Curriculum of Diploma Programme

in

Civil 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
2418103	**BCC**	**Python Programming** (CE, CSE, AIML, EE, ME, ME (Auto)., ELX, ELX (R), MIE, FTS, CRE, CHE, TE, CACDDM, GT)	03	-	04	02	09	06
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
2400006	**NRC**	**Environmental Education and Sustainable Development** (Common for All Programmes)	01	-	01	01	03	02
2400207	**NRC**	**Indian Constitution** (Common for All Programmes)	01	-	-	-	01	01
2418107	**BCC**	**ICT Tools** (CE, ME, ME (Auto), FTS, CSE, AIML, MIE, CRE, CHE, FPP, TE, CACDDM, GT)	-	-	04	02	06	03
2400108	**NRC**	**Essence of Indian Knowledge System and Tradition** (Common for All Programmes)	01	-	-	-	01	01
2400111	**NRC**	**Principles of Management** (CE, AIML, AE, CHE, CSE, ME (Auto), FTS, MIE)	01	-	-	-	01	01
Total			**15**	**1**	**17**	**11**	**44**	**30**

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

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies)
Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

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

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

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

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

Semester - 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
2418103	**BCC**	**Python Programming** (CE, CSE, AIML, EE, ME, ME (Auto)., ELX, ELX (R), MIE, FTS, CRE, CHE, TE, CACDDM, GT)	30	70	20	30	20	30	200
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
2400006	**NRC**	**Environmental Education and Sustainable Development** (Common for All Programmes)	15	-	10	-	10	15	50
2400207	**NRC**	**Indian Constitution** (Common for All Programmes)	25	-	25	-	-	-	50
2418107	**BCC**	**ICT Tools** (CE, ME, ME (Auto), FTS, CSE, AIML, MIE, CRE, CHE, FPP, TE, CACDDM, GT)	-	-	20	30	20	30	100
2400108	**NRC**	**Essence of Indian Knowledge System and Tradition** (Common for All Programmes)	25	-	-	-	-	-	25
2400111	**NRC**	**Principles of Management** (CE, AIML, AE, CHE, CSE, ME (Auto), FTS, MIE)	25	-	-	-	-	-	25
Total			**195**	**280**	**150**	**150**	**90**	**135**	**1000**

Note: Prefix will be added to Course Code if applicable (T for Theory, 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

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/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	1	-	-	-	1	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)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		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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Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

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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)	
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)

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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)
TSO 1a. Distinguish between fundamental and derived physical quantity. *TSO 1b.* Estimate the errors in the measurement of given physical quantity. *TSO 1c.* Derive dimensional formula of a given physical quantity. *TSO 1d.* Apply dimensional analysis for inter conversion of units. *TSO 1e.* Establish relation between physical quantities using dimensional analysis. *TSO 1f.* Use dimensional analysis to check the correctness of a given equation.	**Unit-1.0 Unit and Measurements** 1.1 Physical quantities, fundamentals and derived units and system of units 1.2 Accuracy, precision and errors (systematic and random) in measurements, Method of estimation of errors (absolute and relative) in measurement, propagation of errors, significant figures 1.3 Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimension in an equation 1.4 Applications of dimensions: conversion from one system of units to other, corrections of equations and derivation of simple equations 1.5 Ancient astronomical instruments: Chakra, Dhanuryatra, Yasti and Phalaka yantra. (IKS)	**CO1**
TSO 2a. Explain circular motion and various terms related to circular motion. *TSO 2b.* Apply the concept of centripetal and centrifugal forces in a given situation. *TSO 2c.* Distinguish between translational and rotational motion. *TSO 2d.* Explain the terms torque and angular momentum. *TSO 2e.* Apply the principle of conservation of angular momentum in a given situation. *TSO 2f.* Find the moment of inertia of a given regular shape body.	**Unit-2.0 Circular and Rotational Motion** 2.1 Circular motion, angular displacement, angular velocity, frequency, time period, angular acceleration, relation between angular & linear velocity, linear acceleration & angular acceleration 2.2 Centripetal and centrifugal forces: banking of roads and bending of cyclist 2.3 Translational and rotational motion, torque and angular momentum, conservation of angular momentum and its applications 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)	**CO2**
TSO 3a. Explain the stress-strain curve of a given elastic or plastic body. *TSO 3b.* Interrelate different coefficient of elasticity.	**Unit-3.0 Physical Properties of Matter and Heat** 3.1 Elasticity: Hooke's law, Coefficient of elasticity; Young's modulus, Bulk Modulus and modulus of rigidity and their inter-relation (No	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3c. Apply the concepts of surface tension and viscosity to solve a given engineering problem. *TSO 3d.* Explain the behavior of given fluids on the basis of their viscosity. *TSO 3e.* Determine the various modes heat transfer in a given engineering problem. *TSO 3f.* Establish relation between coefficients of thermal expansion.	derivation), Poisson's ratio, stress-strain curve, elastic potential energy 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 3.3 Viscosity: Fluid, Viscosity and coefficient of viscosity, Critical Velocity, Reynold's number, 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.	
TSO 4a. Differentiate among periodic, oscillatory and simple harmonic motion. *TSO 4b.* Explain the various terms related to SHM. *TSO 4c.* Derive the expression for time period of given Bar pendulum. *TSO 4d.* Distinguish between mechanical and electromagnetic waves with examples *TSO 4e.* Differentiate between longitudinal and transverse waves with examples *TSO 4f.* Find the relation between the terms used to describe wave motion. *TSO 4g.* Explain the principle of Superposition of waves and beat formation with examples.	**Unit-4.0 Simple Harmonic Motion and Wave Motion** 4.1 Periodic and Oscillatory Motion 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 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	**CO4**
TSO 5a. Apply the concept of photoelectric effect to explain the of photonic devices. *TSO 5b.* Explain Laser, components of laser and its various engineering applications. *TSO 5c.* Explain propagation of light in optical fiber and its engineering applications. *TSO 5d.* Describe the properties of nanomaterials and its various applications.	**Unit-5.0 Modern Physics** 5.1 Photoelectric effect; Photon, threshold frequency, work function, Stopping Potential, Einstein's photoelectric equation. 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. 5.3 Optical fibers: Total internal reflection, acceptance angle and numerical aperture, Optical fiber types, applications of optical fibers 5.4 Nanotechnology: Properties (optical, magnetic and dielectric properties) of Nanomaterials and its application, Metallic, Bhasma (Ancient Ayurveda, IKS)	**CO5**

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

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 13.2 Determine the value of Plank's Constant (*h*) from the graph between KE v/s frequency of incident light. LSO 13.3 Determine the variation of stopping potential w.r.t frequency of incident photon			
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(C_{60})
   - 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 ($C_p - C_v = R$)
   - CO_2 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 (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Unit and Measurements	6	CO1	8	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

