

Curriculum of Diploma Programme
in
Mining 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				
2447201	PCC	Elements of Mining Technology	02	01	-	02	05	04
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
2420103	BEC	Fundamentals of Electrical and Electronic Engg. (CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)	03	-	04	02	09	06
2425104	BEC	Engg. Mechanics (CE, EE, ME, ME (Auto), MIE, FTS, AE, CRE, CHE, ELX, ELX (R), TE)	03	-	04	02	09	06
2400105A	ASC	Applied Mathematics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	02	01	-	02	05	04
2425106	BEC	Mechanical Workshop (ME, ME (Auto), MIE, AE, CRE, CE, CHE)	-	-	04	02	06	03
2400009	NRC	Open Educational Resources (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)	01	-	-	-	01	01
Total			14	2	16	12	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)	
2447201	PCC	Elements of Mining Technology	30	70	25	-	-	-	125
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
2420103	BEC	Fundamentals of Electrical and Electronic Engg. (CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)	30	70	20	30	20	30	200
2425104	BEC	Engg. Mechanics (CE, EE, ME, ME (Auto), MIE, FTS, AE, CRE, CHE, ELX, ELX (R), TE)	30	70	20	30	20	30	200
2400105A	ASC	Applied Mathematics -A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)	30	70	20	30	-	-	150
2425106	BEC	Mechanical Workshop (ME, ME (Auto), MIE, AE, CRE, CE, CHE)	-	-	20	30	20	30	100
2400009	NRC	Open Educational Resources (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)	25	-	-	-	-	-	25
Total			175	350	110	165	80	120	1000

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Legend:

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

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

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

Note:

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

- A) **Course Code** : 2447201(T2447201/S2447201)
 B) **Course Title** : Elements of Mining Technology
 C) **Pre- requisite Course(s)** :
 D) **Rationale** :

A mining engineer is responsible for exploring the economically viable mineral using mining operations in different hydro-geological conditions. Mine operations include mine planning, drilling, blasting, excavation and transportation of ores. Mining engineering is the application of combined knowledge of various branches of engineering and technology in extracting the mineral from the earth and making it useful. The purpose of Elements of Mining Technology is to provide understanding of fundamentals of mining and its terminology so as to gain access into further knowledge and skills related to mining technology.

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

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

- CO-1** Apply the basic mining terminology with reference to given context.
CO-2 Choose suitable mode of entry into a mine as per given conditions.
CO-3 Select suitable method of shaft sinking in a given conditions.
CO-4 Choose suitable methods of drilling/boring in a given situation.
CO-5 Select appropriate method of mining at given situation.

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

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

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

G) Teaching & Learning Scheme:

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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: T2447201

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Use mining terminology with reference to UG and OC mining.</p> <p><i>TSO 1b.</i> Explain the history of coal mining in India.</p> <p><i>TSO 1c.</i> Explain the history of metal mining in India.</p> <p><i>TSO 1d.</i> List mineral distribution area in India.</p> <p><i>TSO 1e.</i> Draw a map of the mineral wealth of Bihar.</p> <p><i>TSO 1f.</i> Write significance of mining industry in Indian economy.</p>	<p>Unit-1.0 Introduction</p> <p>1.1 Basic mining terminology related to- Underground (UG) and Opencast (OC) mining.</p> <p>1.2 History of underground and opencast coal mining in India.</p> <p>1.3 History of underground and opencast metal mining in India.</p> <p>1.4 Mineral distribution of in India.</p> <p>1.5 Mineral Wealth of Bihar.</p> <p>1.6 Role of mining industry in Indian economy.</p>	CO-1
<p><i>TSO 2a.</i> Describe different types of mode of entries.</p> <p><i>TSO 2b.</i> Select suitability conditions for shaft, incline and adit.</p> <p><i>TSO 2c.</i> Write factors affecting the shape and size of different mode of entry.</p> <p><i>TSO 2d.</i> Compare between mode of entries.</p> <p><i>TSO 2e.</i> Select a suitable mode of entry at given condition.</p> <p><i>TSO 2f.</i> Explain rules regarding mine outlets in UG mine.</p>	<p>Unit-2.0 Mine Entries</p> <p>2.1 Types of mode of entry (Shaft, Incline and Adit)</p> <p>2.2 Site selection for different modes of entries.</p> <p>2.3 Factors governing shape and size of different modes of entry.</p> <p>2.4 Suitability and Comparison between different modes of entries.</p> <p>2.5 Drivage of incline and adit.</p> <p>2.6 Legal requirement about outlets.</p>	CO-2
<p><i>TSO 3a.</i> Make a preparatory arrangement for sinking operation.</p> <p><i>TSO 3b.</i> List step to perform marking of center of shaft.</p> <p><i>TSO 3c.</i> List sequence of operations to be performed for drivage of a shaft.</p> <p><i>TSO 3d.</i> Identify relevant criteria for sinking shaft in a given condition.</p> <p><i>TSO 3e.</i> Identify precautionary measures to be observed for safe drivage of a shaft.</p> <p><i>TSO 3f.</i> Apply statutory provisions regarding winding in sinking shaft.</p> <p><i>TSO 3g.</i> Explain deepening and widening of shaft.</p>	<p>Unit-3.0 Shaft Sinking</p> <p>3.1 Preparatory arrangement</p> <p>3.2 Marking of center of shaft.</p> <p>3.3 Temporary and permanent lining, scaffolding.</p> <p>3.4 Drilling, blasting, loading and hoisting of muck, ventilation, drainage and lighting;</p> <p>3.5 Shaft fittings, staple shaft.</p> <p>3.6 Precautionary and safety aspects to be observed during shaft sinking.</p> <p>3.7 Statutory provisions regarding winding in sinking shaft</p> <p>3.8 Special methods of shaft sinking.</p> <p>3.9 Deepening and widening of shaft.</p>	CO-3 and CO-4
<p><i>TSO 4a.</i> Write purpose of drilling/boring.</p> <p><i>TSO 4b.</i> List various selection criteria of boring methods.</p> <p><i>TSO 4c.</i> Identify the specific drill bit applicable under a given condition</p> <p><i>TSO 4d.</i> Draw a layout of Surface arrangements for drilling/boring.</p> <p><i>TSO 4e.</i> Select suitable drilling method at given situation.</p> <p><i>TSO 4f.</i> Write problems during boring operation.</p> <p><i>TSO 4g.</i> List the different methods of bore hole surveying.</p> <p><i>TSO 4h.</i> Draw a sketch of different prospecting methods.</p>	<p>Unit-4.0 Drilling/Boring</p> <p>4.1 Purpose of boring in mines.</p> <p>4.2 Selection of boring methods</p> <p>4.3 Types of drill and drill bits, drilling accessories, drillability of rock.</p> <p>4.4 Drilling/boring in different types of strata,</p> <p>4.5 Surface arrangement for Drilling/boring</p> <p>4.6 Drilling/boring methods- Rotary and Percussive</p> <p>4.7 Trouble during boring operation</p> <p>4.8 Safety aspects to be observed during drilling/boring.</p> <p>4.9 Borehole surveying.</p> <p>4.10 Prospecting and its method.</p>	CO-4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 5a.</i> Classify the different methods of mining.</p> <p><i>TSO 5b.</i> Choose a suitable method of mining in a given condition.</p> <p><i>TSO 5c.</i> Write the different parameters for the selection of U/G methods of mining.</p> <p><i>TSO 5d.</i> List the special mining methods.</p>	<p>Unit-5.0 Introduction to Mining Methods</p> <p>5.1 Classification of methods of mining.</p> <p>a. Opencast mining</p> <p>b. Underground mining-</p> <p>i. U/G Coal Mining- Bord and Pillar, Longwall Mining methods.</p> <p>ii. U/G Metal Mining -Different stoping methods</p> <p>5.2 Various parameters for Selection of suitable U/G methods of mining.</p> <p>5.3 Special methods of mining i.e. Placer Mining, Dredging, Hydraulic, Strip, Gassification, Auger and Leaching, Horizon Mining methods.</p>	CO-5

