e-e118-42d0-8a0d-87d1f2f055fb)

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

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A) Course Code **: 2400007(T2400007)**

B) Course Title **:** Indian Constitution (Common for all Programmes)

C) Pre- requisite Course(s) **:**

D) Rationale **:**

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course out comes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/laboratory/workshop/field/ industry.

After completion of the course, the students will be able to-

CO-1 Enumerate salient features and characteristics of the constitution of India.

CO-2 Follow fundamental rights and duties as responsible citizen and engineer of the country.

CO-3 Analyze major constitutional amendments in the constitution.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	**Programme Outcomes (POs)**							**Programme Specific Outcomes* (PSOs)**	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	1	-	-	-	2	-	-		
CO-2	1	-	-	-	2	-	-		
CO-3	1	2	-	-	2	-	1		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400007	Indian Constitution	01	-	-	-	01	01

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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= (1 x 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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400007	Indian Constitution	25	-	-	-	-	-	25

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 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: T2400007

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the meaning of preamble of the constitution. TSO 1b. List the salient features of constitution. TSO 1c. List the characteristics of constitution.	**Unit-1.0 Constitution and Preamble** 1.1 Meaning of the constitution of India. 1.2 Historical perspective of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble to the Constitution of India.	**CO1**
TSO 2a. Enlist the fundamental rights. *TSO 2b.* Identify fundamental duties in general and in particular with engineering field. *TSO 2c.* identify situations where directive principles prevail over fundamental rights.	**Unit-2.0 Fundamental Rights and Directive Principles** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance. 2.3 Relevance of Directive Principles of State Policy under part-IV.	**CO2**
TSO 3a. Enlist the constitutional amendments. *TSO 3b.* Analyze the purposes of various amendments.	**Unit-3.0 Governance and Amendments** 3.1 Amendment of the Constitutional Powers and Procedure 3.2 Major Constitutional Amendment procedure - 42nd, 44th, 74th, 76th, 86th and 91st	**CO3**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: (Not Applicable)

L) Suggested Term Work and Self Learning: 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. Role of Media in Spreading Awareness regarding Fundamental Rights
2. Analysis of Situations where directive principle of State policy has prevailed over Fundamental rights
3. Analyze 42nd and 97th Amendment of Indian Constitution

c. Other Activities:

1. Seminar Topics:
- Democracy and Political Participation in India
- Situations where directive principles prevail over fundamental rights.

2. Visits:
    - Arrange Mock Parliament.
3. Design games and simulation on emergencies declared in last thirty years.

4. Group discussions on current print articles.
    - Adoption of Article 365 in India.

- Need of amendments in the constitution.

5. Prepare collage/posters on current constitutional issues.
   - Emergencies declared in India
   - Seven fundamental rights

6. Cases: Suggestive cases for usage in teaching:

Case	Relevance
A.K. Gopalan Case (1950)	SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.
Shankari Prasad Case (1951)	This case dealt with the amendability of Fundamental Rights (the First Amendment's validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
Minerva Mills case (1980)	This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
Maneka Gandhi case (1978)	A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."

7. **Self-Learning Topics:**

   - Parts of the constitution and a brief discussion of each part.
   - Right to education.
   - Right to equality.

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**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	30%	-	-	-	-	-	-
CO-2	40%	-	-	-	-	-	-
CO-3	30%		-	-	-		
Total Marks	**25**	**-**	-	-	-	**-**	**-**
			-				

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 are 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: (Not Applicable)

O) Suggested AssessmentTable for Laboratory (Practical): (Not Applicable)

P) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Field Trips, Portfolio Based, Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field Information and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

Q) List of Major Laboratory Equipment, Tools and Software: (Not Applicable)

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	The Constitution of India	P.M.Bakshi	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105
2.	Introduction to Indian Constitution	D.D.Basu	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3.	Introduction to Constitution of India	B. K. Sharma	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197
4.	The Constitution of India	B.L. Fadia	Sahitya Bhawan,Agra, 2017, ISBN:8193413768
5.	The Constitutional Law of India	Durga Das Basu	LexisNexis Butterworths Wadhwa, Nagpur 978-81-8038-426-4

(b) Online Educational Resources:

1. https://www.coursera.org/learn/principles-of-management
2. http://www.legislative.gov.in/constitution-of-india
3. https://en.wikipedia.org/wiki/Constitution_of_India
4. https://www.india.gov.in/my-government/constitution-india
5. https://eci.gov.in/about/about-eci/the-setup-r1/
6. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/
7. https://main.sci.gov.in/constitution
8. https://nios.ac.in/media/documents/srsec317newE/317EL8.pdf
9. https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf
10. https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm
11. https://constitutionnet.org/vl/item/basic-structure-indian-constitution

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

(c) Others: -

******

A) Course Code : 2400009(T2400009)

B) Course Title : Open Educational Resources (OER)
(FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)

C) Pre- requisite Course(s) :

D) Rationale :

Open educational resources (OER) are openly-licensed, freely available educational materials that can be modified and redistributed by users. Learning about Open Educational Resources (OER), copyright, and Creative Commons licenses is a valuable endeavor for content creators, users, and anyone interested in sharing knowledge and creative works. Creative Commons licenses, offer a standardized way to grant permissions for the use and sharing of creative works. Learning about OER, copyright, and Creative Commons licenses is an ongoing process. As these fields evolve, it's important to stay informed and continue exploring new resources and practices.

