

Curriculum of Diploma Programme
in
Mechanical Engineering



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

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

Semester – II Teaching & Learning Scheme

Course Codes	Category of course	Course Titles	Teaching & Learning Scheme (Hours/Week)					
			Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
2400102A	ASC	Applied Physics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	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
2425104	BEC	Engg. Mechanics (CE, EE, ME, ME (Auto), MIE, FTS, AE, CRE, CHE, ELX, ELX (R), TE)	03	-	04	02	09	06
2400105A	ASC	Applied Mathematics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	02	01	-	02	05	04
2425106	BEC	Mechanical Workshop (ME, ME (Auto), MIE, AE, CRE, CE, CHE)	-	-	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
2400008	NRC	Sports, Yoga and Meditation (Common for All Programmes)	-	-	01	01	02	01
2400009	NRC	Open Educational Resources (Non-exam course) (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)	01	-	-	-	01	01
Total			12	1	21	13	47	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, work shop, field or other locations using different instructional/Implementation strategies)

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

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

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

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

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

Semester - II 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)	
2400102A	ASC	Applied Physics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	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
2425104	BEC	Engg. Mechanics (CE, EE, ME, ME (Auto), MIE, FTS, AE, CRE, CHE, ELX, ELX (R), TE)	30	70	20	30	20	30	200
2400105A	ASC	Applied Mathematics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	30	70	20	30	-	-	150
2425106	BEC	Mechanical Workshop (ME, ME (Auto), MIE, AE, CRE, CE, CHE)	-	-	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
2400008	NRC	Sports, Yoga and Meditation (Common for All Programmes)	-	-	10	-	06	09	25
2400009	NRC	Open Educational Resources (Non-exam course)	25	-	-	-	-	-	25
Total			145	280	130	180	106	159	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

- A) **Course Code** : 2400102A(T2400102A/P2400102A/S2400102A)
 B) **Course Title** : Applied Physics – A (ME, ME (Auto), CE, MIE, CRE, CHE, AE, FTS)
 C) **Pre- requisite Course(s)** :
 D) **Rationale** :

As a subject Physics includes large numbers of diverse topics, related to materials, energy and their interactions that exists in the world around us, it empowers us to explain the different physical phenomena by observation and prediction. Engineering Diploma graduates are required to use of principles of physics in various fields of engineering and technology and same has been given prominence in the course content. 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 concepts and principles of rotational motion in various civil and mechanical engineering problems.
CO-3 Select relevant materials for industrial applications based on its physical and thermal properties.
CO-4 Apply the concept of waves for various engineering applications involving wave dynamics
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/ 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	1	-	-	-	1	2		
CO-2	3	2	2	1	1	1	1		
CO-3	3	1	2	1	1	1	1		
CO-4	3	2	2	1	-	1	1		
CO-5	3	2	1	2	-	1	2		

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

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

- G) **Teaching & Learning Scheme:**

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

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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)	
2400102A	Applied Physics- A	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: T2400102A

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Distinguish between fundamental and derived physical quantity.</p> <p><i>TSO 1b.</i> Estimate the errors in the measurement of given physical quantity.</p> <p><i>TSO 1c.</i> Derive dimensional formula of a given physical quantity.</p> <p><i>TSO 1d.</i> Apply dimensional analysis for inter conversion of units.</p> <p><i>TSO 1e.</i> Establish relation between physical quantities using dimensional analysis.</p> <p><i>TSO 1f.</i> Use dimensional analysis to check the correctness of a given equation.</p>	<p>Unit-1.0 Unit and Measurements</p> <p>1.1 Physical quantities, fundamentals and derived units and system of units</p> <p>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</p> <p>1.3 Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimension in an equation</p> <p>1.4 Applications of dimensions: conversion from one system of units to other, corrections of equations and derivation of simple equations</p> <p>1.5 Ancient astronomical instruments: Chakra, Dhanuryatra , Yasti and Phalaka yantra .</p>	CO1
<p><i>TSO 2a.</i> Explain circular motion and various terms related to circular motion.</p> <p><i>TSO 2b.</i> Apply the concept of centripetal and centrifugal forces in a given situation.</p> <p><i>TSO 2c.</i> Distinguish between translational and rotational motion.</p> <p><i>TSO 2d.</i> Explain the terms torque and angular momentum.</p> <p><i>TSO 2e.</i> Apply the principle of conservation of angular momentum in a given situation.</p> <p><i>TSO 2f.</i> Find the moment of inertia of a given regular shape body.</p>	<p>Unit-2.0 Circular and Rotational Motion</p> <p>2.1 Circular motion, angular displacement, angular velocity, frequency, time period, angular acceleration, relation between angular & linear velocity, linear acceleration & angular acceleration</p> <p>2.2 Centripetal and centrifugal forces: banking of roads and bending of cyclist</p> <p>2.3 Translational and rotational motion, torque and angular momentum, conservation of angular momentum and its applications</p> <p>2.4 Moment of inertia and its physical significances, radius of gyration of rigid body, theorem of parallel and perpendicular axes (statements only), moment of inertia of rod, ring, disc and sphere (hollow and solid)</p>	CO2
<p><i>TSO 3a.</i> Explain the stress-strain curve of a given elastic or plastic body.</p> <p><i>TSO 3b.</i> Interrelate different coefficient of elasticity.</p> <p><i>TSO 3c.</i> Apply the concepts of surface tension and viscosity to solve a given engineering problem.</p> <p><i>TSO 3d.</i> Explain the behavior of given fluids on the basis of their viscosity.</p> <p><i>TSO 3e.</i> Determine the various modes heat transfer in a given engineering problem.</p> <p><i>TSO 3f.</i> Establish relation between coefficients of thermal expansion.</p>	<p>Unit-3.0 Physical Properties of Matter and Heat</p> <p>3.1 Elasticity: Hooke's law, Coefficient of elasticity; Young's modulus, Bulk Modulus and modulus of rigidity and their inter-relation (No derivation), Poisson's ratio, stress-strain curve, elastic potential energy</p> <p>3.2 Surface tension: Intermolecular Force, cohesive and adhesive forces, Surface Tension, Surface Energy, angle of contact, Ascent formula (No derivation), applications of surface tension, capillary action, effect of temperature and impurity on surface tension</p> <p>3.3 Viscosity: Fluid, Viscosity and coefficient of viscosity, Critical Velocity, Reynold's number,</p>	CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	streamline and turbulent flow, Terminal velocity, Stokes law and effect of temperature on viscosity. 3.4 Heat: Concept of Heat and Temperature and it's difference, modes of heat transfer: conduction, convection, radiation, coefficient of thermal conductivity, thermal expansion of solid, liquid and gas, coefficient of linear, surface and cubical expansions and relation amongst them.	
<p><i>TSO 4a.</i> Differentiate among periodic, oscillatory and simple harmonic motion.</p> <p><i>TSO 4b.</i> Explain the various terms related to SHM.</p> <p><i>TSO 4c.</i> Derive the expression for time period of given Bar pendulum.</p> <p><i>TSO 4d.</i> Distinguish between mechanical and electromagnetic waves with examples</p> <p><i>TSO 4e.</i> Differentiate between longitudinal and transverse waves with examples</p> <p><i>TSO 4f.</i> Find the relation between the terms used to describe wave motion.</p> <p><i>TSO 4g.</i> Explain the principle of Superposition of waves and beat formation with examples.</p>	<p>Unit-4.0 Simple Harmonic Motion and Wave Motion</p> <p>4.1 Periodic and Oscillatory Motion</p> <p>4.2 Simple Harmonic Motion (SHM): Displacement, Amplitude, phase, velocity, acceleration, time period, frequency and their interrelation, Conservation of energy in SHM, Compound pendulum: Bar pendulum</p> <p>4.3 Types of waves: Mechanical and Electromagnetic waves, Transverse and longitudinal waves, wave velocity, frequency and wave length and their relationship, wave equation, amplitude, phase, phase difference, superposition of waves, Beats formation</p>	CO4
<p><i>TSO 5a.</i> Apply the concept of photoelectric effect to explain the of photonic devices.</p> <p><i>TSO 5b.</i> Explain Laser, components of laser and its various engineering applications.</p> <p><i>TSO 5c.</i> Explain propagation of light in optical fiber and its engineering applications.</p> <p><i>TSO 5d.</i> Describe the properties of nanomaterials and its various applications.</p>	<p>Unit-5.0 Modern Physics</p> <p>5.1 Photoelectric effect; Photon, threshold frequency, work function, Stopping Potential, Einstein's photoelectric equation.</p> <p>5.2 Lasers: Properties, Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, types of lasers: Ruby laser, He-Ne Laser, engineering and medical applications of lasers.</p> <p>5.3 Optical fibers: Total internal reflection, acceptance angle and numerical aperture, Optical fiber types, applications of optical fibers</p> <p>5.4 Nanotechnology: Properties (optical, magnetic and dielectric properties) of Nanomaterials and its application, Metallic, Bhasma (Ancient Ayurveda, IKS)</p>	CO5

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400102A

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<p><i>LSO 1.1.</i> Use Vernier caliper to measure the known and unknown dimensions of a given small object.</p> <p><i>LSO 1.2.</i> Estimate the mean absolute error up to two significant figures.</p>	1.	Vernier caliper	CO1
<p><i>LSO 2.1.</i> Use screw gauge to measure the diameter/ thickness of a given object.</p> <p><i>LSO 2.2.</i> Estimate the mean absolute, relative and percentage errors up to three significant figures.</p>	2.	Screw gauge	CO1
<p><i>LSO 3.1.</i> Use Spherometer to measure radius of curvature of given convex and concave mirror/surface.</p> <p><i>LSO 3.2.</i> Estimate errors in the measurement.</p>	3.	Spherometer	CO1
<p><i>LSO 4.1.</i> Determine the spring constant of a given spring.</p>	4.	Spring Oscillator	CO4
<p><i>LSO 5.1.</i> Determine the time period of oscillation of given bar pendulum.</p> <p><i>LSO 5.2.</i> Determine the radius of gyration and moment of inertia about an axis perpendicular to the plane of oscillation and passing through its center of mass of given bar pendulum.</p>	5.	Bar Pendulum	CO2, CO4
<p><i>LSO 6.1.</i> Find the moment of inertia of a given flywheel</p>	6	Fly wheel	CO2
<p><i>LSO 7.1.</i> Determine the coefficient of linear expansion of material of a given rod.</p>	7	Pullingger's apparatus	CO3
<p><i>LSO 8.1.</i> Use Searle's apparatus to determine the Young's modulus of a given wire.</p>	8	Searle's apparatus	CO3
<p><i>LSO 9.1.</i> Apply Stokes law to determine the coefficient of viscosity of a given viscous liquid.</p>	9	Stokes law	CO3
<p><i>LSO 10.1.</i> Determine the inverse square law relation between the distance of photocell and light source v/s intensity of light source.</p>	10	Photo-electric cell experiment	CO5
<p><i>LSO 11.1.</i> Determine the Numerical Aperture (NA) of a given step index optical fiber.</p>	11	Numerical Aperture of an optical fiber	CO5
<p><i>LSO 12.1</i> Measure wavelength of a He-Ne/diode laser by using a plane diffraction grating.</p>	12	He-Ne/diode laser	CO5
<p><i>LSO 13.1</i> Plot the graph between KE of Photo electron v/s frequency of incident light</p> <p><i>LSO 13.2</i> Determine the value of Plank's Constant (h) from the graph between KE v/s frequency of incident light.</p>	13	Photo electric effect (virtual lab experiment)	CO5

