

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 – III

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				
2447301	PCC	Mine Transportation	03	-	04	02	09	06
2447302	PCC	Applied Geology	03	-	04	02	09	06
2447303	PCC	Mine Surveying-I	03	-	04	02	09	06
2447304	PCC	Mine Ventilation	03	-	04	02	09	06
2447305	PSI	Summer Internship – I (After 2 nd Sem) (Common for all programmes)	-	-	02	02	04	02
2400107	NRC	Professional Ethics (CE, CSE, ELX, ELX (R), FTS, ME, AIML, MIE, CHE, CRE, FPP, GT, EE, AE, CACDDM)	01	-	-	-	01	01
2400207	NRC	Indian Constitution (Common for All Programmes)	01	-	-	-	01	01
2400108	NRC	Essence of Indian Knowledge System and Tradition (Common for All Programmes)	01	-	-	-	01	01
2400208	NRC	Sports, Yoga and Meditation (Common for All Programmes)	-	-	01	01	02	01
Total			15	-	19	11	45	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 - III 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)	
2447301	PCC	Mine Transportation	30	70	20	30	20	30	200
2447302	PCC	Applied Geology	30	70	20	30	20	30	200
2447303	PCC	Mine Surveying-I	30	70	20	30	20	30	200
2447304	PCC	Mine Ventilation	30	70	20	30	20	30	200
2447305	PSI	Summer Internship – I (After 2 nd Sem) (Common for all programmes)	-	-	10	15	10	15	50
2400107	NRC	Professional Ethics (CE, CSE, ELX, ELX (R), FTS, ME, AIML, MIE, CHE, CRE, FPP, GT, EE, AE, CACDDM)	25	-	-	-	-	-	25
2400207	NRC	Indian Constitution (Common for All Programmes)	25	-	25	-	-	-	50
2400108	NRC	Essence of Indian Knowledge System and Tradition (Common for All Programmes)	25	-	-	-	-	-	25
2400208	NRC	Sports, Yoga and Meditation (Common for All Programmes)	-	-	25	-	10	15	50
Total			195	280	140	135	100	150	1000

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

Legend:

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

Note:

- ETA & ELA are to be carried out at the end of the term/ semester.
- Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, and 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** : 2447301(T2447301/P2447301/S2447301)
 B) **Course Title** : Mine Transportation
 C) **Pre- requisite Course(s)** :
 D) **Rationale** :

Mine transportation involves moving bulk of minerals using different transportation sources such as rope haulage, conveyors and ropeways. Selection of transportation mechanism depends upon various factors such as minerals to be hauled, terrain, distance and economic value of the mineral. Therefore, it requires systematic planning, scientific approach and safety measures for taking such decisions. The purpose of Mine Transportation course is to provide an understanding of the different types of transport systems from the origin of minerals to the beneficiation plant or processing unit along with their preventive maintenance.

- 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 knowledge of mine machinery for installation and maintenance of rope haulage in mines.
CO-2 Apply knowledge of belt conveyors in mines for the purpose of installation, problem solving and maintenance.
CO-3 Use the principles and operation of chain conveyor to transport bulk material in mines.
CO-4 Choose the appropriate method of Aerial Ropeways for Bulk Material Transport in mines.
CO-5 Maintain the underground mine locomotives efficiently following safe practices.

F) Suggested Course Articulation Matrix (CAM):

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

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				
2447301	Mine Transportation	03	-	04	02	09	06

Legend:

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

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

H) Assessment Scheme:

Course Codes	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)	
2447301	Mine Transportation	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: Terminal & Self Learning Assessment (include 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, and 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: T2447301

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number (s)
<i>TSO 1a.</i> Explain scope and limitation of rope haulage. <i>TSO 1b.</i> Classify the different rope haulage system used in mines. <i>TSO 1c.</i> List the safety devices used in rope haulage. <i>TSO 1d.</i> Write statutory provisions regarding rope haulage using in mines.	Unit 1.0 Rope Haulage 1.1 Scope and application of rope haulage 1.2 Classification of rope haulage- 1.2.1 Direct rope haulage. 1.2.2 Endless rope haulage-Driving pulley and Rope clip, 1.2.3 Gravity rope haulage 1.2.4 Main and tail rope haulage. 1.3 Safety devices used in rope haulage system 1.4 Statutory provision regarding rope haulage.	CO-1
<i>TSO 2a.</i> Describe selection criteria of belt conveyor. <i>TSO 2b.</i> Explain construction, installation and maintenance of belt conveyor. <i>TSO 2c.</i> List the safety devices used in belt conveyor. <i>TSO 2d.</i> Write advantages and disadvantages of belt conveyor. <i>TSO 2e.</i> Solve the numerical problem based on carrying capacity of belt conveyor.	Unit2.0 Belt Conveyor 2.1 Selection of belt conveyor. 2.2 Belt conveyor-types, construction, installation, handling and maintenance, 2.3 Belt conveyor Tensioning devices and holdback 2.4 Carrying capacity of conveyor. 2.5 Merits and demerits of using belt conveyor in mines. 2.5 Numerical calculation	CO-2
<i>TSO 3a.</i> Write different types of chain conveyors. <i>TSO 3b.</i> Explain construction, installation, operation and maintenance of chain conveyor. <i>TSO 3c.</i> List the sequences of operations to be performed for shifting the chain conveyor. <i>TSO 3d.</i> Compare the chain conveyor and belt conveyor.	Unit3.0 Chain Conveyor 3.1 Types of chain conveyors. 3.2 Construction, installation, operation and maintenance 3.3 Shifting of chain conveyor, 3.4 Merits and demerits of chain conveyor. 3.5 Comparison between belt and chain conveyor.	CO-3
<i>TSO 4a.</i> Write the favorable condition of aerial ropeway. <i>TSO 4b.</i> Select the aerial ropeway at given condition. <i>TSO 4c.</i> Draw a sketch of aerial ropeway. <i>TSO 4d.</i> Describe construction, installation and maintenance of aerial ropeway. <i>TSO 4e.</i> Calculate the bucket capacity and output of aerial ropeway at given data.	Unit 4.0 Aerial Ropeway 4.1 Various conditions for use of aerial ropeway. 4.2 Different Types of aerial ropeways used in mines along with their safety features. 4.3 Construction, installation and maintenance of Mono and Bi-cable ropeway. 4.4 Bucket Capacity and Output of Aerial Ropeways.	CO-4
<i>TSO 5a.</i> Classify the different types of locomotive used in underground mines. <i>TSO 5b.</i> Select the man riding system at given condition. <i>TSO 5c.</i> Describe the constructional feature of LHD and SDL. <i>TSO 5d.</i> List the safety devices used in shuttle car. <i>TSO 5e.</i> Describe safe practices for underground mine locomotives	Unit 5.0 Underground Mine Locomotives and Others 5.1 Types of locomotive 5.1.1 Battery locomotive 5.1.2 Diesel locomotive 5.1.3 Electric locomotive 5.1.4 Compressed air locomotive 5.2 Man riding system 5.3 Application, Construction and maintenance of SDL, LHD and Shuttle car. 5.4 Maintenance process of underground mine locomotives	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: P2447301

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO1.1.</i> Write the safety devices used in rope haulage system. <i>LSO1.2.</i> Apply the statutory provisions in direct rope haulage track.	1.	Draw the layout of direct rope haulage system in a given situation.	CO-1
<i>LSO2.1.</i> Enlist the parts of endless rope haulage system. <i>LSO2.2</i> Use the various symbol of mine features in layout.	2.	Draw the layout of endless rope haulage system (with its tensioning device) in a given situation.	CO-1
<i>LSO3.1</i> Use the different types of ply and cover to make belt.	3.	Draw cross sections of various types of belts used in belt conveyors in mines.	CO-2
<i>LSO4.1</i> Write the different parts of loop take up arrangement of belt conveyor. <i>LSO4.2</i> Apply the safety precaution during belt take up arrangement.	4.	Draw loop take up arrangement used in belt conveyors.	CO-2
<i>LSO5.1</i> Use the safety devices attached in chain conveyor.	5.	Draw the layout of chain conveyor used in mines.	CO-3
<i>LSO6.1.</i> Apply the basic principles of chain conveyor. <i>LSO6.2.</i> Schedule the maintenance hour of chain conveyor	6.	Elaborate the construction, operation and maintenance of different types of chain conveyors	CO-3
<i>LSO7.1</i> Explain the working principle of mono- cable aerial ropeway. <i>LSO7.2</i> Write the applicable condition of mono- cable aerial ropeway.	7.	Sketch and describe construction, installation and use of mono-cable aerial ropeway.	CO-4
<i>LSO8.1</i> Use of bi-cable ropeway under condition. <i>LSO8.2</i> Enlist the parts of bi-cable aerial ropeway.	8.	Sketch and describe construction, installation and use of bi-cable aerial ropeway	CO-4
<i>LSO9.1</i> Explain the constructional and working mechanism of SDL. <i>LSO9.2</i> Enlist the safety devices attached in SDL.	9.	Sketch and Describe the construction and working of SDL.	CO-5
<i>LSO10.1</i> Write the different parts of LHD and its uses. <i>LSO10.2</i> Implement statutory provisions regarding use of LHD in underground coal mines.	10.	Sketch and Describe the construction and working of LHD.	CO-5
<i>LSO11.1</i> Apply the basic principle of exhaust conditioner box.	11.	Sketch and Describe the construction and working of exhaust conditioner box.	CO-5

L) Suggested Term Work and Self Learning: S2447301 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. Construct a model of given type of rope haulage showing safety devices.

2. Analyse the data with reference to efficiency of belt conveyor in comparison to other mode of transportation.
3. Prepare a working model of chain conveyor.
4. Prepare a model of SDL and LHD.
5. Draw a layout of belt conveyor showing safety features, driving and return drum, belt tensioning arrangement and supporting frame.

c. Other Activities:-

i. Seminar Topics:

- Different types of safety devices used in endless rope haulage.
- Construction, operation and maintenance of belt conveyor.
- Application of aerial ropeway in mining industry.
- Different types of chain conveyor used in mines.
- Constructional feature, operation and, maintenance of SDL and LHD machine used in underground coal mines.

ii. Visits:

1. Visit nearby mine having a rope haulage transportation system. Observe and list safety devices fitted therein.
2. Visit nearby mines and prepare the list of different types of transportation system used in mines and compare them on given parameters.

iii. Self-Learning Topics:

- Illustrate different types of layout of rope haulages used in mines.
- Enlist preventive maintenance of different types of haulages.
- Enlist preventive maintenance of belt conveyors.
- Enlist preventive maintenance of chain conveyors.
- Calculate quantity of mineral to be transported based on given parameters.
- Illustrate different types of layout of aerial ropeways used in 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	25%	30%	20%	20%	20%	20%	20%
CO-2	20%	30%	20%	30%	20%	10%	20%
CO-3	20%	15%	20%	20%	20%	15%	20%
CO-4	15%	15%	20%	-	20%	20%	20%
CO-5	20%	10%	20%	30%	30%	35%	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 Rope Haulage	10	CO-1	20	5	6	9
Unit-2.0 Belt Conveyor	10	CO-2	20	4	7	9
Unit-3.0 Chain Conveyor	10	CO-3	11	4	3	4
Unit-4.0 Aerial Ropeway	08	CO-4	11	4	3	4
Unit-5.0 Underground Mine Locomotive and others	10	CO-5	8	3	2	3
Total	48	-	70	20	20	30

