Curriculum

of

Diploma Programme

in

Civil Engineering

State Board of Technical Education (SBTE)
Bihar

Semester – I

Teaching & Learning Scheme

Board of Study	Course Codes	CourseTitles	Teaching & Learning Scheme (Hours/Week)					
			Classroom Instruction (CI)		Lab Instruction(LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
	2400101	**Basic Engg. Mathematics** (ME, ME (Auto), CE, MIE, CSE, AIML, EE, CRE, CHE, ELX, ELX (R), CT&M)	2	1	-	2	5	4
	2400102A	**Applied Physics -A** (CE, ME, ME (Auto), MIE, AE, FTS, CRE, CHE, CT&M)	3	-	4	2	9	6
	2425103	**Fundamentals of Mechanical Engg.** (CE, CRE, CHE, CT&M)	3	-	4	2	9	6
	2400104	**Communication Skills (English)** (Common for all Programmes)	3	-	4	2	9	6
	2415105	**Engg. Drawing & Graphics** (MIE, AE, CRE, CE, CHE, FTS, TE, EE, ELX, ELX (R), CT&M)	-	-	4	2	6	3
	2425106	**Mechanical Workshop** (ME, ME (Auto), MIE, AE, CRE, CE, CHE, CT&M)	-	-	4	2	6	3
	2400107	**Professional Ethics** (Cisco/KYP/ST) (Non-exam course) (CE, CSE, ELX, ELX (R), FTS, ME, ME (Auto), AIML, MIE, CHE, CRE, FPP, GT, CT&M)	1	-	-	-	1	1
	2400008	**Sports, Yoga and Meditation** (Common for All Programmes)	-	-	1	1	2	1
Total			**12**	**1**	**21**	**13**	**47**	**30**

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

Legend:

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

LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, 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) **For Non exam course institute have option to choose any one course** (Cisco/KYP/ST)

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

Semester - I

Assessment Scheme

Board of Study	Course Codes	Course Titles	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
			Theory Assessment (TA)		Term work & Self-Learning Assessment (TWA)		Lab Assessment(LA)		
			Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
	2400101	**Basic Engg. Mathematics** (ME, ME (Auto), CE, MIE, CSE, AIML, EE, CRE, CHE, ELX, ELX (R), CT&M)	30	70	20	30	-	-	150
	2400102A	**Applied Physics -A** (CE, ME, ME (Auto), MIE, AE, FTS, CRE, CHE, CT&M)	30	70	20	30	20	30	200
	2425103	**Fundamentals of Mechanical Engg.** (CE, CRE, CHE, CT&M)	30	70	20	30	20	30	200
	2400104	**Communication Skills (English)** (Common for all Programmes)	30	70	20	30	20	30	200
	2415105	**Engg. Drawing & Graphics** (MIE, AE, CRE, CE, CHE, FTS, TE, EE, ELX, ELX (R), CT&M)	-	-	20	30	20	30	100
	2425106	**Mechanical Workshop** (ME, ME (Auto), MIE, AE, CRE, CE, CHE, CT&M)	-	-	20	30	20	30	100
	2400107	**Professional Ethics** (Cisco/KYP/ST) (Non-exam course) (CE, CSE, ELX, ELX (R), FTS, ME, ME (Auto), AIML, MIE, CHE, CRE, FPP, GT, CT&M)	25	-	-	-	-	-	25
	2400008	**Sports, Yoga and Meditation** (Common for All Programmes)	-	-	10	-	06	09	25
Total			**145**	**280**	**130**	**180**	**106**	**159**	**1000**

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

Legend:

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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

A) Course Code : **2400101 (T2400101/S2400101)**

B) Course Title : Basic Engineering Mathematics

C) Pre- requisite Course(s) : Algebra, Geometry, Trigonometry

D) Rationale :

This course provides strong foundation in mathematical concepts and techniques that can be applied in a variety of settings and can help them develop important problem-solving and logical thinking skills that are valuable. This basic course of Mathematics is being introduced as a foundation which will help in developing the competency and the requisite course outcomes. Calculus is a branch of Mathematics that calculates how matter, particles and heavenly bodies actually move. Derivatives are useful to find maxima and minima of the function, velocity and acceleration and also useful for many engineering optimization problems. Statistics can be defined as a type of mathematical analysis which involves the method of collecting and analyzing data and then summing up the data into a numerical form for a given set of factual data or real-world observations. This course is an attempt to initiate the multi-dimensional logical thinking and reasoning capabilities. It will help to apply the principles of basic mathematics to solve related technology problems. The course provides the insight to analyze engineering problems scientifically using, determinants, matrices, trigonometry, coordinate geometry, and statistics. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used for modeling and analysis in a wide range of applications in engineering.