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 13.3 Determine the variation of stopping potential w.r.t frequency of incident photon			
LSO 14.1 Determine the wave length of different spectral lines of Hydrogen spectra	14	Emission Spectra of Hydrogen (virtual lab experiment)	CO5

L) **Suggested Term Work and Self Learning: S2400102A** 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. Convert the units of given physical quantity from one system of units to another.
2. Find the different terms related to SHM/ wave from given equation of SHM/ wave.
3. Determine the change in the parameters related to rotational motion, when a regular shaped body rolls down on an inclined plane and give comparison for different bodies/ parameters.
4. Measure room temperature of hot bath/ bodies by using mercury thermometer and convert it into different temperature scales (lab- based).
5. Use online tool to determine S/V ratio of a given shape and size. (online assignment)

b. **Micro Projects:**

1. Make prototype Vernier calipers and screw gauge of desired Least Count,
2. Collect wires of different materials and find the fracture point for required applications
3. Design prototype model to find thermal conductivity of different metals.
4. Prepare model for determining moment of inertia of bodies with different shapes
5. Fiber optics: Demonstrate the phenomenon of total internal reflection.
6. LASER: Prepare model to demonstrate the properties and applications of LASER.
7. Viscosity: Collect 3 to 5 liquids and prepare a working model to differentiate liquids based on viscosity and demonstrate their applications.
8. Motion: Prepare model of ball rolling down on inclined plane to demonstrate the **conservation of energy** and motion of an object in inclined plane.
9. Waves in string: standing waves in string using woofer loudspeaker
10. Use smartphone to measure the different physical quantity with the sensor applications

c. **Other Activities:**

1. Seminar Topics:

- Needs of measurements in engineering and science.
- Applications of circular motions in daily life.
- LASER: Production & applications in science, industry, medical and defense, holography.
- Optical fibers: Construction and application in communication systems.
- Synthesis and applications of nanomaterials.
- CNT, Graphene and fullerene(C₆₀)
- Application of modes of different heat transmission in daily life.

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.
- Visit planetarium, Science city and research institutions for exploring the experimental and research facilities available.

3. Self-Learning Topics:

- Vectors and its properties with applications
- Types of fundamental units, system of units
- Newton's Laws of motion, momentum, inertia, impulse
- Inertial and non-inertial frame of reference
- Derivation of formula for moment of inertia
- Force, work, energy, power, work-energy theorem, law of **conservation of energy**
- Frictions and its types
- Pressure, density, Pascal's law, atmospheric and gauge pressure
- Work done in various Processes, Adiabatic constant ($C_p/C_v = \gamma$), Mayer's formula ($C_p - C_v = R$)
- CO₂ Laser, Semiconductor LASER.
- Interference and Diffraction of light

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	12%	12%	20%	20%	10%	30%	20%
CO-2	18%	18%	20%	20%	10%	10%	20%
CO-3	30%	30%	30%	20%	30%	30%	20%
CO-4	15%	15%	15%	20%	20%	10%	20%
CO-5	25%	25%	15%	20%	30%	20%	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 Unit and Measurements	6	CO1	8	4	2	2
Unit-2.0 Circular and Rotational motion	10	CO2	12	4	4	4
Unit-3.0 Physical Properties of Matter and Heat	12	CO3	20	4	8	8

Unit-4.0 Simple Harmonic motion and Wave Motion	8	CO4	12	2	4	6
Unit-5.0 Modern Physics	12	CO5	18	6	6	6
Total	48	-	70	20	24	26

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.	Pullingger's apparatus	CO3	60	30	10
7.	Searle's apparatus	CO3	50	40	10
8.	Stokes law	CO3	60	30	10
9.	Photo-electric cell experiment	CO5	40	50	10
10.	Numerical Aperture of an optical fiber	CO5	50	40	10
11.	He-Ne/diode laser	CO5	60	30	10
12.	Fly wheel	CO2	60	30	10
13.	Photo electric effect (virtual lab experiment)	CO5	70	20	10
14.	Emission spectra of Hydrogen (virtual lab experiment)	CO5	70	20	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.	1,8
2.	Micrometer screw gauge	Range 0-25 mm, Resolution 0.01 mm	2,7,8
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 gram, 100 gram) .	4
5.	Bar pendulum	Bar pendulum, meter scale a knife–edge with a platform, spirit level, precision stop watch	5
6.	Pullingger’s apparatus	Linear-expansion apparatus with steam generator, thermometer 0-100°C range, rubber tubes, metal rods of aluminum, iron, copper, brass and steel	6
7.	Searle’s apparatus	Two long steel wires of the same length and diameter, Brass rods, stopwatch, meter scale, 0.5 kg slotted masses, hanger	7
8.	Stokes’s law apparatus	A long cylindrical glass jar, Transparent viscous fluid, stop watch, bob, glycerin, tube clamp stand, Meter scale, Spherical ball, Thread	8
9.	Photo-electric cell experiment	Photo cell mounted in the metal box, Lamp holder with 60W bulb, analog meters (500μA & 1000mV), wooden bench fitted with scale and connecting wires	9
10.	Numerical aperture of an optical fiber	Laser Diode (2- 3 mW, 632nm) 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, optical bench	10
11.	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, 632nm), 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	11
12.	Fly wheel	Fly wheel setup, (Fly wheel 200 mm diameter with axial support on bearing, hanger 100g+9x100g slotted weight	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

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

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
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 and John W. Jewett
5. Physics Laboratory Manual, David H Loyd

- 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) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per 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 Engineering	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	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)	
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- <ul style="list-style-type: none"> ● 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
TSO.3a Explain various terms related to magnetic circuit.	Unit-3.0 Magnetic Circuits and Electromagnetic Induction	CO2, CO3

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number (s)
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 sessional 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)**		Sessional Work Assessment (SWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Sessional 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
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

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
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.

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	
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 Ω), 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:

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

- A) **Course Code** : 2425104(T2425104/P2425104/S2425104)
- B) **Course Title** : Engineering Mechanics
(ELX, ELX (R), TE, CE, ME, EE, ME (Auto), MIE, FTS, AE, CRE, CHE)
- C) **Pre- requisite Course(s)** :
- D) **Rationale** :

In day-to-day working we come across different types of structures created for different purposes and functions, while designing the structures, analysis of forces and stresses' is an important and prerequisite step. Correct analysis is possible only when one knows the types and effects of forces acting on the structures. This course provides the scope to understand fundamental concepts of laws of mechanics and their applications to different engineering problems. This course is designed to provide basic understanding about the different types of forces, moments and their effects on structural elements and to analyze different structural systems. The aim of this course is to help the student to comprehend the importance of applied mechanics and apply the principles of engineering mechanics to solve engineering problems.

- 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 Compute the force to solve the problems
- CO-2 Analyse various analytical and graphical conditions required for equilibrium of engineering systems.
- CO-3 Apply the principles of friction in various conditions to solve problems.
- CO-4 Calculate centroid, center of gravity and moment of Inertia of different geometrical shapes.
- CO-5 Select the relevant lifting machine(s) for the given purposes.

- 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	3	-	-	2	1	-	-		
CO-2	2	3	3	3	2	-	-		
CO-3	3	3	3	2	2	1	1		
CO-4	3	3	3	2	2	1	1		
CO-5	3	2	2	3	3	1	2		

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

* PSOs will be developed by respective programme coordinator at institute level. As per 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				
2425104	Engineering Mechanics	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)	
2425104	Engineering Mechanics	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: T2425104**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Explain concepts of the given terms.</p> <p><i>TSO 1b.</i> Use relevant units of various quantities in the given situations.</p> <p><i>TSO 1c.</i> Explain effects of a force on the given object.</p> <p><i>TSO 1d.</i> Resolve the given single force.</p> <p><i>TSO 1e.</i> Calculate the resultant of the given force system.</p> <p><i>TSO 1f.</i> Find the resultant of the given force system using law of parallelogram</p> <p><i>TSO 1g.</i> Determine graphically the resultant of the given force system by triangle law and polygon law.</p>	<p>Unit-1.0 Mechanics and Force System</p> <p>1.1 Significance and relevance: Mechanics, applied mechanics, statics and dynamics.</p> <p>1.2 Space, time, mass, particle, body, rigid body.</p> <p>1.3 Scalar and vector quantity, Units of measurement (SI units) Fundamental units and derived units.</p> <p>1.4 Force - unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force. Force system and its classification.</p> <p>1.5 Resolution of a force - Orthogonal and Non-Orthogonal components of a force, moment of a force, Avignon's Theorem.</p> <p>1.6 Composition of forces - Resultant, analytical method of determination of resultant for concurrent, non-concurrent and parallel co-planar force systems -Law of triangle, Law of parallelogram and law of polygon of forces.</p> <p>1.7 Graphic statics, graphical representation of force, Space diagram, force diagram, polar diagram and funicular polygon, Graphical method of determination of resultant for concurrent and parallel co-planar force systems.</p>	CO1, CO2
<p><i>TSO 2a.</i> Draw the free body diagram for the given condition.</p> <p><i>TSO 2b.</i> Determine unknown force in the given situation using Lami's theorem.</p> <p><i>TSO 2c.</i> Identify the types of beams required for the given situation.</p> <p><i>TSO 2d.</i> Determine reactions in the given type of beam analytically.</p> <p><i>TSO 2e.</i> Solve problems using free body diagram and Lami's theorem.</p>	<p>Unit-2.0 Static Equilibrium</p> <p>2.1 Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical conditions of equilibrium.</p> <p>2.2 Equilibrium of force systems analytically</p> <p>2.3 Lami's Theorem.</p> <p>2.4 Types of beam (determinate and indeterminate), supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, distributed load, load, couple), span of beam.</p> <p>2.5 Beam reaction for cantilever, simply supported beam with or without overhang - subjected to combination of Point load and LTD load or Vertical Point load and couple.</p> <p>2.6 Beam reaction for simply supported beam subjected to vertical loads only.</p>	CO1, CO2
<p><i>TSO 3a.</i> Calculate force of friction and coefficient of friction for the given condition or situation</p> <p><i>TSO 3b.</i> Describe the conditions for friction for the given situation.</p>	<p>Unit 3.0 Friction</p> <p>3.1 Friction and its relevance in engineering, types</p>	CO3, CO4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 3c.</i> Identify the various forces acting on a ladder for the given conditions using free body diagram.</p> <p><i>TSO 3d.</i> Compare the value of coefficient of friction between different surfaces.</p> <p><i>TSO 3e.</i> Interpret the effect of change of masses, change of angle of inclination or both on the coefficient of friction</p> <p><i>TSO 3f.</i> Calculate forces acting on a body that is moving on a horizontal rough surface</p> <p><i>TSO 3g.</i> Determine the forces acting on a body that is moving on an inclined plane</p>	<p>and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.</p> <p>3.2 Equilibrium of bodies on level surface subjected to force parallel and</p> <p>3.3 inclined to plane.</p> <p>3.4 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. FBD of ladder in friction</p>	
<p><i>TSO 4a.</i> Distinguish between centroid and center of gravity</p> <p><i>TSO 4b.</i> Calculate the centroid of geometrical plane figures.</p> <p><i>TSO 4c.</i> Calculate centroid of the given composite plane lamina</p> <p><i>TSO 4d.</i> Determine centre of gravity of the given simple solid.</p> <p><i>TSO 4e.</i> Determine centre of gravity of the given composite solid.</p> <p><i>TSO 4f.</i> Calculate Moment of Inertia of different geometric shapes.</p>	<p>Unit 4.0 Centroid, Centre of Gravity and Moment of Inertia</p> <p>4.1 Introduction to Centroid, Centre of Gravity and Areas</p> <p>4.2 Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle).</p> <p>4.3 Centroid of composite figures composed of not more than three geometrical figures and centroid of perforated section, axis of symmetry</p> <p>4.4 Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere).</p> <p>4.5 Centre of Gravity of composite solids composed of not more than two simple solids.</p> <p>4.6 Moment of inertia - Introduction, calculation of moment of inertia by integration method, theorem of perpendicular axis, theorem of parallel axis, moment of inertia of a rectangular section, hollow rectangular section, circular section, hollow circular section, triangular section</p>	CO4
<p><i>TSO.5a</i> Describe the components of the given lifting machine.</p> <p><i>TSO.5b</i> Differentiate the working principle of the given two types of lifting machines.</p> <p><i>TSO.5c</i> Determine velocity ratio, efficiency of the given lifting machine.</p> <p><i>TSO.5d</i> Calculate effort required and load lifted by the given lifting machine.</p> <p><i>TSO.5e</i> Draw the graph with the given data</p> <p><i>TSO.5f</i> Interpret the given graphs</p> <p><i>TSO.5g</i> Select the relevant lifting machine for the given purpose with justification</p>	<p>Unit-5.0 Simple Lifting Machine</p> <p>5.1 Simple lifting machine, load, effort, mechanical advantage, Applications and advantages. Velocity ratio, efficiency of machines, Law of machine.</p> <p>5.2 Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility</p> <p>5.3 Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Screw jack, Weston's differential pulley block, geared pulley block.</p> <p>5.4 Graphs of Load verses Effort, Load verses ideal Effort, Load verses Effort lost in friction, Load verses MA, Load verses Efficiency.</p>	CO2, CO5