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.	Draw the layout of direct rope haulage system in a given situation.	CO-1	30	60	10
2.	Draw the layout of endless rope haulage system (with its tensioning device) in a given situation.	CO-1	40	50	10
3.	Draw cross sections of various types of belts used in belt conveyors in mines.	CO-2	30	60	10
4.	Draw loop take up arrangement used in belt conveyors.	CO-2	30	60	10
5.	Draw the layout of chain conveyor used in mines.	CO-3	30	60	10
6.	Elaborate the construction, operation and maintenance of different types of chain conveyors	CO-3	40	50	10
7.	Sketch and describe construction, installation and use of mono-cable aerial ropeway.	CO-4	40	50	10
8.	Sketch and describe construction, installation and use of bi-cable aerial ropeway	CO-4	40	50	10
9.	Sketch and Describe the construction and working of SDL.	CO-5	40	50	10
10.	Sketch and Describe the construction and working of LHD.	CO-5	40	50	10
11.	Sketch and Describe the construction and working of exhaust conditioner box.	CO-5	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.	Direct rope haulage	Model shown the layout of inclined road, branch track, safety devices i.e. stop block, runway switch, back stay and buffer. Set of tubs, haulage rope etc. Approx. Size 2m x 52cm x 73cm height.	01
2.	Endless rope haulage system	Model shown the level haulage road in a coal gallery, two tracks, Clifton pulley, guide and return pulley, man hole etc. Size- 2.4m x 52cm x height 60cm.	02
3.	Gate belt conveyor with loop take up arrangement	Working model shown are- the delivery jib with chute, driving drum, loop take up arrangement. Approx size- 2m x 35cm x height 25cm	04
4.	Mono-cable aerial ropeway	Working model shown- ropeway bucket, driving and return sheave, ladder fitted on trestle etc. Approx. size- 2.44m x 0.5m x height 43cm	07
5.	SDL	Working model	10
6.	LHD	Working model	11

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Elements of Mining Technology Vol 3	D.J. Deshmukh	Denett & Co, 19th edition 2016
2.	Mine pumps and haulages	S.Ghatak	Lovely prakashan, 3 rd edition 1996
3.	Mine Transport	Karline	
4.	Underground mining methods: Engineering fundamentals and international case studies.	William A Hustrulid And Richard R Bullock	SME Publication, may 2001
5.	SME Mining Reference Handbook	Raymond L Lowrie	SME Publication, December 2002
6.	Mining Equipment and System: Theory and Practice of Exploitation and Reliability	Jacek M Czaplicki	CRC Press, December 2009
7.	Extracting the Science: A Century of Mining Research	Jurgen F Brune	SME Publication, 2010

(b) Online Educational Resources:

1. <https://www.miningpapa.com/2020/06/direct-rope-haulage-definition-safety-devices-diagram-pdf.html>
2. <https://www.miningpapa.com/2020/03/main-and-tail-haulage-system.html>
3. <https://www.slideshare.net/alym96/conveyors-and-types>
4. <https://www.slideshare.net/yitagesu21/chain-conveyors>
5. <https://www.youtube.com/watch?v=YaO7ppfdAvw>
6. <https://www.youtube.com/watch?v=YvU0b1a6GFg>
7. <https://www.youtube.com/watch?v=ZyjlQsW-wZY>
8. <https://mineportal.in/assets/uploads/user-notes/df4684fd22721f7396ace865dbf2bf3f/file-166550869228278.pdf>

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

(c) Others:

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

- A) **Course Code** : 2447302(T2447302/P2447302/S2447302)
- B) **Course Title** : Applied Geology
- C) **Pre- requisite Course(s)** :
- D) **Rationale** :

The diploma holders in mining engineering will be responsible to execute mining operation as per mining plan of the area in varying geological conditions to achieve optimum output. To carrying out mining in structurally complex area, paleontological horizon, varied hydro geological conditions etc. Ultimately from geological formation which are economically rich with varied characters. This subject provides him basic elementary knowledge of essential physical geology aspects, mineralogy, petrology, structural geology conditions and as well as broad picture of earth as a planet and its origin hypothesis and interior structures.

- 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 knowledge of applied geology with reference to given context.
- CO-2** Solve simple engineering problems related to physical geology in mining field.
- CO-3** Identify and diagnosis physical properties of common rock forming minerals.
- CO-4** Identify textures, structures, symmetry and forms of different rocks.
- CO-5** Solve simple map problem using strike and dip and preparation of cross sections.

- 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	3	3	1	2	1	-	3		
CO-2	2	3	-	2	-	-	3		
CO-3	3	2	-	2	2	1	3		
CO-4	3	2	1	3	2	-	3		
CO-5	3	3	-	3	-	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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Legend:

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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 Codes	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)	
2447302	Applied Geology	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: Terminal & Self Learning Assessment (include 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, and 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: T2447302

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<i>TSO 1a.</i> Define different branches of geology. <i>TSO 1b.</i> Describe internal structure and composition of the earth. <i>TSO 1c.</i> Describe different hypothesis related to origin of earth. <i>TSO 1d.</i> Determine the age of earth on the basis of various hypothesis. <i>TSO 1e.</i> Explain the relation of diastrophic movements with plate tectonics.	Unit 1.0 Introduction 1.1 Science of geology-Branches of geology, Scope of geology 1.2 Solar system 1.3 Origin of earth-Different hypothesis 1.4 Age of earth-Methods of determination of age 1.5 Interior of the earth-Crust, Mantle and core 1.6 Evidence for gondwana land and laurasia 1.7 Position of India. 1.8 Plate tectonics-Crustal plates, Plate boundaries and plate margins	CO-1
<i>TSO 2a.</i> Understand the scope and application of physical geology. <i>TSO 2b.</i> Analyze the erosion effect due to wind and rivers. <i>TSO 2c.</i> Understand the occurrence and movement of ground water. <i>TSO 2d.</i> Explain the environmental effects of geological weathering, post earthquake and post volcanoes. <i>TSO 2e.</i> Measure the intensity of earthquake by seismograph. <i>TSO 2f.</i> Write the different types of volcano.	Unit2.0 Physical Geology 2.1 Geological weathering- Physical and chemical weathering, Rate of weathering. 2.2 Work of wind –Erosion, transport and deposition pedestal rocks, Sand dunes and loess. 2.3 Work of rivers: erosion transport and deposition, Features of stream erosion. 2.4 Ground water- Occurrence of ground water. 2.5 Earthquake-Terminology, Seismograph, Waves, Classification, Origin and Intensity scale. 2.6 Volcanoes- Types, Product, Eruptions, Distribution and Volcanic activity.	CO-2
<i>TSO 3a.</i> Explain the physical, chemical and optical characteristics of rock forming mineral. <i>TSO 3b.</i> Identify the minerals on the basis of given mineral properties. <i>TSO 3c.</i> Use the geniometer for angle measurement of hand specimen. <i>TSO 3d.</i> Measure specific gravity of given mineral sample by using walkers steel yard instrument.	Unit3.0 Mineralogy 3.1 Definition 3.2 Diagnostic physical properties of minerals – crystal form, Colour, Streak, Luster, hardness, Cleavage, Fracture. Chemical composition and other properties (Habit) 3.3 Identification of common minerals- Orthoclase feldspar Plagioclase feldspar, Augite, fluorite, graphite Hornblende, Biotite, Galena, Muscovite, Olivine, Quartz, Asbestos, Calcite, Dolomite, Corundum, Gypsum, Talc etc. 3.4 Uses of mineral identification instrument like Geniometer, Polarising microscope for optical properties, Streak plate, Knife, Glass plate, Magnifying glass, Mohs scale, Walkers Steel Yard, and Jollys Spring Balance.	CO-3
<i>TSO 4a.</i> Describe the origin, distribution, classification, textures and occurrences of igneous, sedimentary and metamorphic rocks. <i>TSO 4b.</i> Describe sedimentary structure, texture and sedimentary processes. <i>TSO 4c.</i> Describe the various forms of igneous rocks and gives the classification. <i>TSO 4d.</i> Understand the effects of high temperature and pressure transforming affected rocks in to metamorphic rocks.	Unit 4.0 Petrology 4.1 Rocks and Classification of Rocks 4.2 Igneous rocks-Chemical composition, Occurrence, Textures, Structures, Forms and origin of igneous rocks 4.3 Petrological properties of common Igneous rocks – Granite, Syenite, Gabbro, Basalt, Trachyte and Rhyolite. 4.4 Sedimentary rocks - Definition, Classification, Formation, Texture, Sedimentary structures,	CO-4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	(Stratification, Lamination, graded bedding. Current bedding and ripple marks) 4.5 Common Sedimentary rocks- Conglomerate Sandstone, Shale, lime stone, clay and Laterite. 4.6 Metamorphic rock – Definition, Agents, Process of metamorphism and its types. Texture and Structure of Metamorphic rocks– Slaty, Schistose, Gneissose and Granulose. 4.7 Common Metamorphic rocks – Slate, Schist, Gneiss, Quartzite and Marble.	
<i>TSO 5a.</i> Define dip and strike. <i>TSO 5b.</i> Identify folds in the fields and in the geological maps. <i>TSO 5c.</i> Identify the different type of fault on the basis of throw of hanging wall, foot wall and angle of fault plan <i>TSO 5d.</i> Write the different types of unconformities. <i>TSO 5e.</i> Describe morphometry of joints and classify its geometric and genetic.	Unit 5.0 Structural Geology 5.1 Dip and Strike, Apparent dip and True dip. 5.2 Numerical problems on Dip and strike 5.3 Folds- definition, Elements of fold, types of fold, Identification of fold in map and field. 5.4 Fault – definition, Fault Terminology, elements of fault. Classification and type of faults. Identification of fault in map and field. 5.5 Unconformities- definition, Types. Identification of Unconformity in map and field. 5.6 Joints- Classification- Strike joints, Dip joints, Oblique joints, Bedding joints, Mural Joints, Sheet Joints and columnar joints	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: P2447302

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Identify a given geomorphological models. <i>LSO 1.2.</i> Explain the volcano and earthquake.	1.	Sketch and identify different types of geomorphological models such as volcanoes, earthquake etc.	CO-2
<i>LSO 2.1.</i> Use and operate seismograph to measure magnitude of earthquake. <i>LSO 2.2.</i> Determined the magnitude of earthquake by a seismograph.	2.	Measure the intensity of earthquake by seismograph.	CO-2
<i>LSO 3.1.</i> Operate jollys spring balance instrument to determine specific gravity of given hand specimen.	3.	Determine the specific gravity of given hand specimen sample by using jollys spring balance instrument.	CO-3
<i>LSO 4.1.</i> Identify hand-specimen mineral on the basis of its physical property. <i>LSO 4.2.</i> Write impotence and uses of given hand specimen.	4.	Study and identification of important economic minerals in hand-specimen.	CO-3
<i>LSO 5.1.</i> Identify given rock sample and describe its physical properties.	5.	Identify the sedimentary, igneous and metamorphic rock with texture and structure.	CO-4
<i>LSO 6.1.</i> Use of clinometers to measure amount and direction of dip and strike.	6.	Measure the amount and direction of dip and strike of structural model with the help of clinometers compass.	CO-4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 7.1.</i> Select appropriate instrument to measure amount and angle of throw of fault.	7.	Calculate throw and its angle of throw of given data.	CO-5
<i>LSO 8.1.</i> Identify and use geological map to determine dip and strike. <i>LSO 8.2.</i> Identify the structural symbol used in geological map.	8.	Drawing of cross sections determination of dip strike from geological maps.	CO-5

L) Suggested Term Work and Self Learning: S2447302 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. Prepare a model to shown interior structure of the earth.
2. Construct a model of solar system.
3. Prepare a model of volcano to shown its eruption and distribution.
4. Prepare a brief report on mode of formation of minerals.
5. Draw sketches of sedimentation process of formation of sedimentary rock.
6. Draw a sketch to shown different geological abnormalities found in Indian coalfields.

c. Other Activities:

d. Seminar Topics:

- Different methodological concept for determination of earth age.
- Different layer of strata beneath earth surface and its configurations.
- Volcanic activity, types of volcanoes and volcanic products.
- Physical properties of common rock forming mineral found in India.
- Occurrence, chemical composition, textures, structures and forms of sedimentary, metamorphic and igneous rock.
- Geological abnormalities found on Indian coal field.