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
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, sprit level, precision stop watch	5
6.	Pullingger's apparatus	Linear-expansion apparatus with steam generator, thermometer 0-100^{o}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, 632mm) Objective (10X), Optical fiber (1-meter-long), detector with BNC connector, Auto arranging Multimeter, Screen with circular graduations, one circular base with linear and circular motion, 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, 632mm), Transmission grating 15000 lines/inch, photo detector with BNC connector and	11

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
		holder, screen with clamp type holder, knife edge with micrometer movement, digital multimeter, scale with mount	
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
2.	Concept of physics-2	H.C. Verma	Bharti Bhawan Publications, 2021 ISBN: 8177092324, 978-8177092325
3.	Text Book of Physics for Class XI (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-508-3(Part-I) & ISBN: 81-7450-566-0 (Part-II)
4.	Text Book of Physics for Class XII (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-631-4 (Part-I) & ISBN: 81-7450-671-3 (Part II)
5.	Engineering Physics	P. V. Naik	Pearson Education Ltd., 1993 ISBN: 817758362X,978-8177583625
6.	Applied Physics-I	Dr. Mina Talati & Vinod Kumar Yadav	Khanna Book Publishing (2021) ISBN : 978-93-91505-43-1
7.	Applied Physics-II	Dr. Hussain Jeevakhan	Khanna Book Publishing (2021) ISBN: 978-93-91505-57-8
8.	Engineering Physics	D. K. Bhattacharya & Poonam Tandon	Oxford University Press, ISBN: 0199452814, 978-0199452811
9.	The Surya Siddhanta	Aryabhatta	Baptist Mission press , Calcutta

(b) Online Educational Resources:

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

11. https://www.khanacademy.org/science/physics

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

(c) Others:

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

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A) Course Code : 2418103(T2418103/P2418103/S2418103)

B) Course Title : Python Programming

(CE, CSE, AIML, EE, ME, ME (Auto)., ELX, ELX (R), MIE, FTS, CRE, CHE, TE, CACDDM, GT)

C) Pre- requisite Course(s) :

D) Rationale :

Python programming has emerged as a popular programming language across wide range of application segments from Scientific to Machine Learning to mobile app development, and so on. Python is a high-level general-purpose programming language.

Because code is automatically compiled to byte code and executed, Python is suitableuse as a scripting language, Web application implementation language, etc.

In Python there are multiple levels of organizational structure: functions, classes, modules, and packages. These assist in organizing code. An excellentand large example is the Python standard library.

The Object-oriented Python provides a consistent way to use objects: in Python it is easy to implement new object types (called classesin object-oriented programming).

This introductory course to learn basic Python programming features which can be used as building blocks to develop different kind of applications using Python 3.

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 various data types and operators in formation of expressions.
- **CO-2** Write and execute programs using control statements.
- **CO-3** Perform relevant operations on Sequence data types
- **CO-4** Create functions in modules
- **CO-5** Use object-oriented approach and features in writing python programs
- **CO-6** Handle data files and exceptions.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	1	-	1	-	-	-	-		
CO-2	1	2	2	1	-	1	-		
CO-3	1	2	2	1	-	1	-		
CO-4	1	2	2	1	-	1	2		
CO-5	1	2	2	1	-	1	-		
CO-6	1	2	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				
2418103	Python Programming	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)	
2418103	Python Programming	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: T2418103

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Differentiate between Procedure Oriented P and Object Oriented Programming approach with example. *TSO 1b.* Use the concept of Lvalue and Rvalue *TSO 1c.* Write python program using various data types and operators	**Unit-1.0 Basics of Python Programming syntax** 1.1 Python character set, Python tokens, variables, concept of Lvalue and Rvalue, use of comments. 1.2 Data types: number (integer, floating point, complex), Boolean, sequence (string, list, tuple), none, mapping (dictionary), mutable and immutable data types 1.3 Operators: arithmetic operators, relational operators, logical operators, assignment operator, augmented assignment operators. Expressions, statement, type conversion & input/output: precedence of operators, expression, evaluation of expression.	**CO-1**
TSO 2a. Write Python program using decision making statements *TSO 2b.* Write Python program using loop structure to solve iterative problems	**Unit-2.0 Conditional and Iterative statements** 2.1 Conditional statements: simple if statement, if- else statemen, if-elif-else statement 2.2 Iterative statements: while loop, for loop, range function, break and continue statements, nested loops	**CO-2**
TSO 3a. Perform various operations on string using string operators and methods *TSO 3b.* Perform various operations on List using list operators and methods *TSO 3c.* Perform various operations on tuples using tuples operators and methods *TSO 3d.* Perform various operations on set using set methods *TSO 3e.* Perform various operations on dictionary using dictionary methods	**Unit-3.0 String, List, Tuples, set and Dictionary** 3.1 String: indexing, string operations (concatenation, repetition, membership & slicing), traversing a string using loops, built-in functions. 3.2 Lists: introduction, indexing, list operations: concatenation, repetition, membership & slicing, traversing a list, built- in list functions, linear search on list of numbers and counting the frequency of elements in a list 3.3 Tuples: Creating, initializing, accessing elements, tuple assignment, performing operations on tuples, tuple methods and built-in functions, nested tuples 3.4 Set: Creating set, traversing, adding, removing data in set, performing set operations like join, Union intersection, difference	**CO-3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	3.5 Dictionary: accessing items in a dictionary using keys, mutability of dictionary: adding a new item, modifying an existing item, built-in dictionary functions.	
TSO 4a. Create and use user defined functions to implement modular programming approach *TSO 4b.* Differentiate variable scope with example. *TSO 4c.* Import and use Python modules, libraries	**Unit-4.0 Python Functions, Modules and packages** 4.1 Functions: types of function (built- in functions, functions defined in module, user defined functions), creating user defined function, arguments and parameters, default parameters, positional parameters, Lambda functions, returning value, scope of a variable: global scope, local scope 4.2 Modules and Packages: Importing module using 'import' Regular Expressions, Exception Handling, PyPI Python Package Index, Pip Python package manager, Importing Libraries and Functions	**CO-4**
TSO 5a. Write simple Python programs with object oriented approach *TSO 5b.* Use constructors and destructors appropriately in python program *TSO 5c.* Explain different type of inheritance based on its characteristic *TSO 5d.* Implement given type of inheritance in Python. *TSO 5e.* Implement the concept of Polymorphism in Python	**Unit-5.0 Object Oriented Programming (OOP)** 5.1 OOPs Object oriented programming concepts and approach, Abstraction, encapsulation, class, object, class method vs static method in Python, class and static variable, constructor and destructors in python 5.2 Inheritance: types of inheritance: single, multiple, multilevel, hierarchical 5.3 Polymorphism: Polymorphism with class method, polymorphism with inheritance, method overriding, overloading	**CO-5**
TSO 6a. Explain different types of Exceptions in python *TSO 6b.* Write Python programs for exception handling in Python *TSO 6c.* Differentiate different modes of file opening. *TSO 6d.* Perform read, Write, Append operations in files	**Unit 6: Exception and File Handling in Python** 6.1 Exception Handling: syntax errors, exceptions, need of exception handling, user-defined exceptions, raising exceptions, handling exceptions, catching exceptions, Try - except - else clause, Try - finally clause, recovering and continuing with finally, built-in exception classes. 6.2 File Handling: text file and binary file, file types, open and close files, reading and writing text files, reading and writing binary files, file access modes	**CO-6**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2418103