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2425104

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Use force polygon table to determine the resultant of concurrent forces	1.	Determine resultant of concurrent coplanar force system using force polygon table.	CO1, CO2
<i>LSO 2.1</i> Apply Lami's theorem <i>LSO 2.2</i> Use simply supported beams to find reactions	2.	Determine unknown force in a concurrent balance force system using Lami's Theorem.	CO1, CO2
	3	Find reactions at the supports of a simply supported beam and compare the results with analytical values.	
	4	Determine the support reactions for simply supported beam by <ul style="list-style-type: none"> • Beam reaction apparatus • Circular dial type weight 	
<i>LSO 3.1.</i> Apply law of friction on horizontal plane and inclined plane <i>LSO 3.2.</i> Coefficient of friction between different materials <i>LSO 3.3.</i> Coefficient of friction between belt and pulley.	5	Determine coefficient of friction on horizontal and inclined plane.	CO2, CO3
	6	Determine the coefficient of friction between two surfaces by <ul style="list-style-type: none"> • angle of repose methods • friction plane method 	
	7	Find the coefficient of friction between belt and pulley in a belt friction set up.	
<i>LSO 4.1.</i> Determine the centroid of different geometrical figures. <i>LSO 4.2.</i> Find moment of inertia	8	Determine the centroid of geometrical plane figures (squares, rectangle, triangle)	CO4
	9	Determine the moment of inertia of a fly wheel	
<i>LSO 5.1</i> Use simple screw jack <i>LSO 5.2</i> Use differential axle and wheel <i>LSO 5.3</i> Use single and double purchase crab winch <i>LSO 5.4</i> Use jib crane <i>LSO 5.5</i> Use worm and worm wheel apparatus	10	Find M.A, V.R and efficiency of screw jack.	CO5
	11	Find M.A, V.R and efficiency of differential wheel and axle	
	12	Calculate the efficiency of single purchase crab winch and double purchase crab winch	
	13	Determine forces in jib crane.	
	14	Determine the efficiency of worm and worm wheel.	

L) Suggested Term Work and Self Learning: S2425104 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. Visit nearby tool room/industry and collect information regarding lifting machine used with their technical specification and their application and prepare comparison chart.
- ii. prepare model of simple lifting machine.
- iii. Prepare models of beam subject to point load, uniformly distributed loads, simply supported, overhang beam.
- iv. Prepare chart showing real-life examples including various types of forces.

c. Other Activities:

- Seminar Topics:
 - Collision of elastic bodies
 - Law of **conservation of energy**
 - concept of parallel axis and perpendicular axes theorem
- Visits: Visit nearby tool room/industry with workshop facilities. Prepare report of visit with special comments of simple lifting machine to be used.
- Self-Learning Topics:
 - Types of load and beam.
 - Various force system.
 - Simple lifting machine.
 - Centroid of various plane figure

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%	30%	15%	-	-	20%	20%
CO-2	10%	20%	10%	25%	-	10%	20%
CO-3	15%	20%	15%	25%	33%	15%	20%
CO-4	30%	10%	30%	25%	33%	15%	20%
CO-5	30%	20%	30%	25%	34%	40%	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 Mechanics and Force System	14	CO1, CO2	16	5	3	8
Unit-2.0 Static Equilibrium	10	CO1, CO2	14	4	2	8
Unit-3.0 Friction	8	CO2, CO3	14	5	3	6
Unit-4.0 Centroid, Centre of gravity and Moment of Inertia	6	CO4	12	2	2	8
Unit-5.0 Simple Lifting Machine	10	CO2, CO5	14	4	4	6
Total	48	-	70	20	14	36

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.	Determine resultant of concurrent coplanar force system using force polygon table.	CO1	45	45	10
2.	Determine unknown force in a concurrent balance force system using Lami's Theorem.	CO2	40	50	10
3.	Find reactions at the supports of a simply supported beam and compare the results with analytical values.	CO2	30	60	10
4.	Determine the support reactions for simply supported beam by <ul style="list-style-type: none"> Beam reaction apparatus Circular dial type weight 	CO1, CO2	30	60	10
5.	Determine coefficient of friction on horizontal and inclined plane.	CO2, CO3	40	50	10
6.	Determine the coefficient of friction between two surfaces by <ul style="list-style-type: none"> Angle of repose method Friction plane method 	CO2, CO3	40	50	10
7.	Find the coefficient of friction between belt and pulley in a belt friction set up.	CO2, CO3	30	60	10
8.	Determine the centroid of geometrical plane figures (squares, rectangle, triangle)	CO4	40	50	10
9.	Determine the moment of inertia of a fly wheel	CO4	40	50	10
10.	Find M.A, V.R and efficiency of screw jack.	CO2, CO5	30	60	10
11.	Find M.A, V.R and efficiency of differential wheel and axle	CO2, CO5	30	60	10
12.	Calculate the efficiency of single purchase crab winch and double purchase crab winch	CO2, CO5	30	60	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
13.	Determine forces in jib crane.	CO1, CO2	40	50	10
14.	Determine the efficiency of worm and worm wheel	CO2, CO5	40	50	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 and Tools	Broad Specifications	Relevant Experiment/Practical Number
1.	Differential axle and wheel	wall mounted unit with the wheel of 40 cm diameter and axles are in steps of 20 cm and 10 cm reducing diameter	11
2.	Simple screw Jack	Table mounted metallic body, screw with a pitch of 5 mm carrying a double flanged turn table of 20 cm diameter.	10
3.	Worm and worm wheel	wall mounted unit with threaded spindle. load drum. effort wheel: with necessary slotted weights. hanger and thread.	14
4.	Single Purchase Crab winch	Table mounted heavy cast iron body. The wheel is of C.L material of 25 cm diameter mounted on a shaft of about 40mm dia. On the same shaft a geared wheel of 15 cm dia.	12
5.	Double Purchase Crab winch	Having assembly same as above but with double set of gearing arrangement.	11
6.	Weston's Differential pulley block	Consisting of two pulleys; one bigger and other smaller	13
7.	Weston's Differential worm geared pulley block	Consists of a metallic (preferably steel) cogged wheel of about 20 cm along with a protruded load drum of 10 cm dia to suspend the weights of 10 kg, 20 kg-2 weights and a 50 kg weight.	13
8.	Universal Force Table	Consists of a circular 40 cm dia. Aluminum disc. graduated into 360 degrees. with all accessories.	1, 2
9.	Beam Reaction apparatus	The apparatus is with two circular dial type 10 kg.	3,4
10.	Friction apparatus for motion along horizontal and inclined plane	Base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees_ pan. Two weight boxes (each of 5 gm.10 cm, 2-20 gm. 2-50 gm, 2-100 gm, weight.	5,6
11.	Set-up for belt friction apparatus	V and Flat Belt, Cap screw, Spring balance, Belt pulley, Torque cord, Load hanger x2, Weights	7

S. No.	Name of Equipment and Tools	Broad Specifications	Relevant Experiment/Practical Number
12	Fly wheel apparatus	flywheel, weight hanger with slotted weights, stop clock, metre scale etc	9
13	Jib crane	Jib Apparatus, Weight, Meter Rod, Set Square	13
14	Models of geometrical figures	Models of geometrical figures	8

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Applied Mechanics	R.S. Khurmi	S.Chand &Co. New Delhi 2014 ISBN: 9788121916431
2.	Engineering Mechanics	S. Ramamrutham	S Chand & Co. New Delhi 2008 ISBN:9788187433514
3.	Foundations and Applications of Applied Mechanics	H.D. Ram A.K Chauhan	Cambridge University Press. Thomson Press India Ltd., NewDelhi, 2015, ISBN: 9781107499836
4.	Engineering Mechanics- Statics, Vol.1	J.L. Meriam L.G Kraige	Wiley Publication, New Delhi, ISBN: 978-81-265-4396
5.	Applied mechanics	R.K.Rajput	Laxmi publications (p) ltd. ISBN-13: 8105809631
6	Engineering Mechanics	A.R. Basu	TMH Publication, New Delhi
7	Engineering Mechanics	Timosheenko, Young & Rao	TATA McGraw-Hill Education, New Delhi

(b) Online Educational Resources:

1. <http://www.asnu.com.au>
2. www.youtube.com for videos regarding machines and applications, friction
3. www.nptel.ac.in
4. www.discoveryforengineers.com

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

- A) **Course Code** : 2400105A(T2400105A/S2400105A)
 B) **Course Title** : Applied Mathematics- A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)
 C) **Prerequisite Course(s)** : Basic Engineering Mathematics
 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 integration.
CO-2 Develop the ability to use differential equations as a tool to solve problems related to engineering.
CO-3 Select a suitable method to solve nonlinear equations based on engineering applications.
CO-4 Measure the area and volume of engineering-related problems using the concept of numerical integration.
CO-5 Develop the ability to use probability distribution to solve broad-based engineering-related 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/ 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	1	-	-	-	-	-		
CO-2	3	2	-	-	-	-	-		
CO-3	3	2	1	-	-	-	-		
CO-4	3	3	1	1	-	-	-		
CO-5	3	3	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				
2400105A	Applied Mathematics-A	02	01	-	02	05	04