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: S2447201** 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. Make a list of tools, equipment and accessories along with their photographs observed during the visit of a mine. Also write usage of the equipment/ tools/accessories.
2. Prepare a model of Shaft/Adit/Incline showing relevant safety features.
3. Prepare a model of a shaft showing relevant shaft fittings and linings.
4. Collect data related to drilling operations of nearby mines and prepare a report with the result.
5. Draw a model of showing surface mining parameters.

c. Other Activities:

d. Seminar Topics:

- History of coal mining in India.
- Mode of entry used in metal mines.
- Shaft sinking operation in muddy ground.
- Prospecting method used for metallic ore.
- Special mining methods.

1. Visits:

- i. Visit a nearby mine having a shaft. Observe and list safety devices fitted therein.
- ii. Visit nearby mine and draw sketch of the incline/shaft/adit along with relevant installations and fittings.

2. Self-Learning Topics:

- Prepare map of India to show distribution of coal and different minerals.
- Write a handout on types of mode of entries used in mines in different countries along with suitable photographs.
- Collect cases related to accidents in shafts and write brief on each case.

- Collect videos of different types of drilling and boring operations for different strata. Explain each video with specific details.
- Conduct a literature survey and develop a handout on special methods of mining.
- Write a notes on Indians largest opencast and underground coal mines.

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%	-	-	-	-
CO-2	15%	15%	10%	25%	20%	-	-
CO-3	15%	15%	15%	25%	30%	-	-
CO-4	30%	30%	30%	25%	20%	-	-
CO-5	30%	30%	30%	25%	30%	-	-
Total Marks	30	70	20	20	10	-	-
			50				

Legend:

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

**.: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Introduction	8	CO-1	8	3	2	3
Unit-2.0 Mine Entries	10	CO-2	10	2	4	4
Unit-3.0 Shaft Sinking	10	CO-3 & CO-4	10	4	2	4
Unit-4.0 Drilling/Boring	10	CO-4	21	6	7	8
Unit-5.0 Introduction to Mining Methods	10	CO-5	21	5	8	8
Total	48	-	70	20	23	27

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 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.	Principles and Practices of Modern Coal Mining	R. D. Singh	New Age International, 1997
2.	Modern Coal Mining Technology	S. K. Das	2nd edition, Lovely Prakashan Publishers, 1994.
3.	Underground Coal Mining Methods,	J. G. Singh	Braj Kalpa Publishers, Varnasi, 2000
4.	Elements of Mining Technology	D.J Deshmukh	Lovely Prakashan, Dhanbad

(b) Online Educational Resources:

1. <https://www.miningpapa.com/>
2. <http://www.edumine.com/>
3. <http://nptel.ac.in/course.php>
4. <http://octavesim.com/>
5. <https://swayam.gov.in/courses/public>

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. Society for Mining, Metallurgy & Exploration.
2. Lab Manuals

- A) **Course Code** : 2418103(T2418103/P2418103/S2418103)
- B) **Course Title** : Python Programming
(CE, CSE, AIML, ME, ME (Auto), ELX, EE, 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 suitable 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 excellent and 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 classes in 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):**

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

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

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Differentiate between Procedure Oriented P and Object Oriented Programming approach with example.</p> <p><i>TSO 1b.</i> Use the concept of Lvalue and Rvalue</p> <p><i>TSO 1c.</i> Write python program using various data types and operators</p>	<p>Unit-1.0 Basics of Python Programming Syntax</p> <p>1.1 Python character set, Python tokens, variables, concept of Lvalue and Rvalue, use of comments.</p> <p>1.2 Data types: number (integer, floating point, complex), Boolean, sequence (string, list, tuple), none, mapping (dictionary), mutable and immutable data types</p> <p>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.</p>	CO-1
<p><i>TSO 2a.</i> Write Python program using decision making statements</p> <p><i>TSO 2b.</i> Write Python program using loop structure to solve iterative problems</p>	<p>Unit-2.0 Conditional and Iterative Statements</p> <p>2.1 Conditional statements: simple if statement, if- else statemen, if-elif-else statement</p> <p>2.2 Iterative statements: while loop, for loop, range function, break and continue statements, nested loops</p>	CO-2
<p><i>TSO 3a.</i> Perform various operations on string using string operators and methods</p> <p><i>TSO 3b.</i> Perform various operations on List using list operators and methods</p> <p><i>TSO 3c.</i> Perform various operations on tuples using tuples operators and methods</p> <p><i>TSO 3d.</i> Perform various operations on set using set methods</p> <p><i>TSO 3e.</i> Perform various operations on dictionary using dictionary methods</p>	<p>Unit-3.0 String, List, Tuples, set and Dictionary</p> <p>3.1 String: indexing, string operations (concatenation, repetition, membership & slicing), traversing a string using loops, built-in functions.</p> <p>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</p> <p>3.3 Tuples: Creating, initializing, accessing elements, tuple assignment, performing operations on tuples, tuple methods and built-in functions, nested tuples</p> <p>3.4 Set: Creating set, traversing, adding, removing data in set, performing set operations like join, Union intersection, difference</p> <p>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.</p>	CO-3
<p><i>TSO 4a.</i> Create and use user defined functions to implement modular programming approach</p> <p><i>TSO 4b.</i> Differentiate variable scope with example.</p> <p><i>TSO 4c.</i> Import and use Python modules, libraries</p>	<p>Unit-4.0 Python Functions, Modules and Packages</p> <p>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</p>	CO-4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	<p>functions, returning value, scope of a variable: global scope, local scope</p> <p>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</p>	
<p><i>TSO 5a.</i> Write simple Python programs with object oriented approach</p> <p><i>TSO 5b.</i> Use constructors and destructors appropriately in python program</p> <p><i>TSO 5c.</i> Explain different type of inheritance based on its characteristic</p> <p><i>TSO 5d.</i> Implement given type of inheritance in Python.</p> <p><i>TSO 5e.</i> Implement the concept of Polymorphism in Python</p>	<p>Unit-5.0 Object Oriented Programming (OOP)</p> <p>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</p> <p>5.2 Inheritance: types of inheritance: single, multiple, multilevel, hierarchical</p> <p>5.3 Polymorphism: Polymorphism with class method, polymorphism with inheritance, method overriding, overloading</p>	CO-5
<p><i>TSO 6a.</i> Explain different types of Exceptions in python</p> <p><i>TSO 6b.</i> Write Python programs for exception handling in Python</p> <p><i>TSO 6c.</i> Differentiate different modes of file opening.</p> <p><i>TSO 6d.</i> Perform read, Write, Append operations in files</p>	<p>Unit 6.0 Exception and File Handling in Python</p> <p>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.</p> <p>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</p>	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)
<p><i>LSO 1.1.</i> Write, execute and debug simple Python program using Integrated Development and Learning Environment (IDLE)</p> <p><i>LSO 1.2.</i> Write and execute simple 'C' program using variables, arithmetic expressions.</p>	1.	<p>a) Download and Install IDLE.</p> <p>Write and execute Python program to-</p> <p>b) Calculate the Area of a Triangle where its three sides a, b, c are given. $s=(a+b+c)/2$, Area=square root of $s(s-a)(s-b)(s-c)$ (write program without using function)</p> <p>c) Swap Two Variables</p> <p>d) Solve quadratic equation for real numbers.</p>	CO-1
<p><i>LSO 2.1.</i> Write and execute python programs using conditional statements.</p> <p><i>LSO 2.2.</i> Write and execute python programs using various types of Loop statements</p>	2.	<p>Write and execute Python program to-</p> <p>a) Check if a Number is Positive, Negative or zero.</p> <p>b) Check whether the given year is a Leap Year.</p> <p>c) Print all Prime Numbers in an Interval.</p>	CO-2