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Write, execute and debug simple Python program using Integrated Development and Learning Environment (IDLE)	1.	a) Download and Install IDLE. Write and execute Python program to- b) Calculate the Area of a Triangle where its three sides a, b, c are given. s=(a+b+c)/2,	CO-1

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.2. Write and execute simple 'C' program using variables, arithmetic expressions.		Area=square root of s(s-a)(s-b)(s-c) (write program without using function) c) Swap Two Variables d) Solve quadratic equation for real numbers.	
LSO 2.1. Write and execute python programs using conditional statements. *LSO 2.2.* Write and execute python programs using various types of Loop statements	2.	Write and execute Python program to- a) Check if a Number is Positive, Negative or zero. b) Check whether the given year is a Leap Year. c) Print all Prime Numbers in an Interval. d) Display the multiplication Table based on the given input. e) Print the Fibonacci sequence. f) Find the Factorial of a Number.	CO-2
LSO 3.1. Write and execute Python program to perform various operations on string using string operators and methods	3.	Write and execute Python program to- a) Check whether the string is Palindrome b) Reverse words in a given String in Python c) identify in a strings the name, position and counting of vowels. d) Count the Number of matching characters in a pair of string (set) e) Python program for removing i-th character from a string	CO-2, CO-3
LSO 4.1. Write and execute Python program to perform various operations on List using List operators and methods	4.	Write and execute Python program to- a) find largest number in a given list without using max(). b) find the common numbers from two lists. c) create a list of even numbers and another list of odd numbers from a given list. d) To find number of occurrences of given number without using built-in methods.	CO-2, CO-3
LSO 5.1. Write and execute Python program to perform various operations on Tuple using Tuple operators and methods.	5.	Write and execute Python program to- a) find the index of an item of a tuple. b) find the length of a tuple. c) to reverse a tuple. d) Write a Python program to sort a list of tuple by its float element. Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')] Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]	CO-2, CO-3
LSO 6.1. Write and execute Python program to perform various operations on sets using set methods.	6.	Write and execute Python program to- a) create an intersection of sets. b) create a union of sets. c) create set difference. d) check if two given sets have no elements in common.	CO-2, CO-3
LSO 7.1. Write and execute Python program to perform various operations on Dictionary using Dictionary methods	7.	Write and execute Python program to- a) Write a Python script to concatenate two dictionaries to create a new one b) Write a Python script to merge two Python dictionaries. Write a Python program to combine two dictionary adding values for common Keys. d1 = {'a': 100, 'b': 200, 'c':300}	CO-2, CO-3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		d2 = {'a': 300, 'b': 200, 'd':400} Sample output: d({'a': 400, 'b': 400, 'd': 400, 'c': 300})	
LSO 8.1. Write and execute Python program to create user defined functions and call them.	8.	Write and execute Python program to- a) Write a Python function for reversing a string and call it. b) Write a Python function for calculating compound interest and call it. c) Write a Python function for calculating the factorial of a number and call it to calculate !n/(!r)*!(n-r)) where symbol "**!** " stands for factorial.	CO-2, CO-4
LSO 9.1. Write and execute Object Oriented Python program to define a class and its instances. *LSO 9.2.* Develop and execute Python program Using various types of inheritances. *LSO 9.3.* Develop and execute Python program Using various types of inheritances. *LSO 9.4.* Develop and execute Python program Using various types of Polymorphism.	9.	Write program using OOP approach to – a) create an instance of a specified class and display the namespace of the said instance b) create a Python class named Student with two attributes: student_id, student_name. Add a new attribute: student_class. Create a function to display all attributes and their values in the Student class. c) Create a Python class named Student with two instances student1, student2 and assign values to the instances' attributes. Print all the attributes of the student1, student2 instances d) Write programs to demonstrate use of following types of inheritance: i. Single inheritance ii. Multiple inheritance iii. Multilevel inheritance e) Demonstrate use of polymorphism with following situations: i. Polymorphism in operator ii. Polymorphism in user defined method iii. Polymorphism in built-in function iv. Polymorphism with class method v. Polymorphism with method overriding	CO-2, CO-5
LSO 10.1. Develop and execute Python program to handle various type of exceptions. *LSO 10.2.* Develop and execute Python program to perform file operations.	10.	a) Using exception handling feature such as try…except, try finally- write minimum three programs to handle following types of exceptions. i. Type Error ii. Name Error iii. Index Error iv. Key Error v. Value Error vi. IO Error vii. Zero Division Error b) Write Python program to demonstrate file operations.	CO-6, CO-1, CO-2,

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

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

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

b. Micro Projects:

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

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

c. Other Activities:

1. Seminar Topics:

- Tkinter widgets in python
- Python date/time module and its applications
- wxPython and its applications

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	10%	10%	15%	16%	16%	10%	16%
CO-2	15%	15%	15%	16%	16%	15%	16%
CO-3	25%	25%	20%	18%	18%	25%	18%
CO-4	15%	15%	15%	16%	16%	15%	16%
CO-5	25%	25%	25%	18%	18%	25%	18%
CO-6	10%	10%	10%	16%	16%	10%	16%
Total Marks	**30**	**70**	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