1. Visits: i. Visit a nearby mine to identify fault, fold, unconformities, joint and bedding planes, and Prepare a project report on it.

ii Visit a nearby location with exposed geological features and take photograph and Write brief details on it.

2. Self-Learning Topics:

- To watch videos on solar system.
- To visit different scientific research site to know interior structure and composition of earth.
- Study on uniparental and biparental hypotheses on origin of earth.
- Collect the data of post flood activity, desert, volcano and earthquake related to mankind.
- Study the effect of erosion due to river and wind on mining fields.
- Collect various mineral samples from the surrounding and identify them.
- Study the various physical properties of rock forming minerals of nearby mines.
- Classify the igneous metamorphic and sedimentary rocks on the basis of chemical composition, crystallization, origin and texture.
- Study the geological abnormalities found in nearby 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	20%	22%	20%	25%	20%	-	-
CO-2	20%	22%	20%	20%	20%	25%	25%
CO-3	20%	22%	20%	15%	20%	25%	25%
CO-4	20%	22%	20%	20%	20%	25%	25%
CO-5	20%	12%	20%	20%	20%	25%	25%
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 Introduction	10	CO1	15	5	3	7
Unit-2.0 Physical Geology	10	CO2	15	5	6	4
Unit-3.0 Mineralogy	10	CO3	15	3	4	8
Unit-4.0 Petrology	08	CO4	15	4	5	6
Unit-5.0 Structural Geology	10	CO5	10	3	4	3
Total	48	-	70	20	22	28

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA* (%)	
1.	Sketch and identify different types of geomorphological models such as volcanoes earthquake etc.	CO-2	30	60	10
2.	Measure the intensity of earthquake by seismograph.	CO-2	30	60	10
3.	Determine the specific gravity of given hand specimen sample by using jollys spring balance instrument.	CO-3	30	60	10
4.	Study and identification of important economic minerals in hand-specimen.	CO-3	30	60	10
5.	Identify the sedimentary, igneous and metamorphic rock with texture and structure.	CO-4	30	60	10
6.	Measure the amount and direction of dip and strike of structural model with the help of clinometers compass.	CO-4	30	60	10
7.	Calculate throw and its angle of throw of given data.	CO-5	30	60	10
8.	Drawing of cross sections determination of dip strike from geological maps.	CO-5	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.	Seismograph	Measure magnitude upto 10.	02
2.	Jollys spring balance instrument	Mineral hand specimen.	03
3.	Rock sample (hand specimen)	Sedimentary rock- Conglomerate Sandstone, Shale, lime stone, clay and Laterite. Metamorphic rock- Slate, Schist, Gneiss, Quartzite and Marble. Igneous rock- Granite, Syenite, Gabbro, Basalt, Trachyte and Rhyolite etc.	04, 05, 06
4.	Clinometers compass	Dimension-5.5x5.5x3 inch weight-8lbs SPECS-	06-07

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
		dimensions: 2.5 x 3.5 x 0.5" 76.3 x 8.8 x 1.3cm weight: 11.8oz 335.6g graduations: 1° for 3 scales Allows for 3 different scales of angular measurement above and below horizontal: Left: Slope in Degrees, 0-90° Middle: 66' Forestry Chain, 0-200' Right: Slope Percent Grade, 0-150% Side view of slope degree and percent grade also. Offers up to 10x magnification with an adjustable lens. LED option provides enhanced readability in low light conditions. Or equivalent instruments	
5.	Geological maps (3D map of Fault)	Showing-Normal fault, reverse fault and strike slip fault	07,08

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Principles of Engineering Geology	K. M. Bangar	Standard Publishers Disribuers, dec 2020
2.	A Testbook of Geology	P.K. Mukerjee	World Press Pv. Ltd.
3.	Engineering And General Geology	Prabin Singh	S.K. Kataria & Sons
4.	A Test book of Geology	G.B. Mahapatra	CBS Jan 2019
5.	Courses in Mining Geology	RNP arogyaswami	Oxford & IBH Publishing Co Pvt.Ltd
6.	Mining Geology	D.N. Verma	Centrum Press jan 2012 978-9350843888

(b) Online Educational Resources:

1. <https://www.slideshare.net/sihellyay/the-planet-earth-60116984>
2. https://www.youtube.com/watch?v=NLsvisowEdc&list=PLRFsXLaFH0Z-oV__8s4PKtnQTan_ZYymH
3. <https://www.slideshare.net/shuvosaha1612/volcanoes-and-earthquakes-education-powerpoint>
4. <https://www.youtube.com/watch?v=PU4mCkmaUCI>
5. https://www.youtube.com/watch?v=fiMemypKqEI&list=PLHyuArGIIyyR_2mObwQ3yng18LDnDqidp
6. https://www.youtube.com/watch?v=YyyJz6zeUsg&list=PLEUy9VmCy0OYIWBLhuN_nm8-39d_VWYjP

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	: 2447303(T2447303/P2447303/S2447303)
B)	Course Title	: Mine Surveying -I
C)	Pre- requisite Course(s)	:
D)	Rationale	:

To carry out survey of open cast as well as underground mine area so as to achieve efficient planning and survey for development of mining area and proper development of the mine. The course provides elementary knowledge of surveying as chain survey, compass survey, level survey and area and volume calculation with reference to mining and mine surveying. For the development of insight about mine surveying, the course teacher will demonstrate different types of surveying using tools/equipment relevant to each survey and survey plan.

- 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 principle of surveying for conducting a survey work at site.
CO-2 Perform site survey using chain/ tape & prepare a site plan.
CO-3 Carryout compass surveying at given site using relevant equipment.
CO-4 Perform different types of leveling activities at site.
CO-5 Measure area and volume using different methods and determine area by planimeter.

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

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				
2447303	Mine Surveying-I	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= (1x CI hours) + (0.5x LI hours) + (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)	
2447303	Mine Surveying -I	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: Terminal & Self Learning Assessment (include 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, and 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: T2447303

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<i>TSO 1a.</i> Classify survey on basis of instrument used. <i>TSO 1b.</i> Write principles of surveying. <i>TSO 1c.</i> Measure the given distance by direct method.	Unit 1.0 Introduction 1.1 Definition and Objects of surveying 1.2 Classification of survey and Principle of surveying 1.3 Use of surveying in engineering and Methods of locating a point. 1.4 Scales and Representative fraction and Linear measurement and Angular measurements 1.5 Measurement of distances -Direct method and Computation method. 1.6 Sources of errors and kinds of errors	CO-1
<i>TSO 2a.</i> Draw a sketch of a given type of chain/tape showing its constructional detail of a given chain/tape. <i>TSO 2b.</i> List various instruments used in chain surveying. <i>TSO 2c.</i> Observe the effect of error due to damage of chain and tape. <i>TSO 2d.</i> List different types of tape used in surveying. <i>TSO 2e.</i> List the errors occur in chain surveying.	Unit 2.0 Chain Surveying 2.1 Purpose and principle of chain surveying. 2.2 Equipment used in chain surveying- chain (meter chain, engineer's chain, gunter's chain, revenue chain), tape (linen, metallic, fibre glass, steel, invar, steel band), ranging rods, offset rod, pegs, arrow, cross staff, optical square. 2.3 Different operations in chain surveying- Direct and indirect ranging, chaining on flat and sloping ground, perpendicular and oblique offsetting. 2.4 Plotting the survey work. Booking results in field book using conventional sign and plotting common obstacles in chain surveying. Chaining through obstacles. 2.5 Obstacles and errors in chain surveying. 2.6 Corrections, test, and adjustment of chain. 2.7 To calculate correct dimension with a defective chain/tape - correction for change in temperature, sag, etc.	CO-2
<i>TSO 3a.</i> Describe the constructional features of compass. <i>TSO 3b.</i> Measure bearings of given lines and compute included angle and check the result. <i>TSO 3c.</i> Traverse an area with surveyor/prismatic compass by given method. <i>TSO 3d.</i> Define meridian and bearings. <i>TSO 3e.</i> Calculate the included angle from given bearing data. <i>TSO 3f.</i> List the precautionary measure to conduct chain surveying. <i>TSO 3g.</i> Perform compass surveying at a site. <i>TSO 3h.</i> Write temporary and permanent adjustment procedure of plane table.	Unit 3.0 Compass Surveying 3.1 Purpose of compass surveying. 3.2 Construction of surveyors and prismatic compass. 3.3 Comparison between surveyors and prismatic compass. 3.4 Concept of (i) meridian- true, magnetic and arbitrary meridians. (ii) bearing-true, magnetic and arbitrary, magnetic dip and declination. 3.5 System of measuring the bearings- whole circle bearing, reduced bearing (Q.B.), conversion of it. Problems on conversion of bearings. 3.6 Fore bearing and back bearing of a line. Concept of a traverse- open and closed traverse.	CO-3

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	3.7 Local attraction, causes, detection, error and applying correction. 3.8 Checks for an open and closed traverse. Calculation of included angle from bearing and vice-versa. 3.9 Error, precaution and Adjustment of errors in a closed traverse. Booking readings in field book computation and plotting. 3.10 Plane table surveying-Methods and Instruments.	
<i>TSO 4a.</i> List the various leveling instrument used in surveying. <i>TSO 4b.</i> Measure included angle, deflection angle and calculate bearing of given lines <i>TSO 4c.</i> Traverse a given site with the dumpy dial. <i>TSO 4d.</i> Perform temporary and permanent adjustment of a various dial. <i>TSO 4e.</i> Describe dial traversing methods. <i>TSO 4f.</i> List the procedure to transfer the survey station from surface to underground. <i>TSO 4g.</i> Use miners dial in a site.	Unit 4.0 Levelling and Dial 4.1 Definition of level, levelling instruments, level line, names and function of different parts of dumpy level, tilting level, and digital level. 4.2 Temporary adjustment of a dumpy level & tilting level, difference between dumpy level & tilting level. 4.3 Definition of the term-axis of telescope, line of collimation axis of bubble tube, vertical axis of the instrument. Height of the instrument and height of the line of collimation, focusing, parallax, its removal, bench marks, back sight, intermediate sight, change point. 4.4 Simple & differential leveling with dumpy & tilting levels, reduction of level by various methods, arithmetic checks, errors in leveling & precautions to be taken. 4.5 Dials: Construction and use of the miners dial, vernier and micro optic dials, traversing, booking and plotting.	CO-4
<i>TSO 5a.</i> Compute area of a given shape and size. <i>TSO 5b.</i> Compute volume of a given shape and size. <i>TSO 5c.</i> Study and use of Planimeter including digital planimeter	Unit 5.0 Contours and Computation of Area and Volume 5.1 Contouring: Definition, characteristics of contours, method of contouring-Direct and indirect, 5.2 Contour interval and its factor. Use of contour map. Interpolation of contours. 5.3 Computation of area of regular and irregular shapes by Simpsons Rule and by Bowditch Rule. 5.4 Computation of volume of regular and irregular shapes by Simpsons Rule and by Bowditch Rule. 5.5 Area calculation by Planimeter.	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: P2447303