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		d) Display the multiplication Table based on the given input. e) Print the Fibonacci sequence. f) Find the Factorial of a Number.	
<i>LSO 3.1.</i> 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
<i>LSO 4.1.</i> 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
<i>LSO 5.1.</i> 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
<i>LSO 6.1.</i> 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
<i>LSO 7.1.</i> Write and execute Python program to perform various operations on Dictionary using Dictionary methods	7.	Write and execute Python program to- a) Write a Python script to concatenate two dictionaries to create a new one b) Write a Python script to merge two Python dictionaries. c) Write a Python program to combine two dictionary adding values for common keys. d1 = {'a': 100, 'b': 200, 'c':300} d2 = {'a': 300, 'b': 200, 'd':400} Sample output: d({'a': 400, 'b': 400, 'd': 400, 'c': 300})	CO-2, CO-3
<i>LSO 8.1.</i> 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	CO-2, CO-4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
		calculate $n!/r!(n-r)!$ where symbol "!" stands for factorial.	
<p><i>LSO 9.1.</i> Write and execute Object Oriented Python program to define a class and its instances.</p> <p><i>LSO 9.2.</i> Develop and execute Python program Using various types of inheritances.</p> <p><i>LSO 9.3.</i> Develop and execute Python program Using various types of inheritances.</p> <p><i>LSO 9.4.</i> Develop and execute Python program Using various types of Polymorphism.</p>	9.	<p>Write program using OOP approach to –</p> <p>a) create an instance of a specified class and display the namespace of the said instance</p> <p>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.</p> <p>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</p> <p>d) Write programs to demonstrate use of following types of inheritance:</p> <ol style="list-style-type: none"> Single inheritance Multiple inheritance Multilevel inheritance <p>e) Demonstrate use of polymorphism with following situations:</p> <ol style="list-style-type: none"> Polymorphism in operator Polymorphism in user defined method Polymorphism in built-in function Polymorphism with class method Polymorphism with method overriding 	CO-2, CO-5
<p><i>LSO 10.1.</i> Develop and execute Python program to handle various type of exceptions.</p> <p><i>LSO 10.2.</i> Develop and execute Python program to perform file operations.</p>	10.	<p>a) Using exception handling feature such as try...except, try finally- write minimum three programs to handle following types of exceptions.</p> <ol style="list-style-type: none"> Type Error Name Error Index Error Key Error Value Error IO Error Zero Division Error <p>b) Write Python program to demonstrate file operations.</p>	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. Create 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 it to a number by adding all the individual alphabets 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.

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

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

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. 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	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		Viva-Voce (%)
			Performance		
			PRA* (%)	PDA** (%)	
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: 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	40	50	10
10.	Using exception handling feature such as try...except, try finally-write minimum three programs to handle following types of exceptions. i. TypeError ii. NameError	CO-2, CO-6	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
	iii. IndexError iv. KeyError v. ValueError vi. IOError vii. ZeroDivisionError				
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.1 st 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, 2 nd 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.

- A) **Course Code** : 2420103(T2420103/P2420103/S2420103)
 B) **Course Title** : Fundamentals of Electrical and Electronic Engg.
 (CSE, AIML, ME, ME (Auto), MIE, AE, CRE, CHE, TE)
 C) **Pre- requisite Course(s)** : Engineering Physics, Basic Algebra and Calculus
 D) **Rationale** :

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

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

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

- CO-1. Apply basic concepts of electricity to determine various electric parameters in a given electrical system.
 CO-2. Apply the fundamental laws and concepts of DC and AC circuits to a given electrical system.
 CO-3. Apply the principles of magnetism and electromagnetism to a given equipment.
 CO-4. Test the functionality of a given basic electronic component.
 CO-5. Use Boolean expressions and number systems to realize the basic logic circuits.

F) **Suggested Course Articulation Matrix (CAM):**

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

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

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

G) Teaching & Learning Scheme:

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

Legend:

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

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

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

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

SL: Self Learning, MOOCs, spoken tutorials, open educational resources (OERs)

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

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

H) Assessment Scheme:

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

Legend:

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

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

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

Note:

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

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

J) **Theory Session Outcomes (TSOs) and Units: T2420103**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO.1a Apply the concept of charge, voltage and current in the given electrical circuit TSO.1b Differentiate between AC and DC currents. TSO.1c Differentiate between practical and Ideal current/voltage source TSO.1d Calculate work, power, and energy in the given circuit TSO.1e Calculate the equivalent resistance/Capacitance/inductance in the given series and parallel electric circuit. TSO.1f Explain the heating/magnetic/chemical effect of the electric current with a relevant application. TSO.1g Calculate the energy stored in a given resistor/capacitor/inductor. TSO.1h Explain the effect of various media on capacitance TSO.1i Explain behavior of current in a resistor/capacitor/inductor.	Unit-1.0 Basic Electrical Parameters and Concepts 1.1 Electric charge, flow of charges, Electric Current D.C and A.C, Concept of ideal and practical current sources 1.2 Analogy of charge, potential /Voltage difference D.C and A.C, Induced emf/voltage, Terminal voltage, Concept of Ideal & Practical voltage sources 1.3 Resistor - Properties, Classification, Practical application of resistors, Effect of temperature on resistance, Series and parallel combination of resistors, Phase difference 1.4 Heating, magnetic and chemical effect of current, Electrical work, Power and energy, Open and short circuit condition of electric circuit 1.5 Capacitors – Properties, Capacitance formation, Expression for capacitance, Capacitive reactance, Energy stored in capacitor, Series & parallel combination of capacitors, Types of capacitors including super capacitors and their applications 1.6 Inductors – Properties, Self and mutual inductance, inductive reactance, Voltage and current equations of inductor, Energy stored in inductor, Inductance in A.C. and D.C. circuits, Types of Inductors including MEMS inductor and their applications	CO-1
TSO.2a Differentiate between- <ul style="list-style-type: none"> ● AC and DC current in all aspects (Generation, Waveforms and applications) ● Active and passive elements ● Linear & Non-linear circuit ● Unilateral and Bilateral circuit ● Loop and mesh in a given circuit TSO.2b Apply Ohm's law and Kirchhoff's laws to determine current and voltage in a given circuit. TSO.2c Explain various AC fundamental parameters. TSO.2d Use operator 'j' to calculate various quantities in A.C circuit	Unit-2.0 Fundamentals of D.C. and A.C. Circuits DC Circuits 2.1 AC and DC current, voltage and Power 2.2 Ohm's law, Kirchhoff's Current Law, Kirchhoff's Voltage law 2.3 Active & Passive elements, Linear & Non-linear circuit, unilateral and Bilateral circuit element, 2.4 Node, Branch, Loop, Mesh A.C Circuits 2.5 Frequency, Time period, Amplitude, Angular Velocity, RMS Value, Average Value, Form factor, Peak factor, Power factor 2.6 Phasor representation and transformation from Polar to rectangular form and vice versa of alternating quantities	CO1, CO2

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

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

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

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

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

L) **Suggested Term Work and Self-Learning: S2420103** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

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

b. **Micro Projects:**

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

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

c. Other Activities:

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

d. Self-Learning Topics:

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

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Sessional Work Assessment (SWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Sessional Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	15%	15%	20%	20%	33%	20%	20%
CO-2	20%	25%	20%	20%	33%	25%	20%
CO-3	25%	25%	20%	20%	34%	20%	20%
CO-4	25%	20%	20%	20%	--	20%	20%
CO-5	15%	15%	20%	20%	--	15%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-.1.0 Basic Electrical Parameters and Concepts	8	CO1	11	4	4	3
Unit-.2.0 Fundamentals of DC and AC Circuits	12	CO2	17	4	6	7
Unit-.3.0 Magnetic Circuits and Electromagnetic Induction	10	CO3	17	4	6	7
Unit-.4.0 Basic Electronic Components	10	CO4	14	4	6	4
Unit-.5.0 Overview of Digital Electronics	8	CO5	11	4	3	4
Total Marks	48	-	70	20	25	25

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

O) Suggested Assessment Table for Laboratory (Practical):

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

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

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

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

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

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

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

R) Suggested Learning Resources:**(a) Books:**

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

(b) Open Educational Resources:

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

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

(c) Others:

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

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

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

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

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

- CO-1** Compute the force to solve the problems
CO-2 Analyse various analytical and graphical conditions required for equilibrium of engineering systems.
CO-3 Apply the principles of friction in various conditions to solve problems.
CO-4 Calculate centroid, center of gravity and moment of Inertia of different geometrical shapes.
CO-5 Select the relevant lifting machine(s) for the given purposes.

- F) **Suggested Course Articulation Matrix (CAM):**

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

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

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

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2425104	Engineering Mechanics	03	-	04	02	09	06

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2425104	Engineering Mechanics	30	70	20	30	20	30	200

Legend:

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

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

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2425104

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

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

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Use force polygon table to determine the resultant of concurrent forces	1.	Determine resultant of concurrent coplanar force system using force polygon table.	CO1, CO2
<i>LSO 2.1</i> Apply Lami's theorem <i>LSO 2.2</i> Use simply supported beams to find reactions	2.	Determine unknown force in a concurrent balance force system using Lami's Theorem.	CO1, CO2
	3	Find reactions at the supports of a simply supported beam and compare the results with analytical values.	
	4	Determine the support reactions for simply supported beam by <ul style="list-style-type: none"> • Beam reaction apparatus • Circular dial type weight 	
<i>LSO 3.1.</i> Apply law of friction on horizontal plane and inclined plane	5	Determine coefficient of friction on horizontal and inclined plane.	CO2, CO3
<i>LSO 3.2.</i> Coefficient of friction between different materials	6	Determine the coefficient of friction between two surfaces by <ul style="list-style-type: none"> • angle of repose methods • friction plane method 	
<i>LSO 3.3.</i> Coefficient of friction between belt and pulley.	7	Find the coefficient of friction between belt and pulley in a belt friction set up.	
<i>LSO 4.1.</i> Determine the centroid of different geometrical figures.	8	Determine the centroid of geometrical plane figures (squares, rectangle, triangle)	CO4
<i>LSO 4.2.</i> Find moment of inertia	9	Determine the moment of inertia of a fly wheel	
<i>LSO 5.1</i> Use simple screw jack <i>LSO 5.2</i> Use differential axle and wheel <i>LSO 5.3</i> Use single and double purchase crab winch	10	Find M.A, V.R and efficiency of screw jack.	CO5
<i>LSO 5.4</i> Use jib crane <i>LSO 5.5</i> Use worm and worm wheel apparatus	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 <ul style="list-style-type: none"> Beam reaction apparatus Circular dial type weight 	CO1, CO2	30	60	10
5.	Determine coefficient of friction on horizontal and inclined plane.	CO2, CO3	40	50	10
6.	Determine the coefficient of friction between two surfaces by <ul style="list-style-type: none"> Angle of repose method Friction plane method 	CO2, CO3	40	50	10
7.	Find the coefficient of friction between belt and pulley in a belt friction set up.	CO2, CO3	30	60	10
8.	Determine the centroid of geometrical plane figures (squares, rectangle, triangle)	CO4	40	50	10
9.	Determine the moment of inertia of a fly wheel	CO4	40	50	10
10.	Find M.A, V.R and efficiency of screw jack.	CO2, CO5	30	60	10
11.	Find M.A, V.R and efficiency of differential wheel and axle	CO2, CO5	30	60	10
12.	Calculate the efficiency of single purchase crab winch and double purchase crab winch	CO2, CO5	30	60	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
13.	Determine forces in jib crane.	CO1, CO2	40	50	10
14.	Determine the efficiency of worm and worm wheel	CO2, CO5	40	50	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