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

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.	Write and execute Python program to- a) Calculate the Area of a Triangle where its three sides a,b,c are given. s=(a+b+c)/2, Area=square root of s(s-a)(s-b)(s-c) (write program without using function) b) Swap Two Variables c) Solve quadratic equation for real numbers.	CO-1	40	50	10
2.	Write and execute Python program to- a) Check if a Number is Positive, Negative or zero. b) Check whether the given year is a Leap Year. c) Print all Prime Numbers in an Interval. d) Display the multiplication Table based on the given input. e) Print the Fibonacci sequence. f) Find the Factorial of a Number.	CO-2	40	50	10
3.	Write and execute Python program to- a) Check whether the string is Palindrome b) Reverse words in a given String in Python c) identify in a strings the name, position and counting of vowels. d) Count the Number of matching characters in a pair of string (set) e) Python program for removing i-th character from a string	CO-2, CO3	40	50	10
4.	Write and execute Python program to- a) find largest number in a given list without using max(). b) find the common numbers from two lists.	CO-2, CO-3	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
	c) create a list of even numbers and another list of odd numbers from a given list. d) To find number of occurrences of given number without using built-in methods.				
5.	Write and execute Python program to- a) find the index of an item of a tuple. b) find the length of a tuple. c) to reverse a tuple. d) Write a Python program to sort a list of tuple by its float element. Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')] Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]	CO-2, CO-3	40	50	10
6.	Write and execute Python program to- a) create an intersection of sets. b) create a union of sets. c) create set difference. d) check if two given sets have no elements in common.	CO-2, CO-3	40	50	10
7.	Write and execute Python program to- a) Write a Python script to concatenate two dictionaries to create a new one b) Write a Python script to merge two Python dictionaries. c) Write a Python program to combine two dictionary adding values for common keys. d1 = {'a': 100, 'b': 200, 'c':300} d2 = {'a': 300, 'b': 200, 'd':400} Sample output: d({'a': 400, 'b': 400, 'd': 400, 'c': 300})	CO-2, CO-3	40	50	10
8.	Write and execute Python program to- a) Write a Python function for reversing a string and call it. b) Write a Python function for calculating compound interest and call it. c) Write a Python function for calculating the factorial of a number and call it to calculate !n/(!r)*!(n-r)) where symbol "**!** " stands for factorial.	CO-2, CO-4	40	50	10
9.	Write program using OOP approach to – a) create an instance of a specified class and display the namespace of the said instance b) create a Python class named Student with two attributes: student_id, student_name. Add a new attribute: student_class. Create a function to display all attributes and their values in the Student class. c) Create a Python class named Student with two instances student1, student2 and assign values to the instances' attributes. Print all the attributes of the student1, student2 instances d) Demonstrate use of polymorphism with following situations: vi. Polymorphism in operator vii. Polymorphism in user defined method viii. Polymorphism in built-in function ix. Polymorphism with class method x. Polymorphism with method overriding	CO-2, CO-5	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
10.	Using exception handling feature such as try…except, try finally- write minimum three programs to handle following types of exceptions. viii. TypeError ix. NameError x. IndexError xi. KeyError xii. ValueError xiii. IOError xiv. ZeroDivisionError	CO-2, CO-6	40	50	10
11.	Write and execute Python program to- a) Calculate the Area of a Triangle where its three sides a,b,c are given. s=(a+b+c)/2, Area=square root of s(s-a)(s-b)(s-c) (write program without using function) b) Swap Two Variables c) Solve quadratic equation for real numbers.	CO-1	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, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Computer system	Processor Intel Core i5, 4 GB RAM, 15 GB free disk space	All
2.	Integrated Development and Learning Environment (IDLE)	S/w to be downloaded for python 3.11.3 or higher	All

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Introduction to Computing and Problem-Solving using Python	E. Balagurusamy	McGraw Hill Education (India)Pvt. Ltd.1st Edition /2016
2.	Learning Python Programming	Jeffrey Elkner, Allan B.Downey, Chris Meyers	Samurai Media Limited. 2016
3.	Python Programming	Ashok Namdev Kamthane and Amit Ashok Kamthane	McGraw Hill Education (India) Pvt.Ltd.2020, 2nd Edition
4.	Programming in Python	Dr. Pooja Sharma	BPB Publications 2017

(b) Online Educational Resources:

1. https://docs.python.org/3/tutorial/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm

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

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A) Course Code : **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)
TSO 1a. Explain concepts of the given terms. *TSO 1b.* Use relevant units of various quantities in the given situations. *TSO 1c.* Explain effects of a force on the given object. *TSO 1d.* Resolve the given single force. *TSO 1e.* Calculate the resultant of the given force system. *TSO 1f.* Find the resultant of the given force system using law of parallelogram *TSO 1g.* Determine graphically the resultant of the given force system by triangle law and polygon law.	**Unit-1.0 Mechanics and Force System** 1.1 Significance and relevance: Mechanics, applied mechanics, statics and dynamics. 1.2 Space, time, mass, particle, body, rigid body. 1.3 Scalar and vector quantity, Units of measurement (SI units) Fundamental units and derived units. 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. 1.5 Resolution of a force - Orthogonal and Non-Orthogonal components of a force, moment of a force, Avignon's Theorem. 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. 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.	**CO1, CO2**
TSO 2a. Draw the free body diagram for the given condition. *TSO 2b.* Determine unknown force in the given situation using Lami's theorem. *TSO 2c.* Identify the types of beams required for the given situation. *TSO 2d.* Determine reactions in the given type of beam analytically. *TSO 2e.* Solve problems using free body diagram and Lami‟s theorem.	**Unit-2.0 Static Equilibrium** 2.1 Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical conditions of equilibrium. 2.2 Equilibrium of force systems analytically 2.3 Lami's Theorem. 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. 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. 2.6 Beam reaction for simply supported beam subjected to vertical loads only.	**CO1, CO2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3a. Calculate force of friction and coefficient of friction for the given condition or situation *TSO 3b.* Describe the conditions for friction for the given situation. *TSO 3c.* Identify the various forces acting on a ladder for the given conditions using free body diagram. *TSO 3d.* Compare the value of coefficient of friction between different surfaces. *TSO 3e.* Interpret the effect of change of masses, change of angle of inclination or both on the coefficient of friction *TSO 3f.* Calculate forces acting on a body that is moving on a horizontal rough surface *TSO 3g.* Determine the forces acting on a body that is moving on an inclined plane	**Unit 3.0 Friction** 3.1 Friction and its relevance in engineering, types 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. 3.2 Equilibrium of bodies on level surface subjected to force parallel and 3.3 inclined to plane. 3.4 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. FBD of ladder in friction	**CO3, CO4**
TSO 4a Distinguish between centroid and center of gravity TSO 4b Calculate the centroid of geometrical plane figures. TSO 4c Calculate centroid of the given composite plane lamina TSO 4d Determine centre of gravity of the given simple solid. TSO 4e Determine centre of gravity of the given composite solid. TSO 4f Calculate Moment of Inertia of different geometric shapes.	**Unit 4.0 Centroid, Centre of Gravity and Moment of Inertia** 4.1 Introduction to Centroid, Centre of Gravity and Areas 4.2 Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). 4.3 Centroid of composite figures composed of not more than three geometrical figures and centroid of perforated section, axis of symmetry 4.4 Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere). 4.5 Centre of Gravity of composite solids composed of not more than two simple solids. 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	**CO4**
TSO.5a Describe the components of the given lifting machine. TSO.5b Differentiate the working principle of the given two types of lifting machines. TSO.5c Determine velocity ratio, efficiency of the given lifting machine. TSO.5d Calculate effort required and load lifted by the given lifting machine. TSO.5e Draw the graph with the given data TSO.5f Interpret the given graphs TSO.5g Select the relevant lifting machine for the given purpose with justification	**Unit-5.0 Simple Lifting Machine** 5.1 Simple lifting machine, load, effort, mechanical advantage, Applications and advantages. Velocity ratio, efficiency of machines, Law of machine. 5.2 Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility 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.	**CO2, CO5**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	5.4 Graphs of Load verses Effort, Load verses ideal Effort, Load verses Effort lost in friction, Load verses MA, Load verses Efficiency.	