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 the ability to solve engineering related problems based on applications of algebra.

CO-2 Use concept of derivative as a tool to solve engineering related problems.

CO-3 Apply differential calculus to solve branch specific problems.

CO-4 Use concept of Coordinate geometry to solve branch specific engineering related problems.

CO-5 Apply techniques and methods of probability and statistics to crack branch specific problems.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	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	-	-	-	-	-	-		
CO-2	3	1	-	-	-	-	-		
CO-3	3	1	1	-	-	-	1		
CO-4	3	1	-	-	-	-	-		
CO-5	3	2	1	1	-	-	1		

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

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

G) Teaching & Learning Scheme:

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

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

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

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

Legend:

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

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

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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: T2400101

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Find solution of system of equations in three unknown applying Cramer's rule. *TSO 1b.* Solve simple given problems based on Algebra of matrices. *TSO 1c.* Find inverse of matrix applying the concept of Adjoint of matrix. *TSO 1d.* Find solution of simultaneous equations in three variables using the concept of Matrix Inversion method. *TSO 1e.* Solve problems based on sum, subtraction of Vectors. *TSO 1f.* Solve simple problems related to Scalar and Vector product of vectors.	**Unit-1.0 Algebra** **Determinant** 1.1 Concept and properties of determinant. 1.2 Solutions of simultaneous equations in three Unknowns by Cramer's rule. **Matrices** 1.3 Algebra of matrices (Addition, Subtraction, Multiplication by Scalar and Multiplication of Two matrices). 1.4 Transpose, Adjoint and Inverse of Matrix. 1.5 Solutions of simultaneous equations of a Matrix of order 3 x3 by Inversion method. **Vectors** 1.6 Position vector. 1.7 Algebra of Vectors (Addition, Subtraction, Scalar Multiplication with vector). 1.8 Scalar product. 1.9 Vector product.	**CO1**
TSO 2a. Define concept of function and its types. *TSO 2b.* Solve simple problems based on Domain and range of function. *TSO 2c.* Evaluate problems of limit function based on Indeterminate form. *TSO 2d.* Check continuity of function at a point. *TSO 2e.* Find differentiation of some simple function (sinx, cosx, tanx and e^x) by first principle. *TSO 2f.* Calculate derivative of given Algebraic, trigonometric and exponential functions. *TSO 2g.* Find derivative of sum, product and quotient of given two functions. *TSO 2h.* Find the differentiation of given composite functions applying the concept of Chain rule. *TSO 2i.* Find derivative of Logarithmic, Implicit and Parametric functions.	**Unit-2.0 Differential Calculus** **Function and Limit** 2.1 Concept of function. 2.2 Different type of functions. 2.3 Domain and Range of function. 2.4 Concept of Limits and its evaluation. **Continuity** 2.5 Concept of continuity with simple problems. **Differentiation** 2.6 Differentiation by first principle. 2.7 Differentiation of Algebraic, trigonometric, Exponential and Logarithmic functions. 2.8 Differentiation of sum, product and quotient of two functions. 2.9 Differentiation of composite functions by Chain Rule. 2.10 Logarithmic differentiation. 2.11 Implicit differentiation. 2.12 Differentiation of Parametric functions.	**CO2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3a. Find second order derivative of given simple functions. *TSO 3b.* Solve simple problems based on Rolle 's Theorem and Mean Value Theorem. *TSO 3c.* Apply concept of Rate of change to solve give simple problems related to velocity, acceleration. *TSO 3d.* Apply rules of derivative to solve given applied problems related to tangent and normal. *TSO 3e.* Apply rules of derivative to solve applied problems based on Maxima-Minima and Radius of curvature.	**Unit-3.0 Application of Differential Calculus** 3.1 Successive differentiation up to second order. 3.2 Rolle 's Theorem and Mean value Theorem (without proof) with examples. 3.3 Rate of change of quantities. 3.4 Equation of Tangent and Normal. 3.5 Maxima and Minima. 3.6 Radius of curvature.	**CO3**
TSO 4a. Calculate angle between given two lines also find slope. *TSO 4b.* Formulate equation of straight lines of different forms. *TSO 4c.* Find perpendicular distance of a straight line from a given point and perpendicular distance between two parallel lines. *TSO 4d.* Solve given simple problems related to Circle and Parabola for engineering applications. *TSO 4e.* Solve given simple problems related to Ellipse for engineering applications.	**Unit-4.0 Co-ordinate Geometry** **Co-ordinate systems** 4.1 Introduction of Co-ordinate systems. **Straight lines** 4.2 Slope of a line, angle between two lines. **Various forms of Straight Lines** 4.3 Point-slope form, Two-point form, Slope intercept form, Intercept form, Normal form, General form. 4.4 Perpendicular distance of a line from a point, perpendicular distance between two parallel lines. **Conic Section** 4.5 Introduction of Conic-Section. 4.6 Equation of Circle in standard form. 4.7 Standard equation of parabola, ellipse and hyperbola.	**CO4**
TSO 5a. Compute probability of given simple problems based on Addition and Multiplication theorem. *TSO 5b.* Evaluate Mean, Median and Mode of the given data for engineering applications. *TSO 5c.* Calculate Range, Variance and standard deviation of given data for engineering applications. *TSO 5d.* Calculate Coefficient of variance of given data for engineering applications.	**Unit-5.0 Probability and Statistics** **Probability** 5.1 Concept of Probability. 5.2 Addition and multiplication theorems of Probability. **Measure of Central tendency** 5.3 Mean, Median, Mode. **Measure of Dispersion** 5.4 Range, Variance, Standard Deviation. 5.5 Coefficient of Variation.	**CO5**