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

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

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

S. No.	Name of Equipment and Tools	Broad Specifications	Exp. No.
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
10.	Friction apparatus for motion along horizontal and inclined plane	Base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees_ pan. Two weight boxes (each of 5 gm.10 cm, 2-20 gm. 2-50 gm, 2-100 gm, weight.	5,6
11	Set-up for belt friction apparatus	V and Flat Belt, Cap screw, Spring balance, Belt pulley, Torque cord, Load hanger x2, Weights	7

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

R) Suggested Learning Resources:

(a) Books:

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

(b) Online Educational Resources:

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

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

- A) **Course Code** : 2400105A(T2400105A/S2400105A)
 B) **Course Title** : Applied Mathematics- A (ME, ME (Auto), CE, MIE, AE, CHE, FTS, CRE)
 C) **Prerequisite Course(s)** : Basic Engineering Mathematics
 D) **Rationale** :

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

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

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

- CO-1** Demonstrate the ability to solve engineering-related problems based on applications of integration.
CO-2 Develop the ability to use differential equations as a tool to solve problems related to engineering.
CO-3 Select a suitable method to solve nonlinear equations based on engineering applications.
CO-4 Measure the area and volume of engineering-related problems using the concept of numerical integration.
CO-5 Develop the ability to use probability distribution to solve broad-based engineering-related problems.

- F) **Suggested Course Articulation Matrix (CAM):**

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

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

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

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400105A	Applied Mathematics- A	02	01	-	02	05	04

Legend:

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

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

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

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

SL: Self Learning, MOOCs, Spoken Tutorials, online educational resources, etc.

C: Credits= (1xCIhours) + (0.5xLIhours) + (0.5xNotionalhours)

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400105A	Applied Mathematics- A	30	70	20	30	-	-	150

Legend:

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

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

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2400105A

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Use standard forms of integration to find the integral of given simple functions.</p> <p><i>TSO 1b.</i> Apply suitable Trigonometric transformation to solve a given Integration problem.</p> <p><i>TSO 1c.</i> Solve given problems using the properties of the definite integral.</p> <p><i>TSO 1d.</i> Invoke the concept of Integration to solve problems based on area and volume of irregular shapes.</p>	<p>Unit-1.0 Integral Calculus and its Applications</p> <p>1.1 Concept and Definition of Integration.</p> <p>1.2 Working rules and Integral of standard Functions.</p> <p>1.3 Method of Substitution, Trigonometric transformation, Integration by parts, and Partial fraction.</p> <p>1.4 Applications: Area and volume</p>	CO1
<p><i>TSO 2a.</i> Find the order and degree of given differential equations.</p> <p><i>TSO 2b.</i> Solve differential equations using the variable separable method.</p> <p><i>TSO 2c.</i> Obtain the solution of a given homogeneous differential equation.</p> <p><i>TSO 2d.</i> Solve the given linear differential equation based on engineering application.</p> <p><i>TSO 2e.</i> Solve the given Bernoulli differential equation.</p> <p><i>TSO 2f.</i> Solve the homogeneous linear differential equations of second order with constant coefficient.</p>	<p>Unit-2.0 Differential Equations</p> <p>2.1 Concept and Definition, Order, and Degree of Differential Equation.</p> <p>2.2 Differential equation of first order and first degree, variable separable Method.</p> <p>2.3 Homogeneous, linear Differential equation and Bernoulli equation.</p> <p>2.4 Homogeneous linear differential equations of second order with constant coefficient.</p>	CO2
<p><i>TSO 3a.</i> Find the root(s) of the given equation using Iterative methods up to the desired accuracy.</p> <p><i>TSO 3b.</i> Calculate the root(s) of given equations using the Newton-Raphson Method.</p> <p><i>TSO 3c.</i> Apply the Newton-Raphson Method for engineering applications.</p> <p><i>TSO 3d.</i> Solve problems using the Bakhshali iterative method for finding approximate square roots. (IKS)</p>	<p>Unit-3.0 Numerical Solution of Nonlinear Equations</p> <p>3.1 Algebraic and Transcendental equations.</p> <p>3.2 Iteration Methods.</p> <p>3.3 Newton-Raphson Method.</p> <p>3.4 Bakhshali iterative method for finding the approximate square root. (IKS)</p>	CO3
<p><i>TSO 4a.</i> Apply the concept of Numerical integration to find the area from given data by the Trapezoidal rule, also use any open source software to find the same.</p> <p><i>TSO 4b.</i> Apply the concept of Numerical integration to find the area from given data by Simpson's one-third rule, also use any open source software to find the same by comparing the findings.</p> <p><i>TSO 4c.</i> Apply the concept of Numerical integration to find the area from given data by Simpson's three eighth rules, and compare the obtained result with the result found by the analytical method.</p>	<p>Unit-4.0 Numerical Integration</p> <p>4.1 Trapezoidal rule</p> <p>4.2 Simpson's one third rule</p> <p>4.3 Simpson's three eighth rule</p>	CO4
<p><i>TSO 5a.</i> Select discrete and continuous probability distribution for given data.</p>	<p>Unit-5.0 Probability distribution</p> <p>5.1 Discrete and continuous probability distribution.</p>	CO5

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 5b.</i> Solve given problems based on repeated trials using binomial distribution.</p> <p><i>TSO 5c.</i> Use suitable distribution to solve the given problems when the number of trials is large and the probability is very small.</p> <p><i>TSO 5d.</i> Utilize the concept of normal distribution to solve broad-based engineering-related problems.</p>	<p>5.2 Binomial distribution.</p> <p>5.3 Poisson's distribution.</p> <p>5.4 Normal distribution.</p>	

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

K) Suggested Tutorial and Outcomes:

Outcomes	S. No.	Tutorial Titles	Relevant COs Number(s)
<p>1.1 Calculate the area of the hexagon using integration.</p> <p>1.2 Calculate the average temperature of a city over a certain period.</p> <p>1.3 Calculate the total force on the bottom of the tank due to the water.</p> <p>1.4 Estimate the amount of force required to move a component.</p> <p>1.5 Apply the concept of definite integration to find the volume.</p>	1.	<ul style="list-style-type: none"> Area of irregular shape using integration. Average value of a function using integration. Calculation of force using integration. Volume of an irregular shape using integration. 	CO1
<p>1.1 Solve population dynamics using first-order ODEs.</p> <p>1.2 Calculate the vibration of a Mechanical system using differential equations.</p> <p>1.3 Calculate the concentration of a reactant in a chemical reaction over time.</p> <p>1.4 Calculate mechanical vibrations using second-order ODEs.</p>	2.	<ul style="list-style-type: none"> Analysis of a population model through differential equations. Response of vibration of Mechanical system through differential equations. Analysis of chemical system using ODEs Vibrations of a mass-spring system. 	CO2
<p>3.1 Use Newton's method to find the roots of a non-linear equation in one variable.</p> <p>3.2 Use the concept of Newton's method to solve financial modeling-related problems based on the Black-Scholes model.</p> <p>3.3 Calculate the electric field (that satisfies Maxwell's equations) around a wire with a given shape and current, using Newton Raphson's method.</p> <p>3.4 Use Bakhshali iterative methods for finding the approximate value of the square root. (IKS)</p>	3.	<ul style="list-style-type: none"> Applications of iterative techniques. Application of Newton Raphson's method. Iterative scheme using Newton's method. Bakhshali iterative methods for finding the approximate value of square root. (IKS) 	CO3
<p>1.1 Use Numerical integration to determine the total quantity of Heat of given a material.</p> <p>1.2 Use Simpson's 1/3rd rule to find the effective force on the mast of a racing sailboat.</p>	4.	<ul style="list-style-type: none"> Calculation of Heat (Chemical/Bio Engineering based problem). Calculation of effective force (Civil/Environment engineering). Calculation of work done (Mechanical/Aerospace engineering-based problems). 	CO4