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)
LSO 1.1. 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
LSO 2.1 Apply Lami's theorem LSO 2.2 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 • Beam reaction apparatus • Circular dial type weight	
LSO 3.1. Apply law of friction on horizontal plane and inclined plane *LSO 3.2.* Coefficient of friction between different materials *LSO 3.3.* Coefficient of friction between belt and pulley.	5	Determine coefficient of friction on horizontal and inclined plane.	CO2, CO3
	6	Determine the co efficient of friction between two surfaces by • angle of repose methods • friction plane method	
	7	Find the coefficient of friction between belt and pulley in a belt friction set up.	
LSO 4.1. Determine the centroid of different geometrical figures. *LSO 4.2.* 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	
LSO 5.1 Use simple screw jack *LSO 5.2* Use differential axle and wheel *LSO 5.3* Use single and double purchase crab winch *LSO 5.4* Use jib crane *LSO 5.5* 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:

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

c. Other Activities:

1. Seminar Topics:
   - Collision of elastic bodies
   - Law of **conservation of energy**
   - concept of parallel axis and perpendicular axes theorem

2. Visits: Visit nearby tool room/industry with workshop facilities. Prepare report of visit with special comments of simple lifting machine to be used.

3. 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 • 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 co efficient of friction between two surfaces by • 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

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

S. No.	Name of Equipment and Tools	Broad Specifications	Relevant Experiment/Practical Number
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
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 2008ISBN: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)

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

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
source software to find the same by comparing the findings. *TSO 4c.* 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.		
TSO 5a. Select discrete and continuous probability distribution for given data. *TSO 5b.* Solve given problems based on repeated trials using binomial distribution. *TSO 5c.* Use suitable distribution to solve the given problems when the number of trials is large and the probability is very small. *TSO 5d.* Utilize the concept of normal distribution to solve broad-based engineering-related problems.	**Unit-5.0 Probability Distribution** 5.1 Discrete and continuous probability distribution. 5.2 Binomial distribution. 5.3 Poisson's distribution. 5.4 Normal distribution.	**CO5**

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

K) Suggested Tutorials and Outcomes:

Outcomes	S. No.	Tutorials Titles	Relevant COs Number(s)
1.1 Calculate the area of the hexagon using integration. 1.2 Calculate the average temperature of a city over a certain period. 1.3 Calculate the total force on the bottom of the tank due to the water. 1.4 Estimate the amount of force required to move a component. 1.5 Apply the concept of definite integration to find the volume.	1.	• 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
1.1 Solve population dynamics using first-order ODEs. 1.2 Calculate the vibration of a Mechanical system using differential equations. 1.3 Calculate the concentration of a reactant in a chemical reaction over time. 1.4 Calculate mechanical vibrations using second-order ODEs.	2.	• 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
3.1 Use Newton's method to find the roots of a non-linear equation in one variable. 3.2 Use the concept of Newton's method to solve financial modeling-related problems based on the Black-Scholes model. 3.3 Calculate the electric field (that satisfies Maxwell's equations) around a wire with a	3.	• 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. 3.4 Use Bakhshali iterative methods for finding the approximate value of the square root. (IKS)			
1.1 Use Numerical integration to determine the total quantity of Heat of given a material. 1.2 Use Simpson's 1/3rd rule to find the effective force on the mast of a racing sailboat. 1.3 Apply Numerical integration to calculate work done for a given engineering problem.	4.	• 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.	• 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 (Cl) 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://learnengg.com/LE/Index
17. https://ncert.nic.in/textbook.php
18. https://nios.ac.in/online-course-material/sr-secondary-courses/mathematics-(311).aspx

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

(c) Others:

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

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A) Course Code : **2400006(T2400006/P2400006/S2400006)**

B) Course Title : **Environmental Education and Sustainable Development**
(Common for all Programmes)

C) Pre- requisite Course(s) :

D) Rationale :

Every creature depends on nature for their survival. It is therefore, not only essential but also moral responsibility of all of us to keep our environment clean & in a good condition. The global environmental issues such as clean water and sanitation, affordable & clean energy, sustainable cities & communities, etc. are best addresses through sustainable development goals. Environmental education is one of the primary activities to spread the concept of sustainability on a broader scope. In India, environmental education is considered as mandatory for all segment of education including technical education. Every creature depends on nature for their survival. It is therefore, not only essential but also moral responsibility of all of us to keep our environment clean & in a good condition. The concept of sustainable development is closely associated with environmental education to promote developments. Considering importance of environmental education and sustainable development, it became necessary to provide basics of these areas to the engineering graduates. The knowledge gained through this course will help the diploma students to take engineering decisions aligned to ensure sustainability of environment for next generations through proper protection of environment.

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** Explain the importance of ecosystem for the protection of environment
- **CO-2** Use relevant air & water pollution control methods to solve pollution related issues
- **CO-3** Recognize relevant energy sources required for domestic & industrial application
- **CO-4** Analyze the issues of climate change and its impact on sustainability
- **CO-5** Apply engineering solutions/methods/legislations to reduce the activities that are harming the environment.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	-	-	-	2	-	2		
CO-2	3	2	2	2	2	-	2		
CO-3	3	-	-	-	3	-	2		
CO-4	3	3	-	2	2	-	2		
CO-5	3	-	3	3	2	2	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				
2400006	Environmental Education and Sustainable Development	01	-	01	01	03	02

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)	
2400006	Environmental Education and Sustainable Development	15	-	10	-	10	15	50

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: T2400006

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Differentiate aquatic & terrestrial ecosystem *TSO 1b.* Explain structure of ecosystem *TSO 1c.* Compare food chain & web chain *TSO 1d.* Describe carbon, nitrogen, Sulphur & phosphorus cycle *TSO 1e.* Explain causes & effect of global warming	**Unit-1.0 Ecosystem** 1.1 Aquatic & Terrestrial ecosystem 1.2 Structure of ecosystem 1.3 Food chain & Food web 1.4 Carbon, Nitrogen, Sulphur & Phosphorous Cycle 1.5 Global warming – Causes & Effects	**CO1**
TSO 2a. Explain environmental pollution & its sources. *TSO 2b.* Assess the causes of water & air pollution in a given area *TSO 2c.* Explain the effects of water & air pollution on human, plant & animal *TSO 2d.* Take appropriate measures to prevent the pollution problems at city /municipal areas *TSO 2e.* Determine the pollution level in the environment at different seasons.	**Unit-2.0 Air & Water Pollution** 2.1 Traditional pollution issues- Air, Water, Noise 2.2 Water pollution 2.2.1 Sources of water pollution 2.2.2 Effects of water pollution 2.2.3 Control of water pollution 2.2.4 Physical & chemical standard of domestic water as per Indian Standard 2.3 Air pollution 2.3.1 Sources of air pollution 2.3.2 Air pollutants 2.3.3 Effects of air pollution on human, plant & animal 2.3.4 Air monitoring system 2.3.5 Air pollution control	**CO2**
TSO 3a. Describe various types renewable sources of energy *TSO 3b.* Explain solar energy & methods of harnessing *TSO 3c.* Explain wind energy and its impact on environment *TSO 3d.* Explain characteristics of biomass & its digestion process *TSO 3e.* Describe new energy sources & their application	**Unit-3.0 Sustainability & Renewable Sources of Energy** 3.1 Concept of sustainable development 3.2 Renewable sources of energy for sustainable development 3.3 Solar Energy 3.3.1 Features of solar thermal & PV system 3.3.2 Solar pond, Solar water heater, Solar dryer and Solar stills 3.4 Wind Energy	**CO3**