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= (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 the teacher to ensure the 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)	
2400105A	Applied Mathematics-A	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: T2400105A**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Use standard forms of integration to find the integral of given simple functions.</p> <p><i>TSO 1b.</i> Apply suitable Trigonometric transformation to solve a given Integration problem.</p> <p><i>TSO 1c.</i> Solve given problems using the properties of the definite integral.</p> <p><i>TSO 1d.</i> Invoke the concept of Integration to solve problems based on area and volume of irregular shapes.</p>	<p>Unit-1.0 Integral Calculus and its Applications</p> <p>1.1 Concept and Definition of Integration.</p> <p>1.2 Working rules and Integral of standard Functions.</p> <p>1.3 Method of Substitution, Trigonometric transformation, Integration by parts, and Partial fraction.</p> <p>1.4 Applications: Area and volume</p>	CO1
<p><i>TSO 2a.</i> Find the order and degree of given differential equations.</p> <p><i>TSO 2b.</i> Solve differential equations using the variable separable method.</p> <p><i>TSO 2c.</i> Obtain the solution of a given homogeneous differential equation.</p> <p><i>TSO 2d.</i> Solve the given linear differential equation based on engineering application.</p> <p><i>TSO 2e.</i> Solve the given Bernoulli differential equation.</p> <p><i>TSO 2f.</i> Solve the homogeneous linear differential equations of second order with constant coefficient.</p>	<p>Unit-2.0 Differential Equations</p> <p>2.1 Concept and Definition, Order, and Degree of Differential Equation.</p> <p>2.2 Differential equation of first order and first degree, variable separable Method.</p> <p>2.3 Homogeneous, linear Differential equation and Bernoulli equation.</p> <p>2.4 Homogeneous linear differential equations of second order with constant coefficient.</p>	CO2
<p><i>TSO 3a.</i> Find the root(s) of the given equation using Iterative methods up to the desired accuracy.</p> <p><i>TSO 3b.</i> Calculate the root(s) of given equations using the Newton-Raphson Method.</p> <p><i>TSO 3c.</i> Apply the Newton-Raphson Method for engineering applications.</p> <p><i>TSO 3d.</i> Solve problems using the Bakhshali iterative method for finding approximate square roots. (IKS)</p>	<p>Unit-3.0 Numerical Solution of Nonlinear Equations</p> <p>3.1 Algebraic and Transcendental equations.</p> <p>3.2 Iteration Methods.</p> <p>3.3 Newton-Raphson Method.</p> <p>3.4 Bakhshali iterative method for finding the approximate square root. (IKS)</p>	CO3
<p><i>TSO 4a.</i> Apply the concept of Numerical integration to find the area from given data by the Trapezoidal rule, also use any open source software to find the same.</p> <p><i>TSO 4b.</i> Apply the concept of Numerical integration to find the area from given data by Simpson's one-third rule, also use any open</p>	<p>Unit-4.0 Numerical Integration</p> <p>4.1 Trapezoidal rule</p> <p>4.2 Simpson's one third rule</p> <p>4.3 Simpson's three eighth rule</p>	CO4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p>source software to find the same by comparing the findings.</p> <p><i>TSO 4c.</i> Apply the concept of Numerical integration to find the area from given data by Simpson's three eight rules, and compare the obtained result with the result found by the analytical method.</p>		
<p><i>TSO 5a.</i> Select discrete and continuous probability distribution for given data.</p> <p><i>TSO 5b.</i> Solve given problems based on repeated trials using binomial distribution.</p> <p><i>TSO 5c.</i> Use suitable distribution to solve the given problems when the number of trials is large and the probability is very small.</p> <p><i>TSO 5d.</i> Utilize the concept of normal distribution to solve broad-based engineering-related problems.</p>	<p>Unit-5.0 Probability distribution</p> <p>5.1 Discrete and continuous probability distribution.</p> <p>5.2 Binomial distribution.</p> <p>5.3 Poisson's distribution.</p> <p>5.4 Normal distribution.</p>	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)
<p>1.1 Calculate the area of the hexagon using integration.</p> <p>1.2 Calculate the average temperature of a city over a certain period.</p> <p>1.3 Calculate the total force on the bottom of the tank due to the water.</p> <p>1.4 Estimate the amount of force required to move a component.</p> <p>1.5 Apply the concept of definite integration to find the volume.</p>	1.	<ul style="list-style-type: none"> Area of irregular shape using integration. Average value of a function using integration. Calculation of force using integration. Volume of an irregular shape using integration. 	CO1
<p>2.1 Solve population dynamics using first-order ODEs.</p> <p>2.2 Calculate the vibration of a Mechanical system using differential equations.</p> <p>2.3 Calculate the concentration of a reactant in a chemical reaction over time.</p> <p>2.4 Calculate mechanical vibrations using second-order ODEs.</p>	2.	<ul style="list-style-type: none"> Analysis of a population model through differential equations. Response of vibration of Mechanical system through differential equations. Analysis of chemical system using ODEs Vibrations of a mass-spring system. 	CO2
<p>1.1 Use Newton's method to find the roots of a non-linear equation in one variable.</p> <p>1.2 Use the concept of Newton's method to solve financial modeling-related problems based on the Black-Scholes model.</p> <p>1.3 Calculate the electric field (that satisfies Maxwell's equations) around a wire with a</p>	3.	<ul style="list-style-type: none"> Applications of iterative techniques. Application of Newton Raphson's method. Iterative scheme using Newton's method. Bakhshali iterative methods for finding the approximate value of square root. (IKS) 	CO3

Outcomes	S. No.	Tutorials Titles	Relevant COs Number(s)
given shape and current, using Newton Raphson's method. 1.4 Use Bakhshali iterative methods for finding the approximate value of the square root. (IKS)			
4.1 Use Numerical integration to determine the total quantity of Heat of given a material. 4.2 Use Simpson's 1/3rd rule to find the effective force on the mast of a racing sailboat. 4.3 Apply Numerical integration to calculate work done for a given engineering problem.	4.	<ul style="list-style-type: none"> • Calculation of Heat (Chemical/Bio Engineering based problem). • Calculation of effective force (Civil/Environment engineering). • Calculation of work done (Mechanical/Aerospace engineering-based problems). 	CO4
5.1 Use Binomial distribution to solve the problems when the trials are repeated. 5.2 Use Poisson's distribution to solve the problems when the number of trials is large and the probability is minimal. 5.3 The birth weight follows the normal distribution curve, justified through an example.	5.	<ul style="list-style-type: none"> • Applications of Binomial distribution. • Applications of Poisson's distribution. • Applications of Normal distribution. 	CO5

L) Suggested Term Work and Self-Learning: S2400105A

- a. **Assignments:** Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted COs.
1. Calculate the flow rate of a fluid through a pipe with a given velocity profile using integration through open-source software.
 2. Given the plan view of a concrete structure and the desired thickness of the concrete, calculate the area between the curves to determine the surface area of the formwork required.
 3. A beam is subjected to a distributed load. The beam has a length of L and a flexural rigidity EI, where E is Young's modulus and I is the moment of Inertia of the beam cross-section. Write down the differential equations that describe the deflection of the beam and solve it to find the deflection equation.
 4. Use open-source software to plot the family of curves and compute its differential equations.
 5. Write down a program to compute the root of a nonlinear equation the Newton-Raphson method.
 6. Write down a program to find the root of the transcendental equation by iterative method to correct up to 4 decimal places.
 7. Implement Simpson's rule to approximate the definite integral of the function. Choose an appropriate number of sub-intervals and calculate the approximate value of the Integral using open-source software.
 8. Use the Trapezoidal rule to estimate the Integration for a given function using open-source software.
 9. Use Binomial Distribution in decision-making related to Quality control and process improvement in the manufacturing process.
 10. Use Poisson distribution to calculate the number of website visitors per hour.

b. Micro Projects:

1. Prepare charts displaying various standard integration formulas.
2. Explore the use of Integral calculus to calculate the velocity and acceleration of a particle.
3. Prepare charts showing the area and volume of various geometrical shapes using Integral calculus.
4. Prepare a model showing the applications of differential equations for the rate of decay of radioactive materials.
5. Prepare a model showing the applications of differential equations for Newton's law of cooling.
6. Prepare a simulated environment to study the motion of a particle under the influence of gravity.
7. Prepare a comparative chart showing the convergence of various iterative techniques.
8. Prepare a chart consisting of 8-10 nonlinear equations made of real-world problems.
9. Download 5-7 videos based on applications of numerical integration in mechanical, civil, and auto engineering branches, watch them, and write a report to detail the mathematical steps involved.
10. Make a short video of duration 5-7 minutes for the applications of numerical integration in Chemical, Agriculture, and Ceramic engineering branches.
11. Download 5-7 videos based on engineering applications of Binomial and Poisson's distribution, watch them, and write a report to detail the mathematical steps involved.
12. Make a short video of duration 10-15 minutes on at least 7-8 engineering applications of Normal distribution.

c. Other Activities:

1. Seminar Topics:

- Applications of Integral calculus in control systems, dynamics, and vibrations.
- Applications of Integral calculus in production and cost analysis.
- Applications of Integral calculus in algorithms and optimization.
- Applications of Integral calculus in population dynamics and bio-mathematics.
- Applications of Integral calculus in filtering and feature extraction.
- Solving Differential Equations through SCILAB.
- Applications of Differential Equations in population dynamics and epidemiology.
- Differential Equations with discontinued input via Laplace Transform: Techniques and Applications.
- Applications of Numerical Methods for engineers.
- Numerical Solution of Nonlinear Equations using Root-Finding Algorithms: Techniques and Applications.
- Numerical integration and its engineering applications.
- Engineering applications of Binomial and Poisson's distribution.
- Real-life examples of Normal Distribution.
- Probability distribution and its engineering applications.

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 Science museum.
- Visit a mathematics research institute.
- Visit to a Data Science Center.
- Visit the mathematics department of a college or university.
- Visit a software company.
- Visit to a Space Agency.
- Visit to a Gaming Studio.
- Participation in mathematics competitions.

3. Self-Learning Topics:

- Participate in MOOCs on Integration Techniques and Applications.
- Participate in MOOCs on Ordinary Differential Equations: Methods and Applications.
- Participate in an Open courseware of MIT on the Newton-Raphson Method: rate of convergence.
- Watching videos on numerical integration: Concepts and Applications.
- Watching video on Probability distribution and its engineering applications.

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	15%	15%	15%	20%	15%	-	-
CO-2	25%	25%	25%	20%	25%	-	-
CO-3	10%	10%	10%	20%	10%	-	-
CO-4	20%	20%	20%	20%	20%	-	-
CO-5	30%	30%	30%	20%	30%	-	-
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 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 the achievement of each CO.