Practical/Lab Session Outcomes (LSOs)	S.No.	Laboratory Experiment/ Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Select appropriate type of chain under given conditions. <i>LSO 1.2.</i> Identify different types of chain used in survey work.	1.	Ranging and chaining on a given level and sloping ground.	CO-2
<i>LSO 2.1.</i> Record the observation record in field book and analyze the result.	2.	Traversing of a given area by a chain and tape and Recording observation in field book and plotting	CO-2
<i>LSO 3.1.</i> Perform survey work by using engineer's chain.	3.	Testing and adjusting of a given engineers chain.	CO-2
<i>LSO 4.1.</i> Identify factors affecting the chaining operation. <i>LSO 4.2.</i> Carry out necessary action to minimize errors in chaining operation.	4.	Determining Errors in chaining and their corrections	CO-2
<i>LSO 5.1.</i> Use and operate prismatic compass in survey work. <i>LSO 5.2.</i> Write sources of error compass surveying and take necessary action to minimize it.	5.	Perform the site survey using prismatic compass.	CO-3
<i>LSO 6.1.</i> Use the prismatic compass at given survey site. <i>LSO 6.2.</i> Testing and adjustment of prismatic compass.	6.	Traverse by prismatic compass and graphical adjustment of closing error.	CO-3
<i>LSO 7.1.</i> Apply the principles of plane table surveying at given site. <i>LSO 7.2.</i> Perform plane table surveying using plane table at undulation ground surface.	7.	Perform the site survey using the plane table.	CO-3
<i>LSO 8.1.</i> Determine the error of local attraction during surveying. <i>LSO 8.2.</i> Identify factors affecting leveling between two given points.	8.	Calculate the effect of local attraction and applying the corrections of it.	CO-4
<i>LSO 9.1.</i> Use the dumpy and tilting level under given condition.	9.	Finding the difference in level between two points by use of dumpy and tilting level.	CO-4
<i>LSO 10.1.</i> Select a suitable point to setting and adjustment of a dumpy and tilting levels.	10.	Testing and adjustment of dumpy and tilting levels.	CO-4
<i>LSO 11.1.</i> Identify factor affecting counter lines and counter interval. <i>LSO 11.2.</i> Use the counter lines in surface and underground mine plans.	11.	Contouring and preparation of a contour survey plan of a given uneven area.	CO-4
<i>LSO12.1</i> Calculate the volume of given regular/irregular shapes by Simpsons rule and Bowditch rule.	12.	Compute volume of regular and irregular shapes by Simpsons Rule and Bowditch Rule.	CO-5

L) Suggested Term Work and Self Learning: S2447303 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. Prepare a traverse survey report of your institution's campus using suitable survey equipment.
2. Establish a bench mark in your institute campus.
3. Traverse an area by prismatic compass and surveyor compass, plot and compare its results.
4. Shifting of roof stations to floor and floor stations to roof at given condition.
5. Prepare a map of hilly/river area showing contour lines at given interval.

c. Other Activities:

i. Seminar Topics:

- Object and importance of surveying in mining field.
- Different types of Chain and tape used in surveying.
- Use of prismatic and surveyor compass in mining fields.
- Construction and working principles of miners dial.
- Use of contour lines in mine plans/ mining sirdar offset plans.
- Area and volume calculation by different methods.

ii. Visits: Visit a nearby mines survey department and prepare a report on it.

iii. Self-Learning Topics:

- Observe the effect of error due to damage of chain and tape.
- Observe the difference in length by measuring a line with a chain and a tape.
- Preparatory arrangement before chain surveying.
- Check the accuracy of a given chain with the help of a standard tape.
- Observe the variations in magnetic meridian on a particular place according to change in time.
- Case study of levelling work of near by mining or civil construction site.
- Checking of accuracy of given dial and its permanent adjustments
- Study the applicability of contour in given mining conditions.
- Study the contour maps of mines visited nearby areas.
- Computation area and volumes of given site.

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

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Introduction	08	CO-1	14	4	6	4
Unit-2.0 Chain Surveying	10	CO-2	14	4	6	4
Unit-3.0 Compass Surveying	10	CO-3	14	4	5	5
Unit-4.0 Levelling and Dial	10	CO-4	14	4	6	4
Unit-5.0 Contours and Computation of area and volume.	10	CO-5	14	4	6	4
Total	48	-	70	20	29	21

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.	Ranging and chaining on a given level and sloping ground.	CO-2	30	60	10
2.	Traversing of a given area by a chain and tape and Recording observation in field book and plotting	CO-2	30	60	10
3.	Testing and adjusting of a given engineers chain.	CO-2	30	60	10
4.	Determining Errors in chaining and their corrections	CO-2	30	60	10
5.	Perform the site survey using prismatic compass.	CO-3	30	60	10
6.	Traverse by prismatic compass and graphical adjustment of closing error.	CO-3	30	60	10
7.	Perform the site survey using the plane table.	CO-3	30	60	10
8.	Calculate the effect of local attraction and applying the corrections of it.	CO-4	30	60	10
9.	Finding the difference in level between two points by use of dumpy and tilting level.	CO-4	30	60	10
10.	Testing and adjustment of dumpy and tilting levels.	CO-4	30	60	10
11.	Contouring and preparation of a contour survey plan of a given uneven area.	CO-5	30	60	10
12.	Compute volume of regular and irregular shapes by Simpsons rule and Bowditch rule.	CO-5	30	60	10

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.	Linear Measuring Instruments (Chain, tape, arrow peg, ranging rod, offset plumbob etc.)	1.Chain (varying size) i) Metric Chain -30 ii) Gunter's Chain -66 ft iii) Engineer's Chain -100 ft 2. Steel Band -200 ft 3. Tape i) Inver Tape -30m,50m ii) Steel Tape -30m iii) Metalic Tape -30m etc. 4. Arrow -40cm.(each) 5. Wooden Peg -15cm(each) 6. Ranging rod - Metallic type -2m, 3m. Wooden type-(fitted with iron shoe)-2m, 3m. 7. Off Set Rod -3m 8. Plumb Bob -500gm,100gm,50gm 9. Levelling staff- Aluminium Leveling Staff 3000x70x35mm 10. Optical Square –PWD pattern 11.Spring Balance	1-12
2.	Prismatic compass	(10 CM. DIA.) WITH TRIPOD STAND.	5-6,8
3.	Plane table	- Plane Table Board 600x750x22mm (Wooden) - Plane Table Stand (Wooden, Teak wood) - Plane Table Head (Ordinary) –Quality size – (ISI Specification) - Magnetic Compass - 150mm Brass – (ISI Specification) - Spirit Level - Quality Size-(150mm, Brass) ISI Specification) - Alidade/Sight Vane –Brass- Quality Size – (ISI Specification) - Plumbing Fork – Brass- (ISI Specification) - Plumb Bob –Quality Size – (Brass) - Tripod Stand	07
4.	Dumpy level	(WITH PLUMB BOB, TRIPOD, SPIRIT LEVEL) 7"Centre Focusing Telescope Erect, Magnification 24X, Length 225 mm, Shortest Focusing Distance 1.5 mtr, Longest Focusing Distance 200/300 mtr, Objective Aperture 40 mm, Stadia constant 1:100, Addition constant 0, Bubble sensitivity 20"/2 mm,Nominal Accuracy 2-3 mm/km .	9-10
		(WITH PLUMB BOB, TRIPOD, SPIRIT LEVEL) 9"Centre Focusing Telescope Erect, Magnification 24X, Length 225 mm, Shortest Focusing Distance 1.5 mtr, Longest Focusing Distance 200/300 mtr, Objective Aperture 40 mm, Stadia constant 1:100, Addition constant 0, Bubble sensitivity 20"/2 mm, Nominal Accuracy 2-3 mm/km, Weight 2.650 Kg	9-10
5.	Tilting level	Telescope Length: 16" with 190 Micrometer installed Magnification: 200x at 2" from objective; 30x at infinity Field of View: 1 degree Image: Erect Optics: Low reflective, protective coating Effective apature: 1.34" Reticle: Glass, filar/bi-filar pattern Focusing Range: 2" to infinity Bearings: Ball type with a runout of 0.000025" or less	9-10

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

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Mine Surveying Vol. I	S. Ghatak	Coal Field Publishers, 5 th edition, 1996
2.	Mine Surveying Vol. II	S. Ghatak	Coal Field Publishers, 5 th edition, 1996
3.	Surveying for civil and mine engineers	John Walker and Josef Awange	Springer, 2 nd edition
4.	Surveying Vol-I	B.C. Punamia	Laxmi publication 7 th edition 1 jan 2016, ISBN-9788170088530
5.	Surveying and Levelling	N.N. Basak	Mcgraw hill education 2 nd edition july 2017
6.	Surveying & Leveling, Vol-I, II	Kanetkar& Kulkarni	Pune vidyarthi griha prakashan
7.	Surveying Vol-1	Dr. K. R. Arora	Standard book house 1jan 2019

(b) Online Educational Resources:

1. <https://www.teachmint.com/tfile/studymaterial/class-2nd/minesurveying/1introductionsurveypdf/a9d78e1b-b0ef-4ba7-9887-1e4669a5bde9>
2. nptel.ac.in/courses/105104101/
3. <https://www.studocu.com/row/document/university-of-zambia/engineering-surveying/mine-surveying-lecture-notes-pdf-file/16815842>
4. <https://www.slideshare.net/HarisAbdulRahim1/mine-surveying-981-1>
5. <https://www.youtube.com/watch?v=a4oV69DWSVQ>

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** : 2447304(T2447304/P2447304/S2447304)
- B) **Course Title** : Mine Ventilation
- C) **Pre- requisite Course(s)** :
- D) **Rationale** :

The diploma holder in mining Engineering will be responsible for the development of mine maintaining safe, healthy working environmental conditions in underground mining as per the regulations specified from time to time by the DGMS. The teachers while teaching are supposed to give practical examples of environmental conditions of various working in India and typical world examples and visits of mine sites.

The course content of the subject provide him basic knowledge and skills about mine environmental engineering i.e. mine gases, heat and humidity, principles of natural and mechanical ventilation and illuminations in mines.

- 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** Create, comfortable and healthy mine atmosphere in mines.
- CO-2** Apply the knowledge of heat and humidity in mines to create comfortable working conditions.
- CO-3** Apply the basic knowledge of ventilation in underground mines.
- CO-4** Carryout ventilation survey and use ventilation accessories.
- CO-5** Use principles of mine lighting to ensure adequate illuminations in mines.