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

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

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

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

L) Suggested Term Work and Self Learning: S2400006 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

1. Conduct a waste audit in your polytechnic. Categorize waste into different types such as plastic, paper, organic. Quantify the amount of each waste.

b. Micro Projects:

- Conduct of EIA of a project/activity such as construction of roads in the local area. Prepare a report on:

  (a) Environmental issues in your city
  (b) SDGs and environment related acts/laws applicable in your state and in India.
  (c) Current-status & future-prospects of Wind Energy
  (d) New energy sources

- Prepare a model of rain water harvesting system to demonstrate how rainwater can be collected and stored for various purposes such as irrigation and toilet flushing.

- Students may be asked in group to set up a small solar panel to compare the energy output under different lighting condition and angles to understand the concept of solar energy and its potential applications.

c. Other Activities:

1. Seminar Topics:
   - Climate change issue and problems
   - Sustainable development- Global practices
   - Factor affecting sustainability in India

2. Visits:
   Visit Pollution control Board of your city. Prepare report of visit with special comments of initiatives taken for protecting environment and ensuring sustainable development of the city.

   Organize a field trip to a nearby park for the students. Students can be observed different species of the plants, animals and insects. They may be asked to prepare report on importance of biodiversity conservation.

3. Self-Learning Topics:

   - Sustainable Development Goals
   - Climate change.
   - Pollution issues
   - Laws and legislation of environmental protection

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	-	-	15%	-	-	20%	20%
CO-2	-	-	10%	25%	-	10%	20%
CO-3	-	-	15%	25%	50%	15%	20%
CO-4	-	-	30%	50%	50%	15%	20%
CO-5	-	-	30%	-	-	40%	20%
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.	Determine the Air and water pollutants harming local environment	CO1	30	60	10
2.	Determine the water pollutants harming local environment	CO1	40	50	10
3.	Carry out the Assessment of Environmental Impact (EIA) for a given project /activity of development	CO1 CO3	30	60	10
4.	Assess the impact of climate change on local environment	CO1, CO4	30	60	10
5.	Demonstrate sustainable building materials in lab/workshop	CO2 CO5	30	60	10
6.	Demonstrate the recycling process for the different materials such as paper, plastic etc. for waste management	CO3	50	40	10
7.	Setting up composting bins in the laboratory to demonstrate the process of composting organic waste	CO3	50	40	10
8.	Calculation of personal water footprint for daily water usage for activities like bathing, cooking and laundry.	CO3	50	40	10
9.	Develop bio mass energy in the laboratory	CO3 CO4	30	60	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
10.	Develop solar model in the laboratory	CO3	30	60	10
11.	Develop Wind turbine model in the laboratory	CO4	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, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Air analyzer	Air Quality Meter Product Type: Measuring Instrument Analysis Time: 2 sec to 8-hour 59 min. 59 sec Automation Grade: Automatic	1
2.	Water Analyzer	Multi-Parameter Water Testing Meter Digital LCD Multi-Function Water Quality Monitor PH/EC/TDS/Salt/S. G/CF/ORP	2
3.	Sustainable Building Materials	As per availability in the market	2,5
4.	Solar energy Panel – KT	Solar Panel Kit 5 LEDs, 2 ON/Off Switch, Wire, 2 Crocodile Clip	7
5.	Bio mass/energy installation -kit	The Bio-energy Science Kit is a great way to find out how a direct ethanol fuel cell works.	6
6.	Wind power energy -Kit	4M wind turbine kit, to demonstrate power of wind and convert it into electricity by building your own turbine.	8
7.	Ice melting demo kit	Simple bowls of different sizes	--

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Ecology and Control of the Natural Environment	Izrael, Y.A.	Kluwer Academic Publisher eBook ISBN: 978-94-011-3390-6
2.	Renewable Energy Sources and Emerging Technologies	Kothari, D.P. Singal, K.C., Ranjan, Rakesh	PHI Learning, New Delhi, 2009 ISBN-13 - 978-8120344709
3.	Green Technologies and Environmental Sustainability	Singh, Ritu, Kumar, Sanjeev	Springer International Publishing, 2017 eBook ISBN 978-3-319-50654-8
4.	Coping with Natural Hazards: Indian Context	K. S. Valadia	Orient Longman ISBN-10: 8125027351 ISBN-13: 978-8125027355
5.	Introduction to Engineering and Environment	Edward S. Rubin	Mc Graw Hill Publications ISBN-10: 0071181857 ISBN-13: 978-0071181853
6.	Environmental Science	Subrat Roy	Khanna Book Publishing Co. (P) Ltd. ISBN-978: 93-91505-65-3

(b) Online Educational Resources:

1. http://www1.eere.energy.gov/wind/wind_animation.html
2. http://www.nrel.gov/learning/re_solar.html
3. http://www.nrel.gov/learning/re_biomass.html
4. http://www.mnre.gov.in/schemes/grid-connected/biomass-powercogen/
5. http://www.epa.gov/climatestudents/
6. http://www.climatecentral.org
7. http://www.envis.nic.in/
8. https://www.overshootday.org/
9. http://www.footprintcalculator.org/
10. https://www.carbonfootprint.com/calculator.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. www.nptel.iitm.ac.in
2. www.khanacademy

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A) Course Code : 2400207(T2400207/S2400207)

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

C) Pre- requisite Course(s) :

D) Rationale :

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

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

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

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

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

CO-3 Analyze major constitutional amendments in the constitution.

F) Suggested Course Articulation Matrix (CAM):

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

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

***** PSOs will be developed by 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				
2400207	Indian Constitution	01	-	-	-	01	01

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400207	Indian Constitution	25	-	25	-	-	-	50

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: T2400207

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

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

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

L) Suggested Term Work and Self Learning: S2400207 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

b. Micro Projects:

1. Role of Media in Spreading Awareness regarding Fundamental Rights
2. Analysis of Situations where directive principle of State policy has prevailed over Fundamental rights
3. Analyze 42nd and 97th Amendment of Indian Constitution

c. Other Activities:

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

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

4. Group discussions on current print articles.
    - Adoption of Article 365 in India.
    - Need of amendments in the constitution.