After going through this course, students will at first place have reasonable idea to explore and use various OERs useful for their course of study and secondly, be motivated for fair use of resources available to them on various platform by understanding the restrictions and legal issues related to copyright and other licensing policies.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the accomplishment of following course outcomes by the learners. For this, the learners are expected to perform various activities related to three learning domains (Cognitive, Psychomotor and Affective) in classroom/ laboratory/ workshop/ field/ industry.

After completion of the course, the students will be able to-

CO-1 Use Open Educational Resources (OER) after their evaluation
CO-2 Use copyright material appropriately.
CO-3 Implement suitable Creative Common License.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes(POs)							Programme SpecificOutcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	-	2	-	-	3	-	3		
CO-2	-	2	-	-	3	-	3		
CO-3	-	3	-	-	3	-	3		

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by the respective program coordinator at the institute level. As per the latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Codes	Course Title	Scheme of Study (Hours/Week)				
		Classroom Instruction (CI)		Notional Hours (TW/ Activities+ SL)	Total Hours (CI+TW/ Activities)	Total Credits (C)
		L	T			
2400009	Open Educational Resources	01	-	-	01	01

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, 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 = (1 x 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.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400009	Open Educational Resources	25	-	-	-	-	-	25

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 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: T2400009

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the difference between OER and other free educational materials. *TSO 1b.* Describe the challenges and benefits of using OER in a class. *TSO 1c.* Apply various aspects of evaluating OER before use *TSO 1d.* Explain necessity to assess an OER's adaptability. *TSO 1e.* Use preliminary search for open educational resource. *TSO 1f.* Find OER using various resources.	**Unit-1.0 Open Educational Resources** 1.1 OER - definition 1.2 What is NOT OER. 1.3 Benefits of using OER – Benefits to Students - Access to Quality Education 1.4 OER - Benefits to Faculty - Use, Improve and Share, Network and collaborate with peers, Lower Cost, Improve access to information 1.5 Challenges of Using OER – Subject Availability, Format and Material type availability, Time and Support availability 1.6 Evaluating OER – a) Clarity, Comprehensibility, and Readability, b) Content and Technical Accuracy, c) Adaptability and Modularity, d) Appropriateness and Fit, e) Accessibility 1.7 Finding Open Content - OER Search Scenario Filter by Usage Rights in Google, Repositories and Search Tools, Subject-specific Repositories	**CO1**
TSO 2a. Explain benefits of copyright protection for creator *TSO 2b.* Explain exceptions and limitations to copyright law *TSO 2c.* List rights granted to copyright holders. *TSO 2d.* Explain Exceptions and limitations to copyright law *TSO 2e.* Explain Fair use/fair dealing apply to copyright *TSO 2f.* Elaborate Public domain and how does it relate to copyright *TSO 2g.* Elaborate penalties for copyright infringement. *TSO 2h.* Explain copyright for digital content and the internet. *TSO 2i.* Explain use of copyrighted works in education *TSO 2j.* Explain the use of free licenses	**Unit-2.0 Copyright and Open Licensing** 2.1 Copyright and what it does protect, benefits of copyright protection for creators, duration of copyright protection last, rights granted to copyright holders. 2.2 Exceptions and limitations to copyright law, fair use/fair dealing apply to copyright 2.3 Public domain and its relation to copyright. 2.4 Penalties for copyright infringement 2.5 Apply copyright to digital content and the internet 2.6 Use of copyrighted works in education. 2.7 Open Licenses – GNU – Free Documentation license, Free Art License 2.8 Why Free Licenses – Retain, Reuse, Revise, Remix, Redistribute	**CO2**
TSO 3a. Describe the four different Creative Commons License components. *TSO 3b.* Explain the reason some CC-licensed content might not be considered OER. *TSO 3c.* Explain the Strength and weakness of four Open CC Licenses *TSO 3d.* Choose the right Creative Commons license for work.	**Unit-3.0 Creative Common Licenses** 3.1 Alternatives to copyright as Creative Commons licenses. 3.2 Four components of creative common Licenses – Attribution, Share- Alike, Non – commercial, No Derivatives 3.3 Choosing a Creative common licenses – Wiley's 5 Rs and Creative Common Licenses	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3e. Apply a Creative Commons license to existing work. *TSO 3f.* Use of Creative Commons licenses for commercial purposes. *TSO 3g.* Modify a work licensed under Creative Commons. *TSO 3h.* Revoke a Creative Commons license, combine works with different Creative Commons licenses *TSO 3i.* Differentiate between Attribution and Citation	3.4 Four Open CC Licenses and Their Strengths and Weaknesses – (a) CC BY (b) CC BY SA (c) CC BY NC (d) CC BY NC SA 3.5 Attribution Vs Citation - Creative Commons licensed work without giving attribution 3.6 Apply a CC License - choose the right Creative Commons license for work, apply a Creative Commons license to existing work, Creative Commons licenses be used for commercial purposes, modify a work licensed under Creative Commons, revoke a Creative Commons license, combine works with different Creative Commons licenses	