- 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	2	-	3	1	-	3		
CO-2	2	3	-	2	1	-	3		
CO-3	3	3	2	2	2	1	3		
CO-4	3	2	1	3	2	2	3		
CO-5	3	2	3	-	2	2	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)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2447304	Mine Ventilation	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= (1x CI hours) + (0.5x LI hours) + (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)	
2447304	Mine Ventilation	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: Terminal & Self Learning Assessment (include 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, and 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: T2447304

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<i>TSO 1a.</i> List the various gases found in Indian coal mine <i>TSO 1b.</i> Write the physiological effects of mine gases. <i>TSO 1c.</i> Elaborate the principle, procedure and mechanism of methane drainage under given condition in mines.	Unit 1.0 Mine Gases and their Detection 1.1 Composition of atmospheric air, Mine atmosphere. 1.2 Mine gases (O₂, N₂, CO, CO₂, CH₄ Etc.), composition, physical and chemical properties of mine air. 1.3 Occurrence, physiological effects of mine gases. 1.4 Detection of mine gases by flame safety lamps, gas detection equipment their working and up keep. 1.5 The gas laws. 1.6 Methane drainage and its method. 1.7 Monitoring system of mine Environment. 1.8 Analysis of mine air.	CO-1
<i>TSO 2a.</i> . Identify the sources of heat and humidity and their effects in mine atmosphere. <i>TSO 2b.</i> Calculate the cooling power of mine air in the given situation <i>TSO 2c.</i> Use knowledge of installation and operating mechanism of air conditioning plants and spot coolers in mines.	Unit2.0 Heat and Humidity in Mines 2.1 Heat and Humidity in mine atmosphere and their determination and effects. 2.2 Geothermal-gradient, kata thermometer, effects of heat and moisture in mine absolute and relative humidity, 2.3 Dew point, control of temperature and humidity in deep mines, 2.4 Air conditioning in mines, surface, underground and divided installations 2.5 Spot cooler and Assessment of comfort condition.	CO-2
<i>TSO 3a.</i> Explain the need and importance of object and standard of ventilation and related regulations <i>TSO 3b.</i> Measure pressure, quantity and velocity required for air flow in mines with the application of law of air flow. <i>TSO 3c.</i> Calculate equivalent resistance and equivalent orifice based on given parameters.	Unit3.0 Basics of Mine Ventilation 3.1 Object of ventilation, introduction of natural and artificial ventilation and standards of ventilation. 3.2 Measurement of air quantity, pressure and velocity-Anemometer, Velometer, pitot tube etc. 3.3 Law of air flow in mines, flow of air in ducts and mine roadways, resistance of airways, chezy and atkinsons equation. 3.5 Equivalent resistance and equivalent orifice of mine, 3.6 Regulation related with above topics. 3.7 Degree of gassiness of mines	CO-3
<i>TSO 4a.</i> Explain the mechanism of natural ventilation and measure the natural ventilation pressure under different situation. <i>TSO 4b.</i> Use knowledge of constructional features and characteristic curves for selection of suitable mechanical ventilation under given conditions. <i>TSO 4c.</i> Calculate pressure and velocity produced under different mechanical ventilation system based on given parameters.	Unit 4.0 Mine Ventilation Systems 4.1 Natural ventilation and its measurement. 4.2 Principles of ventilation survey, Thermodynamics of natural ventilation, 4.3 Distribution of air and its control. 4.4 Ascensional and descensional ventilation. 4.5 Mechanical ventilation, different types of fans used in mine-their constructions, 4.6 Characteristic curves of fan, relation between pressure quantity and power of fan, fan drift,	CO-4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	their construction feature, auxiliary and booster fan, 4.7 Splitting of air current, reversal of air current, leakage of air and its prevention. 4.8 Ventilation accessories –Door, Airlock, regulator, stopping, air crossing, brattice partition etc. 4.9 Simple numerical problems.	
<i>TSO 5a.</i> Explain various technical terms and parameters related to mine lighting and illumination. <i>TSO 5b.</i> Explain the constructional features and operating procedures of various types of lamps used in mines. <i>TSO 5c.</i> Explain statutory provisions related to underground and surface lighting in mines.	Unit 5.0 Mine Illumination 5.1 Technical terms in lighting and photometry. 5.2 Lighting source in mines, Various types of flame and electric safety lamps their working and maintenance; 5.3 Surface and Underground lighting as per statutory norms. 5.4 Illumination survey; Flameproof & intrinsically safe apparatus 5.5 Lamp room layout, lamp room organization, care and maintenance of cap lamps.	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: P2447304

Practical/Lab Session Outcomes (LSOs)	S.No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Use a multi gas detection equipment. <i>LSO 1.2.</i> Operate and interpretation the result of detection.	1.	To determination of mine gases by using multi gas detector.	CO-1
<i>LSO 2.1.</i> Select an appropriate gas detection equipment under a given condition. <i>LSO 2.2.</i> Prepare a mine air composition chart of underground mine atmosphere after gas detection.	2.	Detect different gases in mine atmosphere using suitable equipment and prepare a chart of composition of mine atmosphere.	CO-1
<i>LSO 3.1.</i> Describe different methods of methane drainage. <i>LSO 3.2.</i> Select a suitable methods of methane drainage.	3.	Draw layouts of different procedure of methane drainage.	CO-1
<i>LSO 4.1.</i> Use and operate flame safety lamp in underground mines. <i>LSO 4.2.</i> Perform accumulation and percentage test of inflammable gas by using flame safety lamp.	4.	Testing of methane with flame safety lamps.	CO-1
<i>LSO 5.1.</i> Use and operate whirling hygrometer to measure heat and humidity in underground mines.	5.	To measure the heat and humidity in mine atmosphere using whirling hygrometer.	CO-2
<i>LSO 6.1.</i> Describe the working principle of kata thermometer. <i>LSO 6.2.</i> Use a kata thermometer under given condition.	6.	Study and use of kata thermometer.	CO-2

Practical/Lab Session Outcomes (LSOs)	S.No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 7.1.</i> Select appropriate equipment for quantity and velocity of air and atmospheric pressure measurement.	7.	Measure the quantity and velocity of air and atmospheric pressure using suitable equipment.	CO-3
<i>LSO 8.1.</i> Choose suitable ventilation accessories to create safe mine environment. <i>LSO 8.2.</i> Minimize and control the leakage of air into goaf area.	8.	Draw a layout of distribution of air current for ventilation under given conditions.	CO-4
<i>LSO 9.1.</i> Draw and interpreted characteristic curve of different ventilation fan.	9.	To draw a characteristic curve of a given ventilation fan.	CO-4
<i>LSO 10.1.</i> Create safe mine working condition by using suitable ventilation accessories. <i>LSO 10.2.</i> Use the symbol of various ventilation accessories to draw a layout.	10.	Make a layout for the installation of various accessories used in ventilation i.e. door, airlock, regulator, stopping, air crossing and brattice cloth under given conditions	CO-4
<i>LSO 11.1.</i> Installation and safe handling of safety lamp in lamp room.	11.	To draw a layout of lamp room organization.	CO-5

L) Suggested Term Work and Self Learning: S2447304 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. Prepare a model of GL60 flame safety lamp.
2. Prepare a model on Spot cooler.
3. Prepare a model to show different ventilation accessories.
4. Prepare a model for different mechanical ventilation system.
5. Design a layout 300 nos. capacity lamp room.

c. Other Activities: -

1. Seminar Topics:

- Occurrence of mine gases and their physiological effects on human life.
- Accumulation and percentage test by flame safety lamp.
- Sources and preventive measures of heat and humidity in underground coal mines.
- Use of Spot cooler and assessment of comfort condition.
- Thermodynamics of natural ventilation in underground mines
- Principles of ventilation survey.
- Statutory provisions of standard of Illumination in opencast and underground mines.

2. Visits:

- a. Visit a nearby UG coal gassy mines and prepare a report on it.
- b. Visit a nearby mine having natural ventilation system.

3. Self-Learning Topics:

- Identify the equipment used for detection of gases like carbon-mono-oxide, methane, carbon di oxide, nitrogen oxides etc
- Carryout the analysis of mine atmosphere in different mines and compare the result.

- To collect information about sources of heat and humidity in mines and their physiological effects in human life.
- Collect ventilation data from different mines and evaluate comfortable conditions of working at work places under given conditions.
- To study the regulations related to mine ventilation.
- Study the effectiveness of use of auxiliary and booster fans in nearby mines.
- Study statutory norms for underground and surface lighting in mines.
- Study the use, care and maintenance of cap lamps.

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%	25%	20%	20%	20%	30%	30%
CO-2	20%	25%	20%	20%	20%	20%	20%
CO-3	20%	10%	20%	20%	20%	10%	10%
CO-4	20%	30%	20%	20%	20%	30%	30%
CO-5	20%	10%	20%	20%	20%	10%	10%
Total	30	70	20	20	10	20	30
Marks			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 Mine Gases and their Detection	10	CO-1	14	4	5	5
Unit-2.0 Heat and Humidity in Mines	10	CO-2	14	4	4	6
Unit-3.0 Basics of Mine Ventilation	10	CO-3	12	4	4	4
Unit-4.0 Mine Ventilation System	10	CO-4	20	4	8	8
Unit-5.0 Mine Illumination	08	CO-5	10	4	2	4
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):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	To determination of mine gases by using multi gas detector.	CO-1	30	60	10
2.	Detect different gases in mine atmosphere using suitable Equipment and prepare a chart of composition of mine atmosphere.	CO-1	30	60	10
3.	Draw layouts of different procedure of methane drainage.	CO-1	40	50	10
4.	Testing of methane with flame safety lamps.	CO-1	30	60	10
5.	To measure the heat and humidity in mine atmosphere using Whirling Hygrometer.	CO-2	30	60	10
6.	Study and use of kata thermometer.	CO-2	40	50	10
7.	Measure the quantity and velocity of air and atmospheric pressure using suitable equipment.	CO-3	30	60	10
8.	Draw a layout of distribution of air current for ventilation under given conditions.	CO-4	40	50	10
9.	To draw a characteristic curve of a given ventilation fan.	CO-4	40	50	10
10.	Make a layout for the installation of various accessories used in ventilation i.e. door, airlock, regulator, stopping, air crossing and brattice cloth under given conditions	CO-4	40	50	10
11.	To draw a layout of lamp room organization.	CO-5	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.	Multi gas detector	DGMS approved, MSA ALTAIR 4X sensor Size:200 x 140 x 135mm (7.9" x 5.5" x 5.3") Weight: 1.2kg Interfaces:Standalone /USB /Ethernet LED Power (Green) /Testing (Yellow) /Pass (Green) Indicators: /Fail (Red) Testing Time:Bump Test 60 secs Calibration Test 90 secs Data Storage:>6000 Bump & Calibration results Power Supply:12V dc, 2AOperating Temperature:- 10oC to 40oC(14oF to 104oF) Gas Ports:3 (Air, Combi Gas & Exhaust DGMS approved	1
2.	D-6 Methanometer	MSA, measurement range from 0 to 5% by Volume, nickel cadmium batteries. DGMS approved	2
3.	P.S. detector (CO detector)	Range of measurement- 0.005%-0.12% Volume of air suck- 120cm ³ Company-Siebe Gorman and Co Ltd. DGMS approved	2
4.	Flame safety lamp	DGMS approved Model no.GL-5, GL-7, GL-60	4
5.	Whirling Hygrometer	Wood body, Response time-500ms, net quantity- 1count	5
6.	Kata thermometer	Alcohol thermometer, two marks graduated on the stem 35°C to 38°C.	6
7.	Rotating vane Anemometer	Anemometer have for vanes, low friction ball or roller bearing, sensitivity 50-100fpm, accuracy 80- 90%, air velocity measuring range .25 to 50 m/s.	7
8.	Pitot Static Tube	DGMS approved apparatus	7

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

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Mine Environmental Engineering.	G. B. Mishra	Oxford University Press
2.	Elements of Mining Technology Vol. II	D. J. Deshmukh	Denette & co. Nagpur publication
3.	Mine Ventilation – Vol I II	D.C. Panigrahi	CRC Press 2001
4.	Mine Ventilation and air conditioning	Howard L. Hartman, Jan M. Mutmanský, Raja V. Ramani, Y. J. Wang	Willy Eastern Publication, New Delhi 1997
5.	Mine Ventilation- Two volumes	D.C. Panigrahi	CRC Press 2001
6.	Practical Mine Ventilation (digitized edition)	James R Robinson	University of California Press 2009
7.	Mine environment and ventilation	G. B. Mishra	Oxford University Press
8.	Advanced Mine Ventilation- Respirable coal dust, combustible gas and mine fire control	Pramod Thakur	Woodhead Publishing 2018

(b) Online Educational Resources:

1. https://www.srk.com/en/services/mine-ventilation?gad=1&gclid=CjwKCAjwv8qkBhAnEiwAkY-ahiMP1uawW_h-Fzspv8MQSkzaUTYtBKLfzB2jA8I1eGxtELKS8xF2QxoCQ1oQAvD_BwE
2. https://en.wikipedia.org/wiki/Underground_mine_ventilation
3. <https://www.slideshare.net/hzharraz/ventilation-of-underground-mine>
4. <https://www.youtube.com/watch?v=eFjYkP9PPtA>

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:

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

A) Course Code	: 2447305(P2447305/S2447305)
B) Course Title	: Summer Internship - I (Common For all Programmes)
C) Pre- requisite Course(s)	:
D) Rationale	:

Diploma students are required to give exposure of their own diploma programme related industrial hardware, software and practices, just after completing one semester, so that they can correlate this industrial exposure with the concept being taught in the branch specific specialized engineering courses in forthcoming semesters. Mentors/Coordinators/ Teachers need to map the academic contents of the programme of study with the activities of this industrial exposure and are advised to follow the 'Whole to Part' approach to make the students aware about the potential industry's expected outcomes & setup ('Whole') from the diploma programme – and then teaching the related concepts ('Part') of the same in subsequent semesters. In this way before actually being exposed to academic input specific to diploma programmes, the students need to be sent to the nearby/local industries and also may be advised to explore information related to their programme of study using different sources related to potential employment opportunities of both wage and self-employment, job function, job position, nearby relevant industries and so on.