Outcomes	S. No.	Tutorial Titles	Relevant COs Number(s)
1.3 Apply Numerical integration to calculate work done for a given engineering problem.			
5.1 Use Binomial distribution to solve the problems when the trials are repeated. 5.2 Use Poisson's distribution to solve the problems when the number of trials is large and the probability is minimal. 5.3 The birth weight follows the normal distribution curve, justified through an example.	5.	<ul style="list-style-type: none"> • Applications of Binomial distribution. • Applications of Poisson's distribution. • Applications of Normal distribution. 	CO5

L) Suggested Term Work and Self-Learning: S2400105A

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

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

b. Micro Projects:

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

11. Download 5-7 videos based on engineering applications of Binomial and Poisson's distribution, watch them, and write a report to detail the mathematical steps involved.
12. Make a short video of duration 10-15 minutes on at least 7-8 engineering applications of Normal distribution.

c. Other Activities:

1. Seminar Topics:

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

2. Visits: Visiting the following places would provide students an opportunity to see the application of various branches of mathematics in different fields. This will also help students to comprehend the career opportunities available in the field of mathematics.

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

3. Self-Learning Topics:

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

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

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

Legend:

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

** : Mentioned under point- (N)

: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Integral Calculus and its Applications	10	CO1	11	4	4	3
Unit-2.0 Differential Equation	12	CO2	16	4	6	6
Unit-3.0 Numerical Solution of Nonlinear Equations	8	CO3	10	3	4	3
Unit-4.0 Numerical integration	8	CO4	12	4	6	2
Unit-5.0 Probability distribution	10	CO5	21	5	8	8
Total	48	-	70	20	28	22

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

O) Suggested Assessment Table for Laboratory (Practical): (Not Applicable)

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

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

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

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Elementary Engineering Mathematics	B. S. Grewal	Khanna Publishers, 15th Edition. ISBN: 978-81-7409-257-1
2.	Engineering Mathematics (Third edition)	Croft, Anthony	Pearson Education, New Delhi, 2014. ISBN 978-81-317-2605-1
3.	Calculus and Its Applications	Marvin L. Bittinger David J. Ellenbogen Scott A. Sargent	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
4.	Calculus and Analytic Geometry	G. B. Thomas, R. L. Finney	Addison Wesley, 9th Edition, 1995. ISBN 978-8174906168
5.	Understanding Engineering Mathematics	John Bird	Routledge; First Edition ISBN 978-0415662840
6.	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publ., New Delhi, 2014, ISBN: 978-0-470-45836-5
7.	Studies in the History of Indian Mathematics	C. S. Seshadri	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
8.	Mathematics-I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
9.	Mathematics-II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3
10.	Consider Dimension and Replace Pi	M.P. Trivedi and P.Y. Trivedi	Notion Press; 1st edition (2018), ISBN: 978-1644291795

(b) Online Educational Resources:

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

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

(c) Others:

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

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

Mechanical Workshop is a basic practical engineering course. Knowledge of basic workshops such as wood working shops, fitting & machine shop, sheet metal shop, welding shop, black smithy and is essential for students to perform duties in industries and field agencies. This course will help the students to develop practical skills by performing various practical tasks using various hand tools, equipment and machinery in the respective shops, which will be useful in many fields like workshop, home and agriculture, construction etc. Job making in the workshop develops an attitude of teamwork and safety awareness. This course provides industrial environment in educational institutions.

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

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

- CO-1** Undertake wood working operations economically and safely.
CO-2 Carryout fitting and turning operations properly in a given situation.
CO-3 Perform various joining operations using welding, brazing, and soldering methods.
CO-4 Perform various sheet metal operations as per given sketch/ drawing.
CO-5 Undertake black smithy operations safely.

- F) **Suggested Course Articulation Matrix (CAM):**

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

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

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

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2425106	Mechanical Workshop	-	-	04	02	06	03

Legend:

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

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

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

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

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

C: Credits = (1xCIhours) + (0.5xLIhours) + (0.5xNotionalhours)

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2425106	Mechanical Workshop	-	-	20	30	20	30	100

Legend:

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

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

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Unit: (Not Applicable)

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: T2425106

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<p><i>LSO 1.1</i> Use relevant wood working tools and instruments as per given job.</p> <p><i>LSO 1.2</i> Undertake wood working operations like marking, cutting, planing and finishing etc.</p> <p><i>LSO 1.3</i> Prepare given wooden joints as per given sketch / drawing.</p>	1.	<p>1.1 Prepare one simple job of wood working comprises of marking, cutting, planing and finishing as per given drawing/sketch.</p> <p>1.2 Prepare any two wooden joints safely as per given drawing using suitable tools-</p> <ul style="list-style-type: none"> - Mortise joint - Dovetail joint - Half lap joint. - Cross joint - Tenon Joint - Bridle joint 	CO-1
<p><i>LSO 2.1</i> Prepare list of relevant tools, equipment, machines and measuring instruments used in fitting shop as per given situation.</p> <p><i>LSO 2.2</i> Perform marking, cutting, filing, punching, drilling, and finishing operations as per given fitting job safely.</p> <p><i>LSO 2.3</i> Select relevant single point cutting tool and associated parameters for a given turning job.</p> <p><i>LSO 2.4</i> Undertake turning operations economically and safely in a given situation</p>	2.	<p>2.1 Selection of different fitting tools, equipment, machines and measuring instruments in a given situation.</p> <p>2.2 Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at Centre) comprises of marking, filing, punching, drilling, and finishing as per given drawing/sketch.</p> <p>2.3 Prepare given step turning / taper turning job as per given sketch/ drawing.</p>	CO-2
<p><i>LSO 3.1</i> Select suitable joining process in a given situation.</p> <p><i>LSO 3.2</i> Use Personal Protective Equipment in welding shop.</p> <p><i>LSO 3.3</i> Perform gas welding operations in a given situation to prepare joint safely.</p> <p><i>LSO 3.4</i> Prepare given welding joint safely using arc welding in a given situation.</p> <p><i>LSO 3.5</i> Carryout soldering / brazing operation(s) as per given job.</p>	3.	<p>3.1 Prepare simple job of joining by using suitable joining process as per given sketch.</p> <p>3.2 Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely.</p> <p>3.3 Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely.</p> <p>3.4 Prepare simple job using soldering/ brazing operations as per given drawing.</p>	CO-3
<p><i>LSO 4.1</i> Select suitable sheet metal tools, machinery / equipment for given used as per requirements.</p> <p><i>LSO 4.2</i> Select suitable sheet metal operations in a given situation.</p> <p><i>LSO 4.3</i> Perform relevant sheet metal operations such as shearing, bending, drawing, squeezing, snipping, riveting, grooving etc.to</p>	4.	<p>4.1 Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing.</p> <p>4.2 Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm.</p> <p>4.3 Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.</p>	CO-4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
prepare utility jobs safely as given sketch/drawing.			
<p><i>LSO 5.1</i> Select suitable black smithy tools and operations to complete jobs as per requirements.</p> <p><i>LSO 5.2</i> Perform various operations safely to prepare given black smithy job(s).</p> <p><i>LSO 5.3</i> Follow safety procedures and use personal safety equipment during black smithy.</p>	5.	<p>5.1 Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations.</p> <p>5.2 Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop.</p> <p>5.3 Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor</p>	CO-5