N) Suggested Specification Table for End Semester Theory Assessment: The specification table represents the reflection of sample representation of assessment of the 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 Integral Calculus and its Applications	10	CO1	11	4	4	3
Unit-2.0 Differential Equation	12	CO2	16	4	6	6
Unit-3.0 Numerical Solution of Nonlinear Equations	8	CO3	10	3	4	3
Unit-4.0 Numerical integration	8	CO4	12	4	6	2
Unit-5.0 Probability distribution	10	CO5	21	5	8	8
Total	48	-	70	20	28	22

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): (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, Portfolio, 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.	Studies in the History of Indian Mathematics	C. S. Seshadri	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
8.	Mathematics-I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
9.	Mathematics-II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3
10.	Consider Dimension and Replace Pi	M.P. Trivedi and P.Y. Trivedi	Notion Press; 1st edition (2018), ISBN: 978-1644291795

(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://learnegg.com/LE/Index>
17. <https://ncert.nic.in/textbook.php>
18. [https://nios.ac.in/online-course-material/sr-secondary-courses/mathematics-\(311\).aspx](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.

- A) **Course Code** : 2425106(P2425106/S2425106)
- B) **Course Title** : Mechanical Workshop (CE, AE, ME, ME (Auto), MIE, CRE, CHE)
- C) **Pre- requisite Course(s)** :
- D) **Rationale:**

Mechanical Workshop is a basic practical engineering course. Knowledge of basic workshops such as wood working shops, fitting & machine shop, sheet metal shop, welding shop, black smithy and is essential for students to perform duties in industries and field agencies. This course will help the students to develop practical skills by performing various practical tasks using various hand tools, equipment and machinery in the respective shops, which will be useful in many fields like workshop, home and agriculture, construction etc. Job making in the workshop develops an attitude of teamwork and safety awareness. 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** Undertake wood working operations economically and safely.
- CO-2** Carryout fitting and turning operations properly in a given situation.
- CO-3** Perform various joining operations using welding, brazing, and soldering methods.
- CO-4** Perform various sheet metal operations as per given sketch/ drawing.
- CO-5** Undertake black smithy operations safely.

- 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	1		
CO-5	3	3	2	3	1	-	1		

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

* PSOs will be developed by respective programme coordinator at institute level. As per 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				
2425106	Mechanical 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, field or other locations using different instructional/Implementations 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 = $(1 \times CI \text{ hours}) + (0.5 \times LI \text{ hours}) + (0.5 \times \text{Notional hours})$

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)	
2425106	Mechanical 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 Unit: (Not Applicable)**

K) **Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2425106**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<p><i>LSO 1.1</i> Use relevant wood working tools and instruments as per given job.</p> <p><i>LSO 1.2</i> Undertake wood working operations like marking, cutting, planing and finishing etc.</p> <p><i>LSO 1.3</i> Prepare given wooden joints as per given sketch / drawing.</p>	1.	<p>1.1 Prepare one simple job of wood working comprises of marking, cutting, planing and finishing as per given drawing/sketch.</p> <p>1.2 Prepare any two wooden joints safely as per given drawing using suitable tools-</p> <ul style="list-style-type: none"> - Mortise joint - Dovetail joint - Half lap joint. - Cross joint - Tenon Joint - Bridle joint 	CO-1
<p><i>LSO 2.1</i> Prepare list of relevant tools, equipment, machines and measuring instruments used in fitting shop as per given situation.</p> <p><i>LSO 2.2</i> Perform marking, cutting, filing, punching, drilling, and finishing operations as per given fitting job safely.</p> <p><i>LSO 2.3</i> Select relevant single point cutting tool and associated parameters for a given turning job.</p> <p><i>LSO 2.4</i> Undertake turning operations economically and safely in a given situation</p>	2.	<p>2.1 Selection of different fitting tools, equipment, machines and measuring instruments in a given situation.</p> <p>2.2 Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at Centre) comprises of marking, filing, punching, drilling, and finishing as per given drawing/sketch.</p> <p>2.3 Prepare given step turning / taper turning job as per given sketch/ drawing.</p>	CO-2
<p><i>LSO 3.1</i> Select suitable joining process in a given situation.</p> <p><i>LSO 3.2</i> Use Personal Protective Equipment in welding shop.</p> <p><i>LSO 3.3</i> Perform gas welding operations in a given situation to prepare joint safely.</p> <p><i>LSO 3.4</i> Prepare given welding joint safely using arc welding in a given situation.</p> <p><i>LSO 3.5</i> Carryout soldering / brazing operation(s) as per given job.</p>	3.	<p>3.1 Prepare simple job of joining by using suitable joining process as per given sketch.</p> <p>3.2 Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely.</p> <p>3.3 Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely.</p>	CO-3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		3.4 Prepare simple job using soldering/ brazing operations as per given drawing.	
<p><i>LSO 4.1</i> Select suitable sheet metal tools, machinery / equipment for given used as per requirements.</p> <p><i>LSO 4.2</i> Select suitable sheet metal operations in a given situation.</p> <p><i>LSO 4.3</i> Perform relevant sheet metal operations such as shearing, bending, drawing, squeezing, snipping, riveting, grooving etc. to prepare utility jobs safely as given sketch/ drawing.</p>	4.	<p>4.1 Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing.</p> <p>4.2 Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm.</p> <p>4.3 Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.</p>	CO-4
<p><i>LSO 5.1</i> Select suitable black smithy tools and operations to complete jobs as per requirements.</p> <p><i>LSO 5.2</i> Perform various operations safely to prepare given black smithy job(s).</p> <p><i>LSO 5.3</i> Follow safety procedures and use personal safety equipment during black smithy.</p>	5.	<p>5.1 Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations.</p> <p>5.2 Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop.</p> <p>5.3 Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor</p>	CO-5

L) **Suggested Term Work and Self Learning: S2425106** 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. Visit different classrooms and prepare a list of wooden joints used in sitting furniture.
2. List the various lathe operations and their applications used in machine repairing shop.
3. Visit nearby welding shop and prepare a list of welding consumables used for various types of welding.
4. Observe small agricultural equipment used nearby you and repair it.
5. Prepare a list of different types of sheets with specification available in market.

c. **Other Activities:**

1. **Seminar Topics:**

- Safety practices and use of personal safety equipment in workshops.
- Different types of machines tools and their functions used in workshops.
- Operating precautions and safety norms for various types of machine and tools in workshops

2. **Visits:**

- Visit any nearby machine shop / carpentry shop / fitting shops /welding shops and sheet metal workshop and prepare a report.
- Make a detailed market survey of local dealers for procurement of workshop tools, equipment machinery and raw materials.

3. Self-learning topic:

- Causes and remedies of welding defects.
- Prepare a brief proposal for making of various small agricultural equipment/machinery.
- Repairing of defective tools and machines in workshop.

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%	10%	20%	20%
CO-4	-	-	20%	20%	25%	20%	20%
CO-5	-	-	20%	20%	25%	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 Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Prepare one simple job of wood working comprises of marking, cutting, planing and finishing as per given drawing/sketch.	CO-1	50	40	10
2.	Prepare any two wooden joints safely as per given drawing using suitable tools- <ul style="list-style-type: none"> • Mortise joint • Dovetail joint • Half lap joint. • Cross joint • Tenon Joint • Bridle joint 	CO-1	40	50	10
3.	Selection of different fitting tools, equipment, machines and measuring instruments in given situation.	CO-2	60	30	10

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		Viva-Voce (%)
			Performance		
			PRA* (%)	PDA** (%)	
4.	Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at center) comprises of marking, filing, punching, drilling and finishing as per given drawing/sketch.	CO-2	50	40	10
5.	Prepare given step turning / taper turning job as per given sketch/ drawing.	CO-2	30	60	10
6.	Prepare simple job of joining by using suitable joining process as per given sketch.	CO-3	60	30	10
7.	Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely.	CO-3	40	50	10
8.	Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely.	CO-3	40	50	10
9.	Prepare simple job using soldering/ brazing operations as per given drawing.	CO-3	30	60	10
10.	Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing.	CO-4	50	40	10
11.	Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm.	CO-4	30	60	10
12.	Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.	CO-4	30	60	10
13.	Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations.	CO-5	60	30	10
14.	Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop.	CO-5	30	60	10
15.	Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor.	CO-5	30	60	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.	Lathe machine	Capacity Light Duty Heavy Duty Height of center 165 mm 254 mm Swing Over Bed 325 mm 490 mm Swing Over Cross Slide 175 mm 290 mm Movement of Cross Slide 225 mm 300 mm Swing in gap 500mm 800 mm With suitable motor drive with all accessories.	All

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
2.	Drilling machine	Up to 15 mm drill cap with 1 HP motor 1000mm height	1,2
3.	Wood working tools	Marking and measuring tools, saw, claw hammer, mallet, chisels, planers, squares	1,2
4.	vice	Carpentry vice 200 mm, bench vice 100mm, pipe vice 100 mm	1,2,3,4,5,6,7,8,9,10,11
5.	Work benches	Size 2000x1000x750 mm	1,2,3,4,5,6,7,8
6.	Fitting tools	Ball pen Hammers(500g), cross pean hammer, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set of suitable sizes	3,4,5
7.	Surface plate	600x900 mm grade I	All
8	Welding machine	20 KV, 400 A Welding current, welding cable 400 amp, with all accessories	6,7,8
9	Soldering and brazing equipment	Solder. Soldering iron (35 W) soldering wick, magnifying glass, wire cutters, brazing torch, aluminum brazing rod,	9
10	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
11	Arc welding and hand tools	Electrode holder, cable connector, chipping hammer, earthing clamp, wire brush.	6,7,8
12	Sheet bending and cutting machine	Mild steel automatic metal sheet bending machine (size 0.5 mm-20 mm X 1000 mm -6300 mm), compound saw (blade diameter 305 mm, power consumption 1520 W, 4000 RPM)	10,11,12
13	Sheet metal and hand tools	Snip, shears sheet gauge, straight edge, L/T square scriber, divider trammel, punches, pliers, stakes, groovers, limit set	10,11,12
14	Black smithy tools and equipment	Anvil (WEIGHT-167 lbs, horn-73/4", face length-10", rear-71/2"), hammer (double face sledge hammer 10 kg), scaling hammer, chipping hammer, tongs (500g ,flat nose size 15 inch) open hearth ,air blower (60 hp capacity 40000 m3/hr.), swage block (14X14X5 inch material iron)	13,14,15
15	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	R. K. Rajput	Laxmi Publications, New Delhi ISBN: 978-9380856650
2.	Workshop practice	Bawa,H.S	McGraw Hill Education, Noida ISBN:978-0070671195
3.	Engineering Workshop Practice	A.K. Sarathe	Khanna Book Publishing Co.(P) LTD. New Delhi, ISBN:978-93-91505-51-6
3.	A textbook of workshop Technology.	R.S. Khurmi and J.K. GUPTA	S.Chand and Co. New Delhi ISBN:9788121908689
4.	Manufacturing Technology Volume-01	P.N. Rao	McGraw Hill Education, Noida ISBN-9789353160500

(b) Online Educational Resources:

1. **Wooden joints:** https://www.youtube.com/watch?v=-f7tTNRH_04
2. **Carpentry tools:** <https://www.youtube.com/watch?v=ZyN9Tw9VTS0>
3. **Fitting tools:** <https://www.youtube.com/watch?v=jbRgJblGAWc>
4. **V -fitting:** https://www.youtube.com/watch?v=iDJ_sMvXsYs
5. **Square -fitting:** <https://www.youtube.com/watch?v=NHLpRgLGEO>
6. **Lathe and its parts:** <https://www.youtube.com/watch?v=LtMJonWHKyU>
7. **Lathe operation:** <https://www.youtube.com/watch?v=hheFVuUBpxo&t=235s>
8. **Classification of welding joints:** https://www.youtube.com/watch?v=cQEUJnMYf_U
9. **Gas welding:** <https://www.youtube.com/watch?v=-SA4D098u-Q>
10. **Arc welding:** <https://youtu.be/5hRgwnejWPs>
11. **Soldering and brazing:** <https://www.youtube.com/watch?v=fnEFuzeM8cc>
12. **Sheet metal working:** <https://www.youtube.com/watch?v=KFdoAYvU4SI>
13. **Sheet metal working:** <https://www.youtube.com/watch?v=k8VskWhx0AY>
14. **Sheet metal work:** <https://www.youtube.com/watch?v=fNB1sunQ66g>
15. **Black smithy tools:** <https://www.youtube.com/watch?v=O3xyNWHxQN8>
16. **Black smithy operation:** <https://www.youtube.com/watch?v=uYvgBwP-1nY>

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

(c) Others:

1. Kents Mechanical Engineering Handbook, John Wiley and Sons, New York.
2. Workshop practice Handbook.
3. 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 respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

- G) **Teaching & Learning Scheme:**

Course Code	Course Title	Scheme of Study (Hours/Week)					Total Credits (C)
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	
		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)
-	<p>Unit-1.0 Word Processing</p> <p>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.</p> <p>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</p> <p>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.</p> <p>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</p> <p>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.</p> <p>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.</p>	CO-1
-	<p>Unit-2.0 Spreadsheets</p> <p>2.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook.</p> <p>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.</p> <p>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.</p> <p>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</p>	CO-2

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	<p>functions such as sqrt, power, statistical functions, applying conditions using IF.</p> <p>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.</p> <p>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.</p>	
-	<p>Unit-3.0 Presentation Tool</p> <p>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,</p> <p>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.</p> <p>3.3 Working with Tables: Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications.</p> <p>3.4 Working with Charts: Insert Charts in a Slide, modify a Chart, Import Charts from Other Office Applications.</p>	CO-3
-	<p>Unit-4.0 Basics of Internet</p> <p>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.</p> <p>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</p>	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)
<i>LSO 1.1.</i> 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
<i>LSO 2.1.</i> Work with images/shapes in a document	2.	Insert and edit images and shapes, resizing, cropping, colour, background, group/ungroup	CO-1
<i>LSO 3.1.</i> Organize data in tabular form in a document	3.	Insert table and apply various table formatting features on it.	CO-1
<i>LSO 4.1.</i> Perform Document proofing operations in a document	4.	Review features such as Spelling, grammar, Thesaurus, translate, language, word count, comments	CO-1
<i>LSO 5.1.</i> 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
<i>LSO 6.1.</i> Create batch of documents with tailored variable information using mail merge	6.	Use mail merge operation with options.	CO-1
Spreadsheets			
<i>LSO 7.1.</i> Create a worksheet <i>LSO 7.2.</i> 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
<i>LSO 8.1.</i> 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
<i>LSO 9.1.</i> Filter the given data set <i>LSO 9.2.</i> Validate data based on criteria <i>LSO 9.3.</i> Sort the data in given order	9.	Apply conditional formatting, data Sorting, Data Filter and Data Validation features.	CO-2
<i>LSO 10.1.</i> Create various types of charts to represent data in graphical form	10.	Create different charts, apply various chart options.	CO-2
<i>LSO 11.1.</i> Print worksheet as per given layout	11.	Apply Page setup and print options on worksheet to print the worksheet.	CO-2
Presentation Tools			
<i>LSO 12.1.</i> 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 sessional 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
6.	Use mail merge operation with options.	CO-1	60	30	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva- Voce (%)
			PRA* (%)	PDA** (%)	
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/ 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, 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 resources before use by the students.

- A) **Course Code** : 2400008(P2400008/S2400008)
 B) **Course Title** : Sports, Yoga and Meditation (Common for all Programmes)
 C) **Pre- requisite Course(s)** :
 D) **Rationale**

Sports or Physical Education, Yoga and Meditation is an integral part of a person's overall well-being and is imperative for a healthy mind and body balance. So, it is necessary that every educational institutes should lay ample emphasis on including sports, yoga and meditation as a necessary part of education, however, it depends on how it is introduced in the curriculum makes all the difference. Sports, Yoga and Meditation plays a very important role in overall Well-being for a good personality, develops value system, sense of friendliness, feeling of togetherness thereby developing team spirit and mutual cooperation. Its also plays a major role in reducing level of stress/anxiety and add to the mental toughness. Looking to the ample benefits there is need to inculcate sports, Yoga and meditation as a day to day habit and imparting education related to physical education is more critical than ever before.

- 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** Select appropriate physical activities to maintain healthy lifestyle.
CO-2 Apply basic principles and practices of Yoga and meditation for overall growth & development.
CO-3 Use fitness and wellness techniques for optimal health and wellbeing
CO-4 Apply ancient Indian ayurvedic methods and techniques, exercises, yoga and meditation for fitness and wellness.

- 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	3	3	3	-	1	-	2		
CO-2	3	3	3	-	1	-	2		
CO-3	3	3	3	-	1	-	2		
CO-4	3	2	1	-	1	-	1		

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

* PSOs will be developed by respective programme coordinator at institute level. As per 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				
2400008	Sports, Yoga and Meditation	-	-	01	01	02	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)	
2400008	Sports, Yoga and Meditation	-	-	10	-	06	09	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:**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO.1a</i> Explain ancient history and development of yoga in India</p> <p><i>TSO.1b</i> Compare the ancient Indian games with the modern games.</p> <p><i>TSO.1c</i> Differentiate between given terms used in sports</p> <p><i>TSO.1d</i> Describe the different aspects of Mental Toughness</p> <p><i>TSO.1e</i> Use Imagery Training for sports</p> <p><i>TSO.1f</i> Apply motivation techniques to motivate students in sports.</p> <p><i>TSO.1g</i> Use concentration techniques for playing and exercising.</p> <p><i>TSO.1h</i> Manage Stress, Anxiety and Arousal during sports.</p> <p><i>TSO.1i</i> Select sports and exercise for healing and developing health and mental wellness</p> <p><i>TSO.1j</i> Describe the impact of parents' involvement in their children's sports activities</p> <p><i>TSO.1k</i> Select sports and exercises for physically challenged as per their need.</p>	<p>Unit-1.0 Sports and Exercises</p> <p>1.1 Historical development of physical activities and sports in India, Indian ancient games- Kho-Kho and Kabaddi, Chariot races, riding elephants and horse, swordsmanship, wrestling, boxing, atyapatya, archery, dancing, dands baithak, malkhamb, lezim, lathi etc</p> <p>1.2 Origin of traditional sports, 3rd century BCE-martial arts and archery, indoor games like Chess and Snakes & Ladders have origins in ancient India, in the form of games of Chaturanga and Gyan Chauper,</p> <p>1.3 Dholavira, the world's oldest terraced arena 3000 BC</p> <p>1.4 Definition of play, game, sports, exercise, psychology, sports psychology and exercise psychology, psychology and common sense.</p> <p>1.5 Mental toughness- mind, Imagery, use of imagery and imagery in sports, types of imagery (visual, kinesthetic, auditory and olfactory)</p> <p>1.6 Motivation in sport and goalsetting in sports</p> <p>1.7 Arousal regulation – self-awareness of regulation, anxiety reduction techniques-somatic anxiety reduction techniques, cognitive Anxiety reduction, multimodal anxiety reduction, coping with stress. Arousal-inducing techniques. Arousal and anxiety measurement factors, Arousal and anxiety signs recognition</p> <p>1.8 Nutrition and rehabilitation, Importance of concentration and attentional focus in sports and training, Impact of health on healing from physical athletic injuries. Impact of exercise to increase mental wellness, Role of coach in sports, parents' involvement in their children's sports activities.</p> <p>1.9 Adaptation of sports and exercises for physically challenged students in all levels.</p>	<p>CO1, CO4</p>
<p><i>TSO.2a</i> Explain ancient history and development of yoga in India</p> <p><i>TSO.2b</i> Identify the physiology of yoga and meditation.</p> <p><i>TSO.2c</i> Evaluate meditation and yoga as a healing modality.</p>	<p>Unit-2.0 Yoga and Meditation</p> <p>2.1 Origin of yoga, History and development of yoga, Adi yogi, evidences of yoga in pre-Vedic period (2700 B.C.), Vedic Period, Pre-Classical</p>	<p>CO2, CO4</p>

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO.2d</i> Select asanas and pranayama as per need.</p> <p><i>TSO.2e</i> Describe the effect of yoga and meditation on ageing, stress and hypertension.</p> <p><i>TSO.2f</i> Select mediation techniques as per the need.</p> <p><i>TSO.2g</i> Explain Bandha, Mudra and Chakra</p> <p><i>TSO.2h</i> Enumerate the steps of Suryanamaskar.</p> <p><i>TSO.2i</i> Select Yoga and Meditation for physically challenged as per their need.</p>	<p>Period, Classical Period- Patanjali's period, Modern Period.</p> <p>2.2 Yoga practices and the related literature- Vedas (4), Upanishads (108), Smritis, teachings of Buddhism, Jainism, Panini, Epics (2), Puranas (18)</p> <p>2.3 Importance of Yoga & Mediation, meaning of the term Yoga and Meditation, Fundamentals Principles of Yoga & Fitness training, Eight Limbs of Yoga</p> <p>2.4 Difference between yoga asana and physical exercises, Difference between yoga and meditation</p> <p>2.5 Role of Yoga and Meditation in Purificatory Process, in character building, developing concentration, will power and discipline</p> <p>2.6 Types of Yoga Practices - Asanas, Pranayama, Meditation</p> <p>2.7 Mindfulness – knowing the mind, training the mind, feeling the mind</p> <p>2.8 Different Methods of meditation, Physiology of meditation, Mental, physical and emotional benefits of Asanas, Pranayama, Concentration and Meditation</p> <p>2.9 Bandha, Mudra and Chakra</p> <p>2.10 Effects of Asanas and pranayama on physiology of human body</p> <p>2.11 Importance of "Suryanamaskar</p> <p>2.12 Adaptation of Yoga and meditations for physically challenged students in all levels.</p> <p>2.13 Yoga Asanas Do's and Don'ts for Beginners</p>	
<p><i>TSO.3a</i> Explain the ancient Indian ayurvedic methods for fitness and wellness</p> <p><i>TSO.3b</i> Identify the different factors affecting the fitness and wellness in the given situation</p> <p><i>TSO.3c</i> Use different methods to maintain Health and Wellness</p> <p><i>TSO.3d</i> Explain the components of Balance Diet</p> <p><i>TSO.3e</i> Identify the causes of stress and anxiety in the given situation</p> <p><i>TSO.3f</i> Use stress reduction techniques to manage Stress and Anxiety</p> <p><i>TSO.3g</i> Manage Stress, Anxiety and Depression in the given situation</p> <p><i>TSO.3h</i> Select recovery process for energy replenishment after exercise.</p>	<p>Unit 3.0 Fitness and Wellness</p> <p>3.1 Evolution of wellness, 3,000-1,500 BC: Ayurveda –holistic system, Tailored Ayurvedic regimens as per unique constitution of each person (their nutritional, exercise, social interaction and hygiene needs) – with the goal of maintaining a balance that prevents illness.</p> <p>3.2 Meaning, Importance, Definition and dimensions of Health and Wellness (WHO/Yoga)</p> <p>3.3 Factors affecting Fitness and Wellness</p> <p>3.4 Role of Physical Activities and Recreational Games in maintaining physiological and psychological wellbeing.</p> <p>3.5 Different Methods to Maintain Health, Wellness and to enhance mood</p> <p>3.6 Nutrition for Health & Wellness, Relationship between Diet and Fitness Components of Balance Diet and its importance – Carbohydrates, Protein, Fat, Vitamins & Minerals, Water, Healthy Lifestyle through Diet and Fitness</p>	<p>CO3, CO4</p>