The summer internship will provide the direction to the students and also help in mind mapping to plan their futuristic course of action, after passing the diploma. This would also bridge the gap between their virtual imagination about the outcome of the programme and real happenings related to the diploma programme.

- 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** Comprehend the practices of identified industry or world of work related to diploma engineering programme of study.
- CO-2** Map real equipment, processes, product, management, and operations etc. to the course of study through various glimpses of input, process and output in different type of industries.
- CO-3** Identify the probable enterprises /startups for futuristic planning and self-growth.
- CO-4** Identify the probable job function and job position in their relevant programme of study.

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

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	-	-	1	-	-	1		
CO-2	3	-	-	1	-	-	1		
CO-3	3	-	-	-	1	-	2		
CO-4	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				
2447305	Summer Internship - I	-	-	02	02	04	02

Legend:

- CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)
- LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies)
- Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.
- TW: Term Work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)
- SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.
- C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)
- Note:** TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2447305	Summer Internship - I	-	-	10	15	10	15	50

Legend:

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

Note:

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

- I) Suggested Instructional/Implementation Strategies:** Mentors/ Coordinators/ Teachers need to plan and implement the summer internship in their respective programme as per the outcome expected from the programme. However in general, summer internship would help in exploring and exposing the student to the below mentioned dimensions of the world of work. These dimensions can further be explored in depth as per the need and advancement in respective programmes in later stages. Mentors/Coordinators/ Teachers need to map the academic contents of the programme of study with the activities of this industrial exposure and are advised to follow the whole to part approach to make the students aware about the potential industry's expected outcomes & setup ('Whole') from the specific diploma programme and then teaching the related concepts ('Part') of the same in subsequent semesters.

- Industrial Layout
- Organizational Structure
- Corporate Communications
- Strategic, Rolling and Developmental plans
- Maintenance Procedures
- Inventory Control and Management System
- Purchase and Store Procedures
- Major Machinery, Tools, Equipment, Devices, Software, Control System etc.
- Product Development, Manufacturing, Packaging and Delivery
- Project Management
- Operation and Maintenance
- Warehouse Management
- Assembly Line
- Quality Assurance and Testing Cell
- Process/ Software Development/ Fabrication/ Construction Work Management
- Testing and Quality Assurance Practices
- Total quality management
- Callibration and Certification practices
- Safety Practices
- Industrial Acts
- Industrial Grievances
- Behavioural Aspects
- Conduction of Meetings and Discussions
- Sales and Marketing Strategies
- Forecasting and Target Setting
- Production Planning and Control
- Storage Retrieved and Material handling Practices
- Automation and Control Facilities
- Enterprise Resource Planning (ERP)
- Supply Chain
- Customer Satisfaction Strategies
- Finance and Accounts
- Research and Development
- Promotion and Capacity Building Schemes
- Reduce, Reuse and Recycling Efforts and Policies
- Recognitions and Rewards
- After Sale Services
- Promotional Avenues
- Social Corporate responsibilities

J) Assessment of Summer Internship -I

S. No.	Criteria of Assessment	% of Weightage
1.	Maintaining the log book after having exposure to different types of industry/ world of work	15
2.	Preparing the list of job functions and job positions of relevant programme	20
3.	Identify the probable enterprise/ startup for futuristic planning	15
4.	Report writing of summer internship as per the prescribed format	30
5.	Presentation of Report	20
Total		100

Note: S. no. 1 to 3 shall be considered for progressive assessment. While S. No. 4 & 5 shall be considered for end term assessment

- A) **Course Code** : **2400107(T2400107)**
- B) **Course Title** : Professional Ethics
(CE, CSE, ELX, ELX (R), FTS, ME, AIML, MIE, CHE, CRE, FPP, GT, EE, AE, CACDDM)
- C) **Pre- requisite Course(s)** : General awareness about moral values and different workplaces
- D) **Rationale** :

One of the programme outcomes of the diploma course incorporates ethical practices in application of appropriate technology in context of society, sustainability, and environment. It is of great importance to distinguish between the terms values and ethics. Ethics are norms of behaviour that are set by authorities at workplace. The persons belonging to that workplace are expected to follow the norms. Ethical behaviour at workplace affects the person's relation to people, creates a positive impact on business processes and environment. It is very important that a person has not only understanding of ethical behavior but also the responsibility to set ethical practices in own area of work.

While values are personal preferences or choices, they may sometimes contradict with ethics at his workplace. The values of a person affect behavior and his decision making.

This course is meant to sensitize the student to ethics in profession and motivate them to demonstrate ethical behavior in day to day activities and be aware of ethics in profession.

- 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 Demonstrate good values and ethics in the day to day activities and at workplace.

CO-2 Identify a set of values and ethics related to fair professional practice.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (Cos)	Programme Outcomes (Pos)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	3	3	3	3	3	3		
CO-2	3	3	3	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			
2400107	Professional Ethics	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)	
2400107	Professional Ethics	25	-	-	-	-	-	25

Legend:

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

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

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2400107

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<i>TSO 1a.</i> Define concepts-values and ethics and attitude, development of attitudes <i>TSO 1b.</i> Identify situations depicting values such as humanity, honesty, punctuality, respect, peace, empathy <i>TSO 1c.</i> Identify situations depicting ethics, healthy competition, integrity, truthfulness,	Unit-1.0 Values and Ethics in Day to Day Life 1.1. Values- Definition and examples, Ethics- definition and examples, Concept of attitude and development of attitude 1.2. Importance of values and ethics in day to day activities and at workplace- Ethical ways of communication, environmental considerations in engineering processes, Basic concept of Carbon footprint, ethics at workplace 1.3. Examples of situations depicting values- based decisions and ethical behavior in day to Day life	CO1
<i>TSO 2a.</i> Identify the relevance of profession to society and environment <i>TSO 2b.</i> Identify the need of values and ethics in profession related activities <i>TSO 2c.</i> Identify Ethical conflicts	Unit-2.0 Values and Ethics in Profession 2.1 Relevance of profession to society 2.2 ethical principles such as respecting others and ourselves, respecting the rights of others, keeping promises, avoiding unnecessary problems to others, avoiding cheating and dishonesty, showing gratitude towards others and encouraging them to work 2.3 Identification of activities and related ethical and unethical behavior for professional activities in their area of work 2.4 Examples of situations depicting values- based decisions and ethical behavior	CO1, CO2

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

K) Suggested Activities and Self-Learning: Reading books related to values and ethics/Epics/ Daily news and discussions in group -

- a. **Assignments:** Preparation for group discussion, panel discussion, role play, case study, seminar, skits
- b. **Micro Projects:** Skits development and performance, poster making,
- c. **Activities:** Role Play, Case studies, Debates, Group Discussion,
- d. **Suggested Seminar/ Debates on Topics such as:**
 - i. charters of professions
 - ii. Importance of Values and ethics in identified profession
 - iii. Issues of ethical conflicts- Professional rivalry,
 - iv. Identified issues from Chanakya Neeti
 - v. Ethics in scriptures such as Kabir ke Dohe etc.
 - vi. Lessons on ethics from religious scriptures
 - vii. Issued based on Happenings reported in Daily news

L) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lecture, Case Method, Group Discussion, seminar, Role Play, Live Demonstrations in Classrooms, Lab, Expert Session, Video Clippings, Use of Open Educational Resources (OER), and MOOCs etc.

M) List of Major Laboratory Equipment, Tools and Software: (Not Applicable)**N) Suggested Learning Resources:****(a) Books:**

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Professional Ethics and Human Values	D. R. Kiran	McGraw-Hill Education Pvt. Ltd. 2007 ISBN: 9780070633872
2.	A Textbook On Professional Ethics And Human Values	Dr. R S Naagarazan	New Age International (P) Ltd., Publishers, 2017 ISBN: 9789386173768
3.	Ethics, Integrity and Aptitude – Hindi (Paperback) (एथिक्स, सत्यनिष्ठा एवं अभिवृत्ति)	P.D Sharma	Rawat Publications, 2019 ISBN: 978-8131609941
4	Chanakya - Niti (Sutra Sahit) (Hindi)	Chanakya	Maple Press. 2014 ISBN 978-9350335529

(b) Online Educational Resources:

1. Free Ethics & Compliance Toolkit - Ethics and Compliance Initiative
(<https://www.ethics.org/resources/free-toolkit>)
2. Free & open source tools for ethics practitioners (<https://www.cityethics.org/harvard-lab>)
3. Microsoft Word - KPTI XII - Indian Ethics 03-05-13
(https://cbseacademic.nic.in/web_material/doc/ktpi/30_KPTI%20XII%20-%20Indian%20Ethics_old.pdf)
4. Knowledge Traditions & Practices of India (cbseacademic.nic.in)
([ps://cbseacademic.nic.in/web_material/Circulars/2012/68_KTPI/Module_5.pdf](https://cbseacademic.nic.in/web_material/Circulars/2012/68_KTPI/Module_5.pdf))

- A) **Course Code** : **2400207(T2400207/S2400207)**
 B) **Course Title** : Indian Constitution (Common for all Programmes)
 C) **Pre- requisite Course(s)** :
 D) **Rationale** :

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

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

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

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

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

CO-3 Analyze major constitutional amendments in the constitution.

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

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

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

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

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

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400207	Indian Constitution	01	-	-	-	01	01

Legend:

- CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)
- LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies)
- Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.
- TW: Term Work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)
- SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.
- C: Credits= (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

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

H) Assessment Scheme:

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

Legend:

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2400207

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

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

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

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

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

b. Micro Projects:

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

c. Other Activities:

1. Seminar Topics:
 - Democracy and Political Participation in India
 - Situations where directive principles prevail over fundamental rights.
2. Visits:
 - Arrange Mock Parliament.
3. Design games and simulation on emergencies declared in last thirty years.