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

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

a. Assignments:

Related to Open Educational Resources – CO1

i. OER help to reduce the cost of education for students. Justify?
ii. Explain why it is necessary to assess an OER's adaptability?
iii. Identify four search tools for finding open educational resources?
iv. Identify at least two search tools for finding openly licensed media?

Related to Copyright – CO2

i. Explain copyright and what does it protect
ii. Explain the rights granted to copyright holders
iii. Describe the exceptions and limitations to copyright law
iv. Elaborate the way fair use/fair dealing apply to copyright?
v. Describe the public domain and its relationship with copyright
vi. Elaborate the penalties for copyright infringement?
vii. Explain copyright apply to digital content and the internet
viii. Explain the way copyright law address the use of copyrighted works in education

Related to Creative Common Licenses – CO3

i. Explain various Creative Commons licenses
ii. Describe, how can you apply a Creative Commons license to your existing work?
iii. Explain the benefits of using Creative Commons licenses?
iv. Elaborate, how you can modify a work licensed under Creative Commons?
v. Are Creative Commons licenses valid worldwide?
vi. Elaborate how Creative Commons license can be revoked, once it has been applied to your work?
vii. Explain, how anyone use a Creative Commons licensed work without giving attribution?
viii. Explain the limitations/restrictions while using works with Creative Commons licenses?

b. Micro Projects:

1. Collect information on the impact of OER on cost savings and student engagement.
2. Search at least four OER related to topic of your Engineering Discipline over Internet. Evaluate the material based on the relevance, accuracy and usability.
3. Explore the different types of resources under creative Commons licenses (e.g., CC BY, CC BY-SA, CC BY-NC, etc.) and their specific permissions and restrictions.
4. Create a comparative analysis chart or infographic that visually represents the key characteristics of each license.
5. Select minimum 5 real-world examples from different domains (such as music, art, literature, or education) where creators have used Creative Commons licenses.

c. Other Activities:

1. Seminar Topics:
    - OER Quality Assurance
    - OER Repositories and Platforms
    - Creative Commons and Digital Media
    - Creative Commons in the Visual Arts
    - Examine the legal implications of using Creative Commons licenses, including the obligations and responsibilities of both creators and users and present it.

2. Self-Learning Topics:
    - Open Licensing and Copyright: Understanding the Legal Framework for OER
    - Creative Commons and the future of Copyright
    - Copyright and Open Access Publishing
    - Copyright and Software

L) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Portfolio Based, Learning, Role Play, Live Demonstrations in Classrooms, Field Information and Communications Technology (ICT)Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Session, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

M) List of Major Laboratory Equipment, Tools and Software: (If Any)

S. No.	Name of Equipment, Tools and Software	Broad Specifications
1.	Computers	Desktop computer with word processing and presentation facility
2.	Internet	Internet Connectivity

N) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	The OER Starter Kit.	Abbey Elder – 2019	IA: Iowa State University Digital Press, available under a Creative Commons Attribution 4.0 International License. Retrieved from iastate.pressbooks.pub/OER starter kit
2.	A Brief History of Open Educational Resources	Bliss, T J and Smith, M. - 2017	In: Jhangiani, R S and Biswas-Diener, R. (Eds.) Open: The Philosophy and Practices that are Revolutionizing Education and Science (pp. 9–27). London: Ubiquity Press. DOI: https://doi.org/10.5334/bbc.b.

Note: Above listed books are available in soft form and can be downloaded as given respective link

(b) Online Educational Resources:

1. OER for Empowering Teachers Instructional Material by P. Malliga is licensed under a Creative Commons Attribution 4.0 International License.
2. William & Flore Hewlett Foundation. (n.d.). OER defined. Retrieved from https://hewlett.org/strategy/open-educational-resources/
3. Free Software Foundation. (2008). GNU Free Documentation License. Retrieved from https://www.gnu.org/licenses/fdl.html
4. Copyleft Attitude. (2007). Free Art License 1.3. Retrieved from http://artlibre.org/licence/lal/en/
5. Free Software Foundation. (n.d.). What is copyleft? Retrieved from https://www.gnu.org/copyleft/copyleft.html

Note: Teachers are requested to check the creative commons license status/ financial implications of the suggested, online educational recourses before use by the students.

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