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Determine the value of determinant by using available open source software. *LSO 1.2.* Determine inverse of a non-singular matrix by using open source software. *LSO 1.3.* Apply Matrix Inversion method to determine currents through various branches of given electrical networks. *LSO 1.4.* Determine the resultant force applied at a particle using properties of vector for a given engineering problem.	1.	• Value of determinant of order 3, 4 and higher using open source software. • Inverse of the non-singular matrix using open source software. • Calculation of current in electrical networks by Matrix Inversion method. • Geometrical interpretation of operations of vector algebra.	**CO1**
LSO 2.1. Geometrically represent the domain and range of given Modulus function, Signum function and Floor function. *LSO 2.2.* Verify geometrically the continuity of given function at a point. *LSO 2.3.* Determine the concavity and convexity of a given continuous function for given engineering application. *LSO 2.4.* Find acceleration of the given moving body at a time t.	2.	• Geometrical interpretation of domain and range of a function. • Geometrical interpretation of limit and continuity. • Branch specific engineering application of derivative. • Vibrations of a mass-spring system. • Branch specific engineering application of derivative of parametric function.	**CO2**
LSO 3.1. Determine the maximum height of a projectile trajectory using Roll's theorem. *LSO 3.2.* Use Lagrange's Mean Value theorem to find point at which the slope of the tangent becomes equal to the slope of the secant through its endpoints. *LSO 3.3.* Use the concept of derivative to find the slope of a bending curve for given engineering problem. *LSO 3.4.* Use the concept of tangent and normal to solve the given problem of Engineering Drawing. *LSO 3.5.* Use the concept of Maxima and Minima to obtain optimum value for given engineering problem. *LSO 3.6.* Use the concept of radius of curvature to solve given branch specific engineering problem.	3.	• Geometrical Interpretation of Rolle 's Theorem. • Geometrical Interpretation of Lagrange's Mean Value theorem. • Branch specific engineering application of rate of change of quantities. • Branch specific engineering applications of tangent and normal. • Branch specific engineering applications of maxima and minima. • Engineering applications of Radius of curvature.	**CO3**
LSO 4.1. Apply the concept of Gradient to draw graphs in engineering drawing. *LSO 4.2.* Use given form of straight line to calculate the speed, distance and time of moving object. *LSO 4.3.* Use concept of Ellipse to prepare a Model of the path of Planet and its foci.	4.	• Geometrical interpretation of Gradient. • Geometrical Interpretation of line in various forms. • Geometrical interpretation of perpendicular distance of a line. • Geometrical representation of conic-section.	**CO4**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 5.1. Use concept of probability to solve given problems based on Board, Playing card. *LSO 5.2.* Calculate the Standard Deviation for Concrete with the given data.	5.	• Applications of Probability and related theorems. • Applications of Mean, Median, and Mode for applied problems.	**CO5**

L) Suggested Term Work and Self Learning: **S2400101**Some sample suggested assignments, micro 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.