L) **Suggested Term Work and Self Learning: S2425106** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

b. **Micro Projects:**

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

c. **Other Activities:**

1. **Seminar Topics:**

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

2. **Visits:**

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

3. **Self-learning topic:**

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

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

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

Legend:

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

** : Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Prepare one simple job of wood working comprises of marking, cutting, planing and finishing as per given drawing/sketch.	CO-1	50	40	10
2.	Prepare any two wooden joints safely as per given drawing using suitable tools- <ul style="list-style-type: none"> • Mortise joint • Dovetail joint • Half lap joint. • Cross joint • Tenon Joint • Bridle joint 	CO-1	40	50	10
3.	Selection of different fitting tools, equipment, machines and measuring instruments in given situation.	CO-2	60	30	10
4.	Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at center) comprises of marking, filing, punching, drilling and finishing as per given drawing/sketch.	CO-2	50	40	10
5.	Prepare given step turning / taper turning job as per given sketch/ drawing.	CO-2	30	60	10
6.	Prepare simple job of joining by using suitable joining process as per given sketch.	CO-3	60	30	10

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		Viva-Voce (%)
			Performance		
			PRA* (%)	PDA** (%)	
7.	Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely.	CO-3	40	50	10
8.	Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely.	CO-3	40	50	10
9.	Prepare simple job using soldering/ brazing operations as per given drawing.	CO-3	30	60	10
10.	Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing.	CO-4	50	40	10
11.	Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm.	CO-4	30	60	10
12.	Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.	CO-4	30	60	10
13.	Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations.	CO-5	60	30	10
14.	Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop.	CO-5	30	60	10
15.	Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor.	CO-5	30	60	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Lathe machine	Capacity Light Duty Heavy Duty Height of center 165 mm 254 mm Swing Over Bed 325 mm 490 mm Swing Over Cross Slide 175 mm 290 mm Movement of Cross Slide 225 mm 300 mm Swing in gap 500mm 800 mm With suitable motor drive with all accessories.	All
2.	Drilling machine	Up to 15 mm drill cap with 1 HP motor 1000mm height	1,2
3.	Wood working tools	Marking and measuring tools, saw, claw hammer, mallet, chisels, planers, squares	1,2
4.	vice	Carpentry vice 200 mm, bench vice 100mm, pipe vice 100 mm	1,2,3,4,5,6,7,8,9,10,11

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
5.	Work benches	Size 2000x1000x750 mm	1,2,3,4,5,6,7,8
6.	Fitting tools	Ball pen Hammers(500g), cross pean hammer, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set of suitable sizes	3,4,5
7.	Surface plate	600x900 mm grade I	All
8	Welding machine	20 KV, 400 A Welding current, welding cable 400 amp, with all accessories	6,7,8
9	Soldering and brazing equipment	Solder. Soldering iron (35 W) soldering wick, magnifying glass, wire cutters, brazing torch, aluminum brazing rod,	9
10	Gas welding and hand tools	Welding torch, welding tip, pressure regulator, oxygen and acetylene gas cylinder and cutting kit with cylinder and regulator, spark lighter	7,8
11	Arc welding and hand tools	Electrode holder, cable connector, chipping hammer, earthing clamp, wire brush.	6,7,8
12	Sheet bending and cutting machine	Mild steel automatic metal sheet bending machine (size 0.5 mm-20 mm X 1000 mm -6300 mm), compound saw (blade diameter 305 mm, power consumption 1520 W, 4000 RPM)	10,11,12
13	Sheet metal and hand tools	Snip, shears sheet gauge, straight edge, L/T square scribe, divider trammel, punches, pliers, stakes, groovers, limit set	10,11,12
14	Black smithy tools and equipment	Anvil (WEIGHT-167 lbs, horn-73/4", face length-10", rear-71/2"), hammer (double face sledge hammer 10 kg), scaling hammer, chipping hammer, tongs (500g ,flat nose size 15 inch) open hearth ,air blower (60 hp capacity 40000 m3/hr.), swage block (14X14X5 inch material iron)	13,14,15
15	Fire extinguisher	A, B, C type with capacity of 5 kg and 10 kg of CO ₂ type	All

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Workshop practice	R. K. Rajput	Laxmi Publications, New Delhi ISBN: 978-9380856650
2.	Workshop practice	Bawa,H.S	McGraw Hill Education, Noida ISBN:978-0070671195
3.	Engineering Workshop Practice	A.K. Sarathe	Khanna Book Publishing Co.(P) LTD. New Delhi ISBN:978-93-91505-51-6
3.	A textbook of workshop Technology.	R.S. Khurmi and J.K. GUPTA	S.Chand and Co. New Delhi ISBN:9788121908689
4.	Manufacturing Technology Volume-01	P.N. Rao	McGraw Hill Education, Noida ISBN-9789353160500

(b) Online Educational Resources:

1. **Wooden joints:** https://www.youtube.com/watch?v=-f7tTNRH_04
2. **Carpentry tools:** <https://www.youtube.com/watch?v=ZyN9Tw9VTSo>
3. **Fitting tools:** <https://www.youtube.com/watch?v=jbRgJbIGAwc>
4. **V -fitting:** https://www.youtube.com/watch?v=iDJ_sMvXsYs
5. **Square -fitting:** <https://www.youtube.com/watch?v=NHLpRgLGeEo>
6. **Lathe and its parts:** <https://www.youtube.com/watch?v=LtMJonWHKyU>
7. **Lathe operation:** <https://www.youtube.com/watch?v=hheFVuUBpxo&t=235s>
8. **Classification of welding joints:** https://www.youtube.com/watch?v=cQEUJnMYf_U
9. **Gas welding:** <https://www.youtube.com/watch?v=-SA4D098u-Q>
10. **Arc welding:** <https://youtu.be/5hRgwnejWPs>
11. **Soldering and brazing:** <https://www.youtube.com/watch?v=fnEFuzeM8cc>
12. **Sheet metal working:** <https://www.youtube.com/watch?v=KFdoAYvU4SI>
13. **Sheet metal working:** <https://www.youtube.com/watch?v=k8VskWhx0AY>
14. **Sheet metal work:** <https://www.youtube.com/watch?v=fNB1sunQ66g>
15. **Black smithy tools:** <https://www.youtube.com/watch?v=O3xyNWHxQN8>
16. **Black smithy operation:** <https://www.youtube.com/watch?v=uYvgBwP-1nY>