4. Group discussions on current print articles.
 - Adoption of Article 365 in India.
 - Need of amendments in the constitution.
5. Prepare collage/posters on current constitutional issues.
 - Emergencies declared in India
 - Seven fundamental rights
6. Cases: Suggestive cases for usage in teaching:

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

7. Self-Learning Topics:

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

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

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

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

O) Suggested 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.	The Constitution of India	P.M.Bakshi	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105
2.	Introduction to Indian Constitution	D.D.Basu	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3.	Introduction to Constitution of India	B. K. Sharma	PHI, New Delhi, 6th edition, 2011, ISBN:8120344197
4.	The Constitution of India	B.L. Fadia	Sahitya Bhawan, Agra, 2017, ISBN:8193413768
5.	The Constitutional Law of India	Durga Das Basu	LexisNexis Butterworths Wadhwa, Nagpur 978-81-8038-426-4

(b) Online Educational Resources:

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

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

- A) **Course Code** : **2400108(T2400108)**
- B) **Course Title** : **Essence of Indian Knowledge System and Tradition**
(Common for all Programmes)
- C) **Pre- requisite Course(s)** :
- D) **Rationale** :

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

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

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

CO-1 Identify the rich heritage and legacy residing in our Indian Knowledge systems.

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

F) Suggested Course Articulation Matrix (CAM):

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

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

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

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400108	Essence of Indian Knowledge System and Tradition	01	-	-	-	01	01

Legend:

- CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)
- LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies)

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

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

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

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

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

H) Assessment Scheme:

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

Legend:

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

Note:

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

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

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

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

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

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

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

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

b. Micro Projects:

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

c. Other Activities:

1. Seminar Topics: discuss any one IKS domain in details a highlighting the eminent works in the area.

2. Visits:

- Visit any nearby ancient temple and correlate the geomatical, Shilpa and Vaastu on IKS dimensions specified in each domain.

3. Self-Learning Topics:

- Sustainable practices adopted in ancient India that can be applied for current engineering situations.

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	-	-	-	-	-	-	-
CO-2	100%	-	100%	100%	100%	-	-
Total Marks	25	-	5	10	10	-	-
			25				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

O) Suggested 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.	Introduction to Indian Knowledge System: Concepts and Applications	Archak, K.B. (2012).	Kaveri Books, New Delhi
2.	Introduction to Indian Knowledge System: Concepts and Applications	Mahadevan, B. Bhat, Vinayak Rajat Nagendra Pavana R.N.	PHI, ISBN: 9789391818203
3.	Glimpse into Kautilya's Arthashastra	Ramachandrudu P. (2010)	Sanskrit Academy, Hyderabad
4.	"Introduction" in Studies in Epics and Purāṇas, (Eds.)	KM Munshi and N Chandrashekara Aiyer	Bhartiya Vidya Bhavan

(b) Online Educational Resources:

1. <http://bhavana.org.in>
2. www.academia.edu/23254393/Science_in_Ancient_India_-_an_educational_module
3. www.academia.edu/23305766/Technology_in_Ancient_India_-_Michel_Danino
4. www.hamsi.org.nz/http://insaindia.res.in/journals/ijhs.php
5. www.niscair.res.in/sciencecommunication/ResearchJournals/rejour/ijtk/ijtk0.asp
6. www-history.mcs.st-andrews.ac.uk/Indexes/Indians.html

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

(c) Others:

1. Swami Harshananda. "A bird's eye view of vedas". R K Math. Bangalore., <http://rkmathbangalore.org/Books/ABirdsEyeViewOfTheVedas.pdf>.
2. Sanskrit Prosody, https://en.wikipedia.org/wiki/Sanskrit_prosody.
3. Vartak, P.V. (1995). "Veda and Jyotish," Part II, Chapter 2, in Issues in Veda and Astrology, H Pandya (Ed.), pp 65 – 73.
4. Sundaram, A.V. (1995). "Astrology: Its usefulness and Limitations in ModernTimes", Part II, Chapter 9, in Issues in Veda and Astrology, H Pandya (Ed.), pp 129 – 135.
5. Archak, K.B. (2012), "The Vedāṅga Literature", Chapter VIII in Essentials of Vedic Literature, Kaveri Books, New Delhi, pp 330 – 391.
6. Vasant Lad (1996), "Ayurveda: A Brief Introduction and Guide", (whole article).

- A) **Course Code** : 2400208(S2400208/P2400208)
- B) **Course Title** : Sports, Yoga and Meditation (Common for all Programmes)
- C) **Pre- requisite Course(s)** :
- D) **Rationale**

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

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

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

CO-1 Select appropriate physical activities to maintain healthy lifestyle.

CO-2 Apply basic principles and practices of Yoga and meditation for overall growth & development.

CO-3 Use fitness and wellness techniques for optimal health and wellbeing

CO-4 Apply ancient Indian ayurvedic methods and techniques, exercises, yoga and meditation for fitness and wellness.

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

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

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

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

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		L	T				
2400208	Sports, Yoga and Meditation	-	-	01	01	02	01

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2400208	Sports, Yoga and Meditation	-	-	25	-	10	15	50

Legend:

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

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

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

Note:

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

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

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

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
<i>TSO.1a</i> Explain ancient history and development of yoga in India <i>TSO.1b</i> Compare the ancient Indian games with the modern games. <i>TSO.1c</i> Differentiate between given terms used in sports <i>TSO.1d</i> Describe the different aspects of Mental Toughness <i>TSO.1e</i> Use Imagery Training for sports <i>TSO.1f</i> Apply motivation techniques to motivate students in sports. <i>TSO.1g</i> Use concentration techniques for playing and exercising. <i>TSO.1h</i> Manage Stress, Anxiety and Arousal during sports. <i>TSO.1i</i> Select sports and exercise for healing and developing health and mental wellness <i>TSO.1j</i> Describe the impact of parents' involvement in their children's sports activities <i>TSO.1k</i> Select sports and exercises for physically challenged as per their need.	Unit-1.0 Sports and Exercises 1.1 Historical development of physical activities and sports in India, Indian ancient games- Kho-Kho and Kabaddi, Chariot races, riding elephants and horse, swordsmanship, wrestling, boxing, atyapatya, archery, dancing, dands baithak, malkhamb, lezim, lathi etc 1.2 Origin of traditional sports, 3rd century BCE- martial arts and archery, indoor games like Chess and Snakes & Ladders have origins in ancient India, in the form of games of Chaturanga and Gyan Chauper, Dholavira, the world's oldest terraced arena 3000 BC 1.3 Definition of play, game, sports, exercise, psychology, sports psychology and exercise psychology, psychology and common sense. 1.4 Mental toughness- mind, Imagery, use of imagery and imagery in sports, types of imagery (visual, kinesthetic, auditory and olfactory) 1.5 Motivation in sport and goalsetting in sports 1.6 Arousal regulation – self-awareness of regulation, anxiety reduction techniques- somatic anxiety reduction techniques, cognitive Anxiety reduction, multimodal anxiety reduction, coping with stress. Arousal -inducing techniques. Arousal and anxiety measurement factors, Arousal and anxiety signs recognition 1.7 Nutrition and rehabilitation, Importance of concentration and attentional focus in sports and training, Impact of health on healing from physical athletic injuries. Impact of exercise to increase mental wellness, Role of coach in sports, parents' involvement in their children's sports activities. 1.8 Adaptation of sports and exercises for physically challenged students in all levels.	CO1, CO4
<i>TSO.2a</i> Explain ancient history and development of yoga in India <i>TSO.2b</i> Identify the physiology of yoga and meditation. <i>TSO.2c</i> Evaluate meditation and yoga as a healing modality. <i>TSO.2d</i> Select asanas and pranayama as per need. <i>TSO.2e</i> Describe the effect of yoga and meditation on ageing, stress and hypertension.	Unit-2.0 Yoga and Meditation 2.1 Origin of yoga, History and development of yoga, Adi yogi, evidences of yoga in pre-Vedic period (2700 B.C.), Vedic Period, Pre-Classical Period, Classical Period- Patanjali's period, Modern Period. 2.2 Yoga practices and the related literature- Vedas (4), Upanishads (108), Smritis, teachings of Buddhism, Jainism, Panini, Epics (2), Puranas (18)	CO2, CO4

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO.2f Select mediation techniques as per the need. TSO.2g Explain Bandha, Mudra and Chakra TSO.2h Enumerate the steps of Suryanamaskar. TSO.2i Select Yoga and Meditation for physically challenged as per their need.	2.3 Importance of Yoga & Meditation, meaning of the term Yoga and Meditation, Fundamentals Principles of Yoga & Fitness training, Eight Limbs of Yoga 2.4 Difference between yoga asana and physical exercises, Difference between yoga and meditation 2.5 Role of Yoga and Meditation in Purificatory Process, in character building, developing concentration, will power and discipline 2.6 Types of Yoga Practices - Asanas, Pranayama, Meditation 2.7 Mindfulness – knowing the mind, training the mind, feeling the mind 2.8 Different Methods of meditation, Physiology of meditation, Mental, physical and emotional benefits of Asanas, Pranayama, Concentration and Meditation 2.9 Bandha, Mudra and Chakra 2.10 Effects of Asanas and pranayama on physiology of human body 2.11 Importance of “Suryanamaskar 2.12 Adaptation of Yoga and meditations for physically challenged students in all levels. 2.13 Yoga Asanas Do’s and Don’ts for Beginners	
TSO.3a Explain the ancient Indian ayurvedic methods for fitness and wellness TSO.3b Identify the different factors affecting the fitness and wellness in the given situation TSO.3c Use different methods to maintain Health and Wellness TSO.3d Explain the components of Balance Diet TSO.3e Identify the causes of stress and anxiety in the given situation TSO.3f Use stress reduction techniques to manage Stress and Anxiety TSO.3g Manage Stress, Anxiety and Depression in the given situation TSO.3h Select recovery process for energy replenishment after exercise.	Unit 3.0 Fitness and Wellness 3.1 Evolution of wellness, 3,000-1,500 BC: Ayurveda – holistic system, Tailored Ayurvedic regimens as per unique constitution of each person (their nutritional, exercise, social interaction and hygiene needs) – with the goal of maintaining a balance that prevents illness. 3.2 Meaning, Importance, Definition and dimensions of Health and Wellness (WHO/Yoga) 3.3 Factors affecting Fitness and Wellness 3.4 Role of Physical Activities and Recreational Games in maintaining physiological and psychological wellbeing. 3.5 Different Methods to Maintain Health, Wellness and to enhance mood 3.6 Nutrition for Health & Wellness, Relationship between Diet and Fitness Components of Balance Diet and its importance – Carbohydrates, Protein, Fat, Vitamins & Minerals, Water, Healthy Lifestyle through Diet and Fitness 3.7 Anxiety, Stress and Aging-Meaning of Anxiety, Stress and Aging, Types and Causes of Stress, 3.8 Stress, anxiety and depression reduction with exercise, yoga and meditation 3.9 Energy Continuum and Recovery Process, Metabolism and exercise, Recovery from exercise, Replenishment of energy stores during recovery process, Removal of excess lactic acid produced during exercise	CO3, CO4