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	3.7 Anxiety, Stress and Aging-Meaning of Anxiety, Stress and Aging, Types and Causes of Stress, 3.8 Stress, anxiety and depression reduction with exercise, yoga and meditation 3.9 Energy Continuum and Recovery Process, Metabolism and exercise, Recovery from exercise, Replenishment of energy stores during recovery process, Removal of excess lactic acid produced during exercise	

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400008

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Perform various sports activities for overall growth and development LSO 1.2. Select suitable sport activities as per your need.	1.	Track & Field: Running, Jumping, walking and Throwing, Cycling Event to develop Endurance, Speed, Strength, Agility, Flexibility etc	CO1
	2.	Aerobics and Gymnastics to develop Strength, Agility and Flexibility	
	3.	Net/Wall Sports – Volleyball and Basketball to develop Endurance, Speed, Strength, Agility and Flexibility	
	4.	Striking & Fielding sports like Cricket, bowling, Hockey, Football Baseball etc. to develop Endurance, Speed, Strength, Agility, Flexibility and Coordination	
	5.	Racket Game- Tennis, Badminton, Table tennis etc to develop Endurance, Speed, Strength, Agility and Flexibility	
	6.	Outdoor games: Kho-Kho and Kabaddi and cycling develop Endurance, Speed, Strength, Agility and Flexibility	
	7.	Indoor games: Chess and Carrom, Swimming, Boxing, Karate Weightlifting, Power Lifting, Physique Training, Archery, Roller Skating etc to develop concentration.	
	8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.	
LSOs 2.1 Perform various yogic techniques for internal purification and development.	9.	Shat Karmas: Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	CO2
	10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasanana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana	
	11.	Perform following asanas with correct posture: Vakrasana, Chakrasana, Paschimottanasana, Ugrasana, Gomukhasana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra	
	12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwsini-Mudra, Suriyanamaskar	
	13.	BANDHAS Jalandhara-Bandha, Jihva-Banda, Uddiyana Bandha, Moola-Bandha	

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
	14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari , Sitali , Kapalabhati	
	15.	MEDITATION -Silent Meditation	
	16.	MEDITATION – Mantra Meditation	
LSO 3.1. Prepare diet chart for optimal health and wellbeing	17.	Prepare a diet chart for the given sport.	CO3
LSO 3.2. Use health monitoring device	18.	Measure heart rate and heart function with health monitoring device	
	19.	Measure blood sugar and blood pressure	
LSO 3.3. Use different equipment's	20.	Use massage therapy equipment, Hot and cold therapy equipment, Ultrasound therapy equipment	
LSO 3.4. Identify your own threshold and identification level for different taste Stimulations	21.	Determine the taste threshold for three different sensations- sweet salty and sour	
LSO 3.5. Check the given sample for conformance to the standard for moisture content.	22.	Determine the moisture content in the given sample of oil/fat	
LSO 3.6. Purity tests of oils/fats	23.	Determine the impurities in the given sample of oil.	
LSO 3.7. Acidity test in given sample of fat/oil	24.	Determines the acid value and free fatty acids in the given sample of oil/fat.	
LSO 3.8. Check whether any given samples of oils/fats conform to the standard.	25.	Determine the peroxide value in the given sample of fat or oil.	

L) Suggested Term Work/ Activities and Self Learning: S2400008 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. Calculate your Body Composition (BMI) and Cardiovascular Assessment
 - ii. Assessment for Muscular Endurance, Muscular Strength,
 - iii. Flexibility, Cardio-respiratory Endurance, Body Composition
 - iv. Rules and Regulations of different indoor and outdoor games.
- b. Micro Projects:**
- i. Identify and synthesize the factors that influence health in various situations (05 situations). Prepare a report with details of situations and solutions to remove the factors.
 - ii. Visit different sports club, gyms, and schools and identify various measure taken by them for Fitness and wellness of students/ members
 - iii. Visit different sports club, gyms, and schools and identify various measure taken by them for Fitness and wellness of physically challenged students/ members
 - iv. Identify which type of stress, anxiety and depression students are facing and steps and solutions to overcome this.

c. **Other Activities:**

1. Seminar Topics:

- Identify the health-related challenges in current time and able to apply the preventive measures.
- Role of peers, community and media in health and wellbeing in each level
- Knowledge and skills required to preserve community health and well-being
- Effect of yoga and meditation in maintaining fitness.
- Methods to involve physically challenged students /members in all levels in sports, yoga and meditation in community.
- Counselling techniques to counsel players in matters of handling success and failure.

2. Visits: Visit nearby sports complex, Gyms, stadium etc and prepare a report on hygiene maintenance, medical facilities available, facilities available for physically challenged members, facilities available for old aged members, tools and equipment available and training facilities.

3. **Self-Learning Topics:**

- Anatomy and physiology of human being
- Role of Yoga and Meditation in Purificatory Process, in character building, developing concentration, will power and discipline
- Mindfulness
- Different Methods to Maintain Health, Wellness and to enhance mood
- Diet and Nutrition
- Metabolic adaptations to exercise
- Cardio-respiratory changes

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, CO-4	-	-	35%	35%	35%	35%	35%
CO-2, CO-4	-	-	35%	35%	35%	35%	35%
CO-3, CO-4	-	-	30%	30%	30%	30%	30%
Total Marks	-	-	10	10	05	10	15
			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 Assessment Table for Laboratory (Practical):**

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Track & Field: Running, Jumping, walking and Throwing, Cycling Event to develop Endurance, Speed, Strength, Agility, Flexibility etc	CO1	30	60	10
2.	Aerobics and Gymnastics to develop Strength, Agility and Flexibility		30	60	10
3.	Net/Wall Sports – Volleyball and Basketball to develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
4.	Striking & Fielding sports like Cricket, bowling, Hockey, Football Baseball etc. to develop Endurance, Speed, Strength, Agility, Flexibility and Coordination		30	60	10
5.	Racket Game- Tennis, Badminton, Table tennis etc to develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
6.	Outdoor games: Kho-Kho and Kabaddi and cycling develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
7.	Indoor games: Chess and Carrom, Swimming, Boxing, Karate Weightlifting, Power Lifting, Physique Training, Archery, Roller Skating etc to develop concentration.		30	60	10
8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.		30	60	10
9.	Shat Karmas Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	CO2	40	50	10
10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana		40	50	10
11.	Perform following asnas with correct posture: Vakrasana, Chakrasana, Paschimottanasana, Ugrasana, Gomukhasana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra		40	50	10
12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwsini-Mudra, Suriyanamaskar		40	50	10
13.	BANDHAS Jalandhara-Bandha, Jihva-Banda, Uddiyana Bandha, Moola-Bandha		40	50	10
14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari, Sitali, Kapalabhati		40	50	10
15.	MEDITATION -Silent Meditation		40	50	10
16.	MEDITATION - Mantra Meditation		40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
17.	Prepare a diet chart for the given sport.	CO3	40	50	10
18.	Measure heart rate and heart function with health monitoring device		40	50	10
19.	Measure blood sugar and blood pressure		40	50	10
20.	Use massage therapy equipment, Hot and cold therapy equipment, Ultrasound therapy equipment		40	50	10
21.	Determine the taste threshold for three different sensations- sweet salty and sour		40	50	10
22.	Determine the moisture content in the given sample of oil/fat		40	50	10
23.	Determine the impurities in the given sample of oil.		40	50	10
24.	Determines the acid value and free fatty acids in the given sample of oil/fat.		40	50	10
25.	Determine the peroxide value in the given sample of fat or oil.		40	50	10

Note: -All the above Games can be selected from the list of SGFI/AIU/IOA

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.	High end computers for record keeping	Processor Intel Core i7 with Open GL Graphics Card, RAM 32 GB, DDR3/DDR4, HDD 500 GB, Graphics Card NVIDIA OpenGL 4 GB, OS Windows 10	All
2.	Aerobics and Gymnastic	Basic facilities and equipment's – Balance Beams, Gymnastic Ball, Gymnastic Chalk, Gymnastic Clubs, Flex Floor Systems, High Bars, Hoops, Horizontal Bars, Leotards, Music, Parallel Bar, Pommel Horses, Ribbons, Rings, Ropes, Single Bar Trainer, Spotting Blocks, Streamers, Trampoline, Tumble Track, Uneven Bar, Vault, Vault Spring Board Gymnastic Accessories – Chalk, Grips, Wrist Supports, Mat, Tape, Socks Singlets, Pants Shoes, Shorts	2