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

(c) Others:

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

- A) **Course Code** : **2400009(T2400009)**
 B) **Course Title** : **Open Educational Resources (OER)**
 (FTS, CHE, CSE, EE, ME, ME (Auto), MIE, ELX, AIML, CRE, CACDDM, AE, CE, ELX (R), GT)
 C) **Pre- requisite Course(s)** :
 D) **Rationale** :

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

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

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

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

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

- F) **Suggested Course Articulation Matrix (CAM):**

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

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

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

G) Teaching & Learning Scheme:

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

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

Legend:

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

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

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

Note:

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

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

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

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 1a.</i> Explain the difference between OER and other free educational materials.</p> <p><i>TSO 1b.</i> Describe the challenges and benefits of using OER in a class.</p> <p><i>TSO 1c.</i> Apply various aspects of evaluating OER before use</p> <p><i>TSO 1d.</i> Explain necessity to assess an OER's adaptability.</p> <p><i>TSO 1e.</i> Use preliminary search for open educational resource.</p> <p><i>TSO 1f.</i> Find OER using various resources.</p>	<p>Unit-1.0 Open Educational Resources</p> <p>1.1 OER - definition</p> <p>1.2 What is NOT OER.</p> <p>1.3 Benefits of using OER – Benefits to Students - Access to Quality Education</p> <p>1.4 OER - Benefits to Faculty - Use, Improve and Share, Network and collaborate with peers, Lower Cost, Improve access to information</p> <p>1.5 Challenges of Using OER – Subject Availability, Format and Material type availability, Time and Support availability</p> <p>1.6 Evaluating OER – a) Clarity, Comprehensibility, and Readability, b) Content and Technical Accuracy, c) Adaptability and Modularity, d) Appropriateness and Fit, e) Accessibility</p> <p>1.7 Finding Open Content - OER Search Scenario Filter by Usage Rights in Google, Repositories and Search Tools, Subject-specific Repositories</p>	CO1
<p><i>TSO 2a.</i> Explain benefits of copyright protection for creator</p> <p><i>TSO 2b.</i> Explain exceptions and limitations to copyright law</p> <p><i>TSO 2c.</i> List rights granted to copyright holders.</p> <p><i>TSO 2d.</i> Explain Exceptions and limitations to copyright law</p> <p><i>TSO 2e.</i> Explain Fair use/fair dealing apply to copyright</p> <p><i>TSO 2f.</i> Elaborate Public domain and how does it relate to copyright</p> <p><i>TSO 2g.</i> Elaborate penalties for copyright infringement.</p> <p><i>TSO 2h.</i> Explain copyright for digital content and the internet.</p> <p><i>TSO 2i.</i> Explain use of copyrighted works in education</p> <p><i>TSO 2j.</i> Explain the use of free licenses</p>	<p>Unit-2.0 Copyright and Open Licensing</p> <p>2.1 Copyright and what it does protect, benefits of copyright protection for creators, duration of copyright protection last, rights granted to copyright holders.</p> <p>2.2 Exceptions and limitations to copyright law, fair use/fair dealing apply to copyright</p> <p>2.3 Public domain and its relation to copyright.</p> <p>2.4 Penalties for copyright infringement</p> <p>2.5 Apply copyright to digital content and the internet</p> <p>2.6 Use of copyrighted works in education.</p> <p>2.7 Open Licenses – GNU – Free Documentation license, Free Art License</p> <p>2.8 Why Free Licenses – Retain, Reuse, Revise, Remix, Redistribute</p>	CO2
<p><i>TSO 3a.</i> Describe the four different Creative Commons License components.</p> <p><i>TSO 3b.</i> Explain the reason some CC-licensed content might not be considered OER.</p> <p><i>TSO 3c.</i> Explain the Strength and weakness of four Open CC Licenses</p> <p><i>TSO 3d.</i> Choose the right Creative Commons license for work.</p> <p><i>TSO 3e.</i> Apply a Creative Commons license to existing work.</p>	<p>Unit-3.0 Creative Common Licenses</p> <p>3.1 Alternatives to copyright as Creative Commons licenses.</p> <p>3.2 Four components of creative common Licenses – Attribution, Share- Alike, Non – commercial, No Derivatives</p> <p>3.3 Choosing a Creative common licenses – Wiley's 5 Rs and Creative Common Licenses</p> <p>3.4 Four Open CC Licenses and Their Strengths and Weaknesses – (a) CC BY (b) CC BY SA (c) CC BY NC (d) CC BY NC SA</p>	CO3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<p><i>TSO 3f.</i> Use of Creative Commons licenses for commercial purposes.</p> <p><i>TSO 3g.</i> Modify a work licensed under Creative Commons.</p> <p><i>TSO 3h.</i> Revoke a Creative Commons license, combine works with different Creative Commons licenses</p> <p><i>TSO 3i.</i> Differentiate between Attribution and Citation</p>	<p>3.5 Attribution Vs Citation - Creative Commons licensed work without giving attribution</p> <p>3.6 Apply a CC License - choose the right Creative Commons license for work, apply a Creative Commons license to existing work, Creative Commons licenses be used for commercial purposes, modify a work licensed under Creative Commons, revoke a Creative Commons license, combine works with different Creative Commons licenses</p>	

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

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

a. Assignments:

Related to Open Educational Resources – CO1

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

Related to Copyright – CO2

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

Related to Creative Common Licenses – CO3

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

b. Micro Projects:

1. Collect information on the impact of OER on cost savings and student engagement.
2. Search at least four OER related to topic of your Engineering Discipline over Internet. Evaluate the material based on the relevance, accuracy and usability.
3. Explore the different types of resources under creative Commons licenses (e.g., CC BY, CC BY-SA, CC BY-NC, etc.) and their specific permissions and restrictions.

4. Create a comparative analysis chart or infographic that visually represents the key characteristics of each license.
5. Select minimum 5 real-world examples from different domains (such as music, art, literature, or education) where creators have used Creative Commons licenses.

c. Other Activities:

1. Seminar Topics:

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

2. Self-Learning Topics:

- Open Licensing and Copyright: Understanding the Legal Framework for OER
- Creative Commons and the future of Copyright
- Copyright and Open Access Publishing
- Copyright and Software

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

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

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

M) Suggested Learning Resources:

(a) Books:

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

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

(b) Online Educational Resources:

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

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