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

6. Cases: Suggestive cases for usage in teaching:

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

7. Self-Learning Topics:

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

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	30%	-	30%	-	-	-	-
CO-2	40%	-	40%	50%	50%	-	-
CO-3	30%		30%	50%	50%		
Total Marks	**25**	**-**	**5**	**10**	**10**	**-**	**-**
			25				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

N) Suggested Specification Table for End Semester Theory Assessment: (Not Applicable)

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

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

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

R) Suggested Learning Resources:

(a) Books:

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

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
5.	The Constitutional Law of India	Durga Das Basu	LexisNexis Butterworths Wadhwa, Nagpur 978-81-8038-426-4

(b) Online Educational Resources:

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

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

******

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)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2418107	ICT Tools	-	-	04	02	06	03

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

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

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2418107

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

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

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

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

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

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

L) Suggested Term Work and Self Learning: S2418107 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

b. Micro Projects:

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

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

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

c. Other Activities: ---

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	-	-	15%	-	-	20%	20%
CO-2	-	-	10%	25%	-	10%	20%
CO-3	-	-	15%	25%	33%	15%	20%
CO-4	-	-	30%	25%	33%	15%	20%
CO-5	-	-	30%	25%	34%	40%	20%
Total Marks	**-**	**-**	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

N) Suggested Specification Table for End Semester Theory Assessment: (Not Applicable)

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	a) Create, edit and save document: apply formatting features on the text - line, paragraph b) Use bullets, numbering, page formatting, header, footer, margin, layout	CO-1	60	30	10
2.	Insert and edit images and shapes, resizing, cropping, colour, background, group/ungroup	CO-1	60	30	10
3.	Insert table and apply various table formatting features on it.	CO-1	60	30	10
4.	Review features such as Spelling, grammar, Thesaurus, translate, language, word count, comments	CO-1	70	20	10
5.	Apply page layout features i. Print layout, web layout, show ruler, gridline, page zoom, split ii. Themes, page background, paragraph, page setup iii. Create multicolumn page iv. Use different options to print the documents	CO-1	60	30	10
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/ ImplementationStrategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Tutorial, Case Method, Group Discussion, Industrial visits, Industrial Training, Portfolio Based Learning, Role Play, Live Demonstrations in Classrooms, Lab, Field, Information and Communications Technology (ICT) Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Sessions, Video Clippings, Use of Open Educational Resources (OER), MOOCs etc.

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

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

R) Suggested Learning Resources:

(a) Books:

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

(b) Online Educational Resources:

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

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

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A) Course Code : **2400108(T2400108)**

B) Course Title : Essence of Indian Knowledge System and Tradition
(Common for all Programmes)

C) Pre- requisite Course(s) :

D) Rationale :

This course will survey the basic structure and operative dimensions of Indian knowledge system. With the new education policy-NEP 2020 focusing on Indian Knowledge Systems (IKS) and Traditions of India. This course introduces the learners to the rich and varied knowledge traditions of India from antiquity to the present. This also helps the learner to know and understand their own systems and traditions which are imperative for any real development and progress. Also, it helps the learner to think independently and originally adopting Indian frameworks and models for solving the problems related to world of work where the student is supposed to perform.

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 Identify the rich heritage and legacy residing in our Indian Knowledge systems.

CO-2 Correlate the technological & philosophical concepts of IKS with engineering domain specific problems and local problems for finding out possible solutions.

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	-	-	-	1	1	1		
CO-2	1	2	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				
2400108	Essence of Indian Knowledge System and Tradition	01	-	-	-	01	01

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work& Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400108	Essence of Indian Knowledge System and Tradition	25	-	-	-	-	-	25

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2400108

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the architecture of the Ancient Indian Knowledge Systems. *TSO 1b.* List the salient features of IKS. *TSO 1c.* Comprehend the given IKS model. *TSO 1d.* Identify the role and relevance of the given IKS model in contemporary society.	**Unit-1.0 Introduction to Indian Knowledge Systems** 1.1 Overview of IKS 1.2 Organization of IKS – चतुर्दश-विद्यास्थानं 1.3 Conception and Constitution of Knowledge in Indian Tradition 1.4 The Oral Tradition 1.5 Models and Strategies of IKS	**CO1**
TSO 2a. Enlist the importance of Veda, Vedanga, Visaya, Siksaka. *TSO 2b.* Describe the given IKS domain. *TSO 2c.* Identify elements of mentioned IKS domains that are relevant to Technical Education System. *TSO 2d.* Correlate the elements of mentioned IKS domains with given engineering domain.	**Unit-2.0 Overview of IKS Domains and Relevance in Current Technical Education System.** 2.1 The Vedas as the basis of IKS 2.2 Overview of all the six Vedāṅgas 2.3 Relevance of following IKS domains in present Technical Education System: • Arthashastra (Indian economics and political systems) • Ganita and Jyamiti (Indian Mathematics, Astronomy and Geometry • Rasayana (Indian Chemical Sciences) • Ayurveda (Indian Biological Sciences / Diet & Nutrition) • Jyotish Vidya (Observational astronomy and calendar systems) • Prakriti Vidya (Indian system of Terrestrial/ Material Sciences/ Ecology and Atmospheric Sciences) • Vastu Vidya (Indian system of Aesthetics-Iconography and built-environment /Architecture) • Nyaya Shastra (Indian systems of Social Ethics, Logic and Law) • Shilpa and Natya Shastra (Indian Classical Arts: Performing and Fine Arts) • Sankhya and Yoga Darshna (Indian psychology, Yoga and consciousness studies) • Vrikshayurveda (Plant Science / Sustainable agriculture/food preservation methods)	**CO1, CO2**

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

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

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

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

b. Micro Projects:

1. Write a report on any IKS domain highlighting the correlation with one domain specific engineering course.

c. Other Activities:

1. Seminar Topics: discuss any one IKS domain in details a highlighting the eminent works in the area.
2. Visits:
   - Visit any nearby ancient temple and corelate the geomatical, Shilpa and Vaastu on IKS dimensions specified in each domain.
3. Self-Learning Topics:
   - Sustainable practices adopted in ancient India that can be applied for current engineering situations.