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
		Aerobics- Resistance bands, Jump rope, Step bench or box, Abdominal wheel, Exercise mat, Gliding discs, dumbbells, fitness trampolines, hoops	
3.	Striking & Fielding sports	Complete Cricket Kit, Football Kit, Bowling Kit, Hockey Kit	4
4.	Net/Wall Sports	Complete Volley Ball and basketball kit	3
5.	Racket Game	Complete Tennis Kit, Table Tennis Kit and badminton kit	5
6.	Outdoor games	Complete Kho-Kho and Kabaddi and cycling kit	6
7.	Indoor games	Complete Chess kit, Carrom kit, Swimming kit, Boxing kit, Karate kit, Weightlifting kit, Power Lifting kit, Archery kit and Roller-Skating kit	7
8.	Physique Training	Cardio Machines- Treadmills, Elliptical Trainers, Exercise Bikes, Rowing Machines, Indoor Bikes, Vibration Machines, Steppers Recumbents Dumbbells, Multi-Purpose Bench, power rack, Adjustable Dumbbell Set 2 x 3-10 kg, Exercise mat, resistance band, balance trainer	7
9.	Sports and wellbeing equipment's for physically challenged and impairments.	Fusion Wheel – all-in-one portable wheelchair gym, Pedal exerciser, Deluxe hand exerciser, Greeper sports shoelaces, Active Hands, Ramble Tag Guidance Aid, Cat Tongue Grip Tape Adaptive Cycling- Straps, Leg/ Foot Adapters, Prosthetics, Steering Dampener, Handlebar Adapters, HANDCYCLING-Wheelchairs, Bike-On Handcycles, Trikes, Racing Wheelchairs, Trikes, Recumbent Bikes, All-terrain Handcycles, Mono Cycling, Hand Bikes - Off-Road, Cross Country, Racing, Downhill Archery - Field Tripod and Quad Mounts (Archery & Gun), In-Line Draw-Loc, Mounts (Archery & Gun), Stands (Gun), Mounts (Archery & Gun) Binoculars and Rests (Gun), Crossbows (Archery), Wheelchair Platform Stabilizing Crutch Poles, Dampeners, Crossbows (Archery), Hands free shooting rest (Gun) Bowling: ramp, roll assist Fitness: Anti-Gravity Treadmill, LapMat for Wheelchairs, Strike Assist, Adaptive Treadmill	8
10.	Yoga	Yoga Mats, Yoga Rollers, Yoga Blocks, Aero Yoga Clothing Blankets, cloth Straps, Bolsters, Wheels	9-16
11.	Fitness and wellbeing equipment's	Health monitoring devices for overall health- Personal health monitor for heart health, Blood sugar monitoring device, Wireless blood pressure device, Smart watch to track heart function, Hot and cold therapy equipment, Massage therapy equipment, Ultrasound therapy equipment	18-20
12.	Taste kit -To test three different sensations- sweet salty and sour	Salt solution (%) -0.5, 0.8, 1.0, 1.2, 1.5, Sugar solution (%) - 0.05, 0.5, 0.7, 1.0, 1.2, Citric acid (%) - 0.02, 0.04, 0.1, 0.5, 1.0 Spoons, Bowls, Beakers, Plain distilled water	21
13.	Test kit to measure peroxide value in the oil	Reagents: Acetic acid-chloroform solution, Saturated potassium iodide solution, Sodium thiosulphate solution- 0.1 N, Starch solution (1%) Apparatus: Pipette 1ml capacity, Conical flask	25
14.	Test kit to measure acid value and free fatty acids in the oil	Sample of oil/fats namely any refined oil or hydrogenated fat. Reagents - ethyl alcohol (95%), phenolphthalein indicator solution, standard aqueous sodium or potassium hydroxide solution (0.1 N or 0.5 N), Pipette (10 ml), Conical flask	24
15.	Test kit to measure impurities in the oil	Sample of Oil/fat, Oven-electric, maintained at $100 \pm 1^\circ\text{C}$., Desiccator, Weighing balance, Filter paper	23

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
16.	Test kit to measure moisture content in the oil	Sample of oil/fat, Moisture dish-made of porcelain, silica, glass or aluminum, Oven-electric, maintained at $105 \pm 1^\circ\text{C}$., Desiccator Weighing balance	22

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher with ISBN
1.	Practical Applications in Sports Nutrition	Heather Hedrick Fink, Alan E. Mikesky	Jones & Bartlett Learning (2020) ISBN No: 978-1284181340
2.	Massage and Medical Gymnastics,	Lace, M. V.	London: J & A Churchill Ltd. ASIN: B000RY4YB0
3.	ACSM's Guidelines for Exercise Testing and Prescription	Gary Liguori	LWW; (2021) ISBN-13: 1975150198-978
4.	Essentials of Strength Training and Conditioning	Javair Gillett	Human Kinetics, (2021) ISBN-13: 1718210868-978
5.	Practical Applications in Sports Nutrition	Heather Hedrick Fink, Alan E. Mikesky	Jones & Bartlett Learning, (2017) ISBN-13: 1284101393-978
6.	Health Fitness Management	Mike Bates, Mike Spezzano, Guy Danhoff	Human Kinetics, (2019) ISBN-13: 1450412230-978
7.	Yoga for Every Body: A beginner's guide to the practice of yoga postures, breathing exercises and meditation	Luisa Ray, Angus Sutherland	Vital Life Books (2022) ISBN-13: 1739737009-978
8.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Ann Swanson	DK Publisher, (2019) ISBN-13: 1465479358-978
9.	Mudras for Modern Living: 49 inspiring cards to boost your health, enhance your yoga and deepen your meditation Cards	Swami Saradananda	Watkins Publishing (2019) ISBN-13: 1786782786-978
10.	Principles and Methods of Adapted Physical Education & Recreation	Kristi Roth, Laurie Zittel, Jean Pyfer, David Auxter	Jones & Bartlett Learning, (2016) ISBN-13: 1284077810-978
11.	Adapted Physical Education and Sport Sixth Edition	Joseph P. Winnick, David L. Porretta	Human Kinetics, (2016) ISBN-13: 1492511533-978
12.	Counselling Skills in Applied Sport Psychology: Learning How to Counsel	Paul McCarthy, Zoe Moffat	Routledge, (2023) ISBN-13: 1032592589-978
13.	Basic Counselling Skills: A Helper's Manual	Richard Nelson Jones	Sage Publication 2012, New Delhi.
14.	Advancements in Mental Skills Training (ISSP Key Issues in Sport and Exercise Psychology)	Maurizio Bertollo, Edson Filho, Peter Terry	Routledge, (2020) ISBN-13: 0367111588-978
15.	The Relaxation and Stress Reduction Workbook	Martha Davis, Elizabeth Robbins, Matthew McKay, Eshelman MSW	A New Harbinger Self-Help Workbook (2019)
16.	Patanjalis Yoga Sutras	Swami Vivekananda	Fingerprint Publishing (2023) Prakash Books India Pvt Ltd, New Delhi ISBN-13: 9354407017-978

(b) Online Educational Resources:

1. https://onlinecourses.swayam2.ac.in/aic19_ed28/preview- introduction to Yoga and Applications of Yoga
2. https://onlinecourses.swayam2.ac.in/aic23_ge09/preview- Yoga for Creativity
3. https://onlinecourses.swayam2.ac.in/aic23_ge05/preview- Yoga for concentration
4. https://onlinecourses.swayam2.ac.in/aic23_ge06/preview- yoga for memory development
5. https://onlinecourses.nptel.ac.in/noc21_hs29/preview-Psychology of Stress, Health and Well-being
6. https://onlinecourses.swayam2.ac.in/nce19_sc04/preview- Food Nutrition for Healthy Living - Course – Swayam
7. <https://www.classcentral.com/course/swayam-fitness-management-17608>- Fitness Management from Swayam
8. https://onlinecourses.swayam2.ac.in/nce19_sc04/preview-Food Nutrition for Healthy Living
9. https://onlinecourses.swayam2.ac.in/cec21_ed02/preview Health Education and Recreation
10. https://onlinecourses.swayam2.ac.in/cec22_ed31/preview Sports Administration and Management

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. <https://www.yogajournal.com/yoga-101/philosophy/good-read>
2. <http://hdl.handle.net/123456789/38171>- Yoga Philosophy
3. <https://yoga.ayush.gov.in>

- 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 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	-	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 respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	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.

I) 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.

H) **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.

I) **Theory Session Outcomes (TSOs) and Units: T2400009**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Explain the difference between OER and other free educational materials.</p> <p><i>TSO 1b.</i> Describe the challenges and benefits of using OER in a class.</p> <p><i>TSO 1c.</i> Apply various aspects of evaluating OER before use</p> <p><i>TSO 1d.</i> Explain necessity to assess an OER's adaptability.</p> <p><i>TSO 1e.</i> Use preliminary search for open educational resource.</p> <p><i>TSO 1f.</i> Find OER using various resources.</p>	<p>Unit-1.0 Open Educational Resources</p> <p>1.1 OER - definition</p> <p>1.2 What is NOT OER.</p> <p>1.3 Benefits of using OER – Benefits to Students - Access to Quality Education</p> <p>1.4 OER - Benefits to Faculty - Use, Improve and Share, Network and collaborate with peers, Lower Cost, Improve access to information</p> <p>1.5 Challenges of Using OER – Subject Availability, Format and Material type availability, Time and Support availability</p> <p>1.6 Evaluating OER – a) Clarity, Comprehensibility, and Readability, b) Content and Technical Accuracy, c) Adaptability and Modularity, d) Appropriateness and Fit, e) Accessibility</p> <p>1.7 Finding Open Content - OER Search Scenario Filter by Usage Rights in Google, Repositories and Search Tools, Subject-specific Repositories</p>	<p>CO1</p>
<p><i>TSO 2a.</i> Explain benefits of copyright protection for creator</p> <p><i>TSO 2b.</i> Explain exceptions and limitations to copyright law</p> <p><i>TSO 2c.</i> List rights granted to copyright holders.</p> <p><i>TSO 2d.</i> Explain Exceptions and limitations to copyright law</p> <p><i>TSO 2e.</i> Explain Fair use/fair dealing apply to copyright</p> <p><i>TSO 2f.</i> Elaborate Public domain and how does it relate to copyright</p> <p><i>TSO 2g.</i> Elaborate penalties for copyright infringement.</p> <p><i>TSO 2h.</i> Explain copyright for digital content and the internet.</p> <p><i>TSO 2i.</i> Explain use of copyrighted works in education</p> <p><i>TSO 2j.</i> Explain the use of free licenses</p>	<p>Unit-2.0 Copyright and Open Licensing</p> <p>2.1 Copyright and what it does protect, benefits of copyright protection for creators, duration of copyright protection last, rights granted to copyright holders.</p> <p>2.2 Exceptions and limitations to copyright law, fair use/fair dealing apply to copyright</p> <p>2.3 Public domain and its relation to copyright.</p> <p>2.4 Penalties for copyright infringement</p> <p>2.5 Apply copyright to digital content and the internet</p> <p>2.6 Use of copyrighted works in education.</p> <p>2.7 Open Licenses – GNU – Free Documentation license, Free Art License</p> <p>2.8 Why Free Licenses – Retain, Reuse, Revise, Remix, Redistribute</p>	<p>CO2</p>

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 3a.</i> Describe the four different Creative Commons License components.</p> <p><i>TSO 3b.</i> Explain the reason some CC-licensed content might not be considered OER.</p> <p><i>TSO 3c.</i> Explain the Strength and weakness of four Open CC Licenses</p> <p><i>TSO 3d.</i> Choose the right Creative Commons license for work.</p> <p><i>TSO 3e.</i> Apply a Creative Commons license to existing work.</p> <p><i>TSO 3f.</i> Use of Creative Commons licenses for commercial purposes.</p> <p><i>TSO 3g.</i> Modify a work licensed under Creative Commons.</p> <p><i>TSO 3h.</i> Revoke a Creative Commons license, combine works with different Creative Commons licenses</p> <p><i>TSO 3i.</i> Differentiate between Attribution and Citation</p>	<p>Unit-3.0 Creative Common Licenses</p> <p>3.1 Alternatives to copyright as Creative Commons licenses.</p> <p>3.2 Four components of creative common Licenses – Attribution, Share- Alike, Non – commercial, No Derivatives</p> <p>3.3 Choosing a Creative common licenses – Wiley’s 5 Rs and Creative Common Licenses</p> <p>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</p> <p>3.5 Attribution Vs Citation - Creative Commons licensed work without giving attribution</p> <p>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</p>	<p>CO3</p>

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

J) 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

K) 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.

L) 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

M) 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/oerstarterkit
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 resources before use by the students.