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400208

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
<i>LSO 1.1.</i> Perform various sports activities for overall growth and development <i>LSO 1.2.</i> Select suitable sport activities as per your need.	1.	Track & Field: Running, Jumping, walking and Throwing, Cycling Event to develop Endurance, Speed, Strength, Agility, Flexibility etc	CO1
	2.	Aerobics and Gymnastics to develop Strength, Agility and Flexibility	
	3.	Net/Wall Sports – Volleyball and Basketball to develop Endurance, Speed, Strength, Agility and Flexibility	
	4.	Striking & Fielding sports like Cricket, bowling, Hockey, Football Baseball etc. to develop Endurance, Speed, Strength, Agility, Flexibility and Coordination	
	5.	Racket Game- Tennis, Badminton, Table tennis etc to develop Endurance, Speed, Strength, Agility and Flexibility	
	6.	Outdoor games: Kho-Kho and Kabaddi and cycling develop Endurance, Speed, Strength, Agility and Flexibility	
	7.	Indoor games: Chess and Carrom, Swimming, Boxing, Karate Weightlifting, Power Lifting, Physique Training, Archery, Roller Skating etc to develop concentration.	
	8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.	
<i>LSOs 2.1</i> Perform various yogic techniques for internal purification and development.	9.	Shat Karmas: Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	CO2
	10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana	
	11.	Perform following asnas with correct posture: Vakrasana, Chakrasana, Paschimottanasana, Ugrasana, Gomukh asana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra	
	12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwsini-Mudra, Suriyanamaskar	
	13.	BANDHAS Jalandhara-Bandha, Jihva-Banda, Uddiyana Bandha, Moola-Bandha	
	14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari, Sitali, Kapalabhati	
	15.	MEDITATION -Silent Meditation	
	16.	MEDITATION – Mantra Meditation	
<i>LSO 3.1.</i> Prepare diet chart for optimal health and wellbeing	17.	Prepare a diet chart for the given sport.	CO3
<i>LSO 3.2.</i> Use health monitoring device	18.	Measure heart rate and heart function with health monitoring device	

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
	19.	Measure blood sugar and blood pressure	
LSO 3.3. Use different equipment's	20.	Use massage therapy equipment, Hot and cold therapy equipment, Ultrasound therapy equipment	
LSO 3.4. Identify your own threshold and identification level for different taste Stimulations	21.	Determine the taste threshold for three different sensations- sweet salty and sour	
LSO 3.5. Check the given sample for conformance to the standard for moisture content.	22.	Determine the moisture content in the given sample of oil/fat	
LSO 3.6. Purity tests of oils/fats	23.	Determine the impurities in the given sample of oil.	
LSO 3.7. Acidity test in given sample of fat/oil	24.	Determines the acid value and free fatty acids in the given sample of oil/fat.	
LSO 3.8. Check whether any given samples of oils/fats conform to the standard.	25.	Determine the peroxide value in the given sample of fat or oil.	

L) Suggested Term Work/ Activities and Self Learning: S2400208 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.

- Calculate your Body Composition (BMI) and Cardiovascular Assessment
- Assessment for Muscular Endurance, Muscular Strength,
- Flexibility, Cardio-respiratory Endurance, Body Composition
- Rules and Regulations of different indoor and outdoor games.

b. Micro Projects:

- Identify and synthesize the factors that influence health in various situations (05 situations). Prepare a report with details of situations and solutions to remove the factors.
- Visit different sports club, gyms, and schools and identify various measure taken by them for Fitness and wellness of students/ members
- Visit different sports club, gyms, and schools and identify various measure taken by them for Fitness and wellness of physically challenged students/ members
- Identify which type of stress, anxiety and depression students are facing and steps and solutions to overcome this.

c. Other Activities:

1. Seminar Topics:

- Identify the health-related challenges in current time and able to apply the preventive measures.
- Role of peers, community and media in health and wellbeing in each level
- Knowledge and skills required to preserve community health and well-being
- Effect of yoga and meditation in maintaining fitness.

- Methods to involve physically challenged students /members in all levels in sports, yoga and meditation in community.
 - Counselling techniques to counsel players in matters of handling success and failure.
2. Visits: Visit nearby sports complex, Gyms, stadium etc and prepare a report on hygiene maintenance, medical facilities available, facilities available for physically challenged members, facilities available for old aged members, tools and equipment available and training facilities.

3. Self-Learning Topics:

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

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1, CO-4	-	-	35%	35%	35%	35%	35%
CO-2, CO-4	-	-	35%	35%	35%	35%	35%
CO-3, CO-4	-	-	30%	30%	30%	30%	30%
Total Marks	-	-	10	10	05	10	15
			25				

Legend:

- *: Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.
 **: Mentioned under point- (N)
 #: Mentioned under point-(O)

Note:

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

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Track & Field: Running, Jumping, walking and Throwing, Cycling Event to develop Endurance, Speed, Strength, Agility, Flexibility etc	CO1	30	60	10
2.	Aerobics and Gymnastics to develop Strength, Agility and Flexibility		30	60	10
3.	Net/Wall Sports – Volleyball and Basketball to develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
4.	Striking & Fielding sports like Cricket, bowling, Hockey, Football Baseball etc. to develop Endurance, Speed, Strength, Agility, Flexibility and Coordination		30	60	10
5.	Racket Game- Tennis, Badminton, Table tennis etc to develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
6.	Outdoor games: Kho-Kho and Kabaddi and cycling develop Endurance, Speed, Strength, Agility and Flexibility		30	60	10
7.	Indoor games: Chess and Carrom, Swimming, Boxing, Karate Weightlifting, Power Lifting, Physique Training, Archery, Roller Skating etc to develop concentration.		30	60	10
8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.		30	60	10
9.	Shat Karmas Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	CO2	40	50	10
10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana		40	50	10
11.	Perform following asanas with correct posture: Vakrasana, Chakrasana, Paschimottanasana, Ugrasana, Gomukhasana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra		40	50	10
12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwini-Mudra, Suriyanamaskar		40	50	10
13.	BANDHAS Jalandhara-Bandha, Jihva-Bandha, Uddiyana Bandha, Moola-Bandha		40	50	10
14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari, Sitali, Kapalabhati		40	50	10
15.	MEDITATION -Silent Meditation		40	50	10
16.	MEDITATION - Mantra Meditation		40	50	10
17.	Prepare a diet chart for the given sport.	CO3	40	50	10
18.	Measure heart rate and heart function with health monitoring device		40	50	10
19.	Measure blood sugar and blood pressure		40	50	10
20.	Use massage therapy equipment, Hot and cold therapy equipment, Ultrasound therapy equipment		40	50	10
21.	Determine the taste threshold for three different sensations- sweet salty and sour		40	50	10
22.	Determine the moisture content in the given sample of oil/fat		40	50	10
23.	Determine the impurities in the given sample of oil.		40	50	10
24.	Determines the acid value and free fatty acids in the given sample of oil/fat.		40	50	10
25.	Determine the peroxide value in the given sample of fat or oil.		40	50	10

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

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
1.	High end computers for record keeping	Processor Intel Core i7 with Open GL Graphics Card, RAM 32 GB, DDR3/DDR4, HDD 500 GB, Graphics Card NVIDIA OpenGL 4 GB, OS Windows 10	All
2.	Aerobics and Gymnastic	Basic facilities and equipment's – Balance Beams, Gymnastic Ball, Gymnastic Chalk, Gymnastic Clubs, Flex Floor Systems, High Bars, Hoops, Horizontal Bars, Leotards, Music, Parallel Bar, Pommel Horses, Ribbons, Rings, Ropes, Single Bar Trainer, Spotting Blocks, Streamers, Trampoline, Tumble Track, Uneven Bar, Vault, Vault Spring Board Gymnastic Accessories – Chalk, Grips, Wrist Supports, Mat, Tape, Socks Singlets, Pants Shoes, Shorts Aerobics- Resistance bands, Jump rope, Step bench or box, Abdominal wheel, Exercise mat, Gliding discs, dumbbells, fitness trampolines, hoops	2
3.	Striking & Fielding sports	Complete Cricket Kit, Football Kit, Bowling Kit, Hockey Kit	4
4.	Net/Wall Sports	Complete Volley Ball and basketball kit	3
5.	Racket Game	Complete Tennis Kit, Table Tennis Kit and badminton kit	5
6.	Outdoor games	Complete Kho-Kho and Kabaddi and cycling kit	6
7.	Indoor games	Complete Chess kit, Carrom kit, Swimming kit, Boxing kit, Karate kit, Weightlifting kit, Power Lifting kit, Archery kit and Roller-Skating kit	7

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
8.	Physique Training	Cardio Machines- Treadmills, Elliptical Trainers, Exercise Bikes, Rowing Machines, Indoor Bikes, Vibration Machines, Steppers Recumbents Dumbbells, Multi-Purpose Bench, power rack, Adjustable Dumbbell Set 2 x 3-10 kg, Exercise mat, resistance band, balance trainer	7
9.	Sports and wellbeing equipment's for physically challenged and impairments.	Fusion Wheel – all-in-one portable wheelchair gym, Pedal exerciser, Deluxe hand exerciser, Greepier sports shoelaces, Active Hands, Ramble Tag Guidance Aid, Cat Tongue Grip Tape Adaptive Cycling- Straps, Leg/ Foot Adapters, Prosthetics, Steering Dampener, Handlebar Adapters, HANDCYCLING- Wheelchairs, Bike-On Handcycles, Trikes, Racing Wheelchairs, Trikes, Recumbent Bikes, All-terrain Handcycles, Mono Cycling, Hand Bikes - Off-Road, Cross Country, Racing, Downhill Archery - Field Tripod and Quad Mounts (Archery & Gun), In-Line Draw-Loc, Mounts (Archery & Gun), Stands (Gun), Mounts (Archery & Gun) Binoculars and Rests (Gun), Crossbows (Archery), Wheelchair Platform Stabilizing Crutch Poles, Dampeners, Crossbows (Archery), Hands free shooting rest (Gun) Bowling: ramp, roll assist Fitness: Anti-Gravity Treadmill, LapMat for Wheelchairs, Strike Assist, Adaptive Treadmill	8
10.	Yoga	Yoga Mats, Yoga Rollers, Yoga Blocks, Aero Yoga Clothing Blankets, cloth Straps, Bolsters, Wheels	9-16
11.	Fitness and wellbeing equipment's	Health monitoring devices for overall health- Personal health monitor for heart health, Blood sugar monitoring device, Wireless blood pressure device, Smart watch to track heart function, Hot and cold therapy equipment, Massage therapy equipment, Ultrasound therapy equipment	18-20
12.	Taste kit -To test three different sensations- sweet salty and sour	Salt solution (%) -0.5, 0.8, 1.0, 1.2, 1.5, Sugar solution (%) - 0.05, 0.5, 0.7, 1.0, 1.2, Citric acid (%) - 0.02, 0.04, 0.1, 0.5, 1.0 Spoons, Bowls, Beakers, Plain distilled water	21
13.	Test kit to measure peroxide value in the oil	Reagents: Acetic acid-chloroform solution, Saturated potassium iodide solution, Sodium thiosulphate solution- 0.1 N, Starch solution (1%) Apparatus: Pipette 1ml capacity, Conical flask	25
14.	Test kit to measure acid value and free fatty acids in the oil	Sample of oil/fats namely any refined oil or hydrogenated fat. Reagents - ethyl alcohol (95%), phenolphthalein indicator solution, standard aqueous sodium or potassium hydroxide solution (0.1 N or 0.5 N), Pipette (10 ml), Conical flask	24
15.	Test kit to measure impurities in the oil	Sample of Oil/fat, Oven-electric, maintained at $100 \pm 1^\circ\text{C}$., Desiccator, Weighing balance, Filter paper	23
16.	Test kit to measure moisture content in the oil	Sample of oil/fat, Moisture dish-made of porcelain, silica, glass or aluminum, Oven-electric, maintained at $105 \pm 1^\circ\text{C}$., Desiccator Weighing balance	22

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

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

(b) Online Educational Resources:

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

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

(c) Others:

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