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-2	100%	-	100%	100%	100%	-	-
Total Marks	**25**	**-**	**5**	**10**	**10**	**-**	**-**
			25				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

N) Suggested Specification Table for End Semester Theory Assessment: (Not Applicable)

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

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

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

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Introduction to Indian Knowledge System: Concepts and Applications	Archak, K.B. (2012).	Kaveri Books, New Delhi
2.	Introduction to Indian Knowledge System: Concepts and Applications	Mahadevan, B. Bhat, Vinayak Rajat Nagendra Pavana R.N.	PHI, ISBN: 9789391818203
3.	Glimpse into Kautilya's Arthashastra	Ramachandrudu P. (2010)	Sanskrit Academy, Hyderabad
4.	"Introduction" in Studies in Epics and Purāṇas, (Eds.)	KM Munshi and N Chandrashekara Aiyer	Bhartiya Vidya Bhavan

(b) Online Educational Resources:

1. http://bhavana.org.in
2. www.academia.edu/23254393/Science_in_Ancient_India_-_an_educational_module
3. www.academia.edu/23305766/Technology_in_Ancient_India_-_Michel_Danino
4. www.hamsi.org.nz/http://insaindia.res.in/journals/ijhs.php
5. www.niscair.res.in/sciencecommunication/ResearchJournals/rejour/ijtk/ijtk0.asp
6. www-history.mcs.st-andrews.ac.uk/Indexes/Indians.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. Swami Harshananda. "A bird's eye view of vedas". R K Math. Bangalore.,http:// rkmathbangalore. org/Books/ABirdsEyeViewOfTheVedas.pdf.
2. Sanskrit Prosody, https://en.wikipedia.org/wiki/Sanskrit_prosody.
3. Vartak, P.V. (1995). "Veda and Jyotish," Part II, Chapter 2, in Issues in Veda and Astrology, H Pandya (Ed.), pp 65 – 73.
4. Sundaram, A.V. (1995). "Astrology: Its usefulness and Limitations in ModernTimes", Part II, Chapter 9, in Issues in Veda and Astrology, H Pandya (Ed.), pp 129 – 135.
5. Archak, K.B. (2012), "The Vedāṅga Literature", Chapter VIII in Essentials of Vedic Literature, Kaveri Books, New Delhi, pp 330 – 391.
6. Vasant Lad (1996), "Ayurveda: A Brief Introduction and Guide", (whole article).

******

A) Course Code **: 2400111(T2400111)**

B) Course Title **:** Principles of Management
(CE, AIML, AE, CHE, CSE, ME (Auto), FTS, MIE)

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

D) Rationale **:**

The course is designed to provide students with an overview of the management functions and its role in organizations and society. The course aims to provide students with the basic managerial knowledge necessary for engineering students in the world of work. The course focuses on providing students with analytical, developmental, managerial, and technical skills that relate to managerial positions in organizations. This course is an introduction to the critical management skills involved in planning, organizing, controlling, leading and decision making in an organization. It provides a framework for understanding issues involved in both managing and being managed, and it will help you to be a more effective contributor to organizations that you join.

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 Design strategic plan for various types of organizations.
CO-2 Take decisions to handle world of work situations.
CO-3 Formulate organizational hierarchy for different situations.
CO-4 Identify various leadership styles.

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	-	-	-	-	3	1		
CO-2	1	2	2	-	-	3	1		
CO-3	1	-	3	-	-	3	1		
CO-4	1	2	-	-	1	3	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)		Notional Hours (TW/ Activities+ SL)	Total Hours (CI+TW/ Activities)	Total Credits (C)
		L	T			
2400111	Principles of Management	01	-	-	01	01

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work& Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400108	Principles of Management	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: T2400111

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the nature of management *TSO 1b.* List the steps of evolution of management. *TSO 1c.* Differentiate between different plans. *TSO 1d.* Design Strategic plan for the given world of work situation. *TSO 1e.* Take decisions in the given situation with justification.	**Unit-1.0 Introduction to Management and Planning** 1.1 Nature and Purpose. 1.2 Evolution of Management Thoughts. 1.3 System approach to Management Process. 1.4 Types of Plans: Missions or Purpose, Objective or Goals, Strategies, Policies, Procedures. 1.5 Decision Making.	**CO1, CO2**
TSO 2a. Differentiate formal and informal organizations. *TSO 2b.* Identify the levels of hierarchy in the given organization. *TSO 2c.* List the staffing principles.	**Unit-2.0 Organizing and Staffing** 2.1 Nature of Organizing 2.2 Formal and Informal Organization 2.3 Principles of Organizing, Organizational Hierarchy, Authority, and Power. 2.4 Staffing, Recruitment, Selection, Performance Appraisal.	**CO3**
TSO 3a. Explain the theories of motivation *TSO 3b.* Differentiate between leadership styles	**Unit-3.0 Motivation and Leadership** 3.1 Motivation 3.2 McGregor Theory of X and Y 3.3 Maslow Hierarchy of Needs Theory 3.4 Herzberg's Motivation- Hygiene Theory 3.5 Leadership: Definition, Ingredients, Styles, theories	**CO4**

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

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

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

- Describe about adopting the systems approach in any organization.
- Write in brief about grapevine communication.
- Compare the traits Theory of X and Y as proposed by McGregor

b. **Micro** Projects:

- Apply Maslow's need hierarchy theory in workplace.

c. Other Activities:

1. Seminar Topics:
   - Importance of management theories in the corporates.
   - The hierarchy levels crate smoothness in functioning of any organization.
   - Leadership practices that are popular in current scenario.

2. Visits:
   - Visit nearby corporate setup and report
   - Interview leaders in the organization and identify leadership style'

3. Self-Learning Topics:
   - Herzberg's Motivation- Hygiene Theory
   - Leadership theories
   - Motivation for efficient productivity

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, 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.

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

M) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Fundamentals of Management: Essential Concepts and Applications	Robbins S.P. and DeCenzo David A	Pearson Education
2.	Koontz Essentials of Management	Koontz	Tata McGraw Hill Latest Edition
4.	Principles and Practices of Management	Shejwalkar and Ghanekar	Tata McGraw Hill Latest Edition
5.	Fundamentals of Management	Robbins and Dinzo	2002, Pearson India.
6.	Organization Theory, Structure, Design and Application	Stephen P. Robbins	PHI, New Delhi, 2005

(b) Online Educational Resources:

1. https://www.coursera.org/learn/principles-of-management
2. https://alison.com/course/an-introduction-to-the-principles-of-management
3. https://www.udemy.com/course/principles-of-management-j/
4. https://lumenlearning.com/courses/principles-of-management/
5. https://www.mygreatlearning.com/academy/learn-for-free/courses/principles-of-management

6. https://onlineprogrammes.insead.edu/leadership-programme-for-senior-executives
7. implilearn.com/general-management-certification-training-course?utm_source=google&utm_medium=cpc&utm_term
8. https://discovery.ucl.ac.uk/id/eprint/10115948/1/Educational-Resource-Management.pdf
9. https://libraries.etsu.edu/research/guides/management/oer
10. https://www.cmu.edu/teaching/designteach/syllabus/checklist/learningresources.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: -

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