1. Solve the simultaneous system of equation in two variables by Matrix Inversion Method. Write down a Mathematical programming using any open source software to verify the result.
2. A rigid body is subjected to multiple forces acting at different points. Apply vector technique to calculate the net moment or torque acting on the body. Discuss the equilibrium condition and the significance of moment in term of structural integrity and mechanical system using open source software.
3. Represent the Graph of Trigonometric function, Logarithmic function on Geogebra and interpret the nature of graph and Make a pdf file.
4. Find the derivative of y= x^sinx and visualize the graph of the function and its derivative using any open source software geometrically.
5. A window in the form of a rectangle surmounted by a semicircular opening. The total perimeter of the window to admit maximum light through the whole opening. Prepare a model using concept of Maxima and Minima for the above problem and verify the result.
6. Find the curvature of x=4cos t and y= 3 sin t, at what point on this ellipse does the curvature have the greatest and least values? What are the magnitudes? Visualize the result graphically using any open source software.
7. When a double sided right circular cone is intersected by a plane, different types of conic sections are generated. Represent all these conic section on Geogebra and write down their equation.
8. Explain how parabolic reflectors are used in engineering applications such as Satellite Dish Antennas or Head Lights.
9. By Collecting the Data of Last 5 IPL series, Calculate the probability of winning a match by any two teams.
10. Collect the Data of Marks obtained by your class in 1st class test. Compute the Mean, Median, Mode and variance of the data and interpret the result.

b. Micro Projects:

1. Prepare charts displaying properties of Determinant and Matrices.
2. Prepare a chart for the use of Vector algebra to solve problems of rate of change of the mass of a fluid flow.
3. Draw graph of functions like x^2, sinx, cosx, tanx and e^x etc analytically on graph paper and verify using suitable open-source software like SageMaths, MATHS3D, GeoGebra, Graph and DPLOT and prepare a pdf file.
4. Collect at least 10 engineering applications for each Limits, Continuity and Differentiability and prepare a pdf file.
5. Prepare a chart consisting of 8-10 engineering related functions whose derivative does not exist.
6. Prepare model showing the application of Rolle's Theorem to determine the projectile trajectories of maximum height.
7. Prepare a chart consisting of any 10 applications of Mean value theorem related to real world problems.

8. Model to maximize the volume of a box made of a rectangle tin sheet by cutting off squares of same size from each corner and folding up. Also design models for at least 5 similar situation and prepare a soft file with animation.
9. Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
10. Prepare models using the concept of radius of curvature to bending of railway track.
11. Make a short video of duration 5-7 minutes for the use of Derivative to calculate the profit and loss in business using graphs.
12. Download 5-7 videos based on applications of Derivative to check the temperature variation, to find the range of magnitudes of the earthquake etc. watch them and write a report to detail out the mathematical steps involved.
13. Prepare the Charts of formulae showing different forms of straight line for engineering applications.
14. Draw the graph for the standard equations of Circle, Parabola, Ellipse and Hyperbola on the Chart paper using any open source software and make a file.
15. Prepare the Charts consisting tree diagram to find probability of given event.
16. Collect the data of world of work and find mean, mean deviation and standard deviation for that data using any open source software of Statistics and make a soft copy.
17. Download 5-7 videos based on applications of probability for the weather forecast, watch them and write a report to detail out the mathematical steps involved.

c. Other Activities:

1. Seminar Topics:
    - Applications of Integral calculus in control systems, dynamics and vibrations.
    - Applications of Determinant and matrices in graphic design to make digital images.
    - Application of Determinant and matrices for calculating the battery power outputs.
    - Application of Vector algebra in engineering mechanics.
    - Application of limit and continuity to measure the strength of the magnetic field, electric field.
    - Applications of Derivative for engineering & technology.
    - Application of radius of curvature for engineering and Science.
    - Applications of Derivative in economy to compute the level of output at which the total revenue is the highest, the profit is the highest and (or) the lowest etc.
    - Applications of Co-ordinate geometry to design of athletic tracks, recreational parks, building plans, roundabouts, Ferris wheels.
    - Application of ellipses to be used to orbits of planets, satellites, moons and comets etc.
    - Probability and statistics: Civil engineering, estimation of model uncertainties, identification of probability distribution.

2. Visits: Visiting following places would provide students an opportunity to see the application of various branches of mathematics in different fields. This will also help students to comprehend the career opportunities available in the field of mathematics.
    - Visit to a Science museum.
    - Visit to a mathematics research institute.
    - Visit to a Data Science Center.
    - Visit to a mathematics department of a college or university.
    - Visit to a software company.
    - Visit to a Space Agency.
    - Visit to a Gamming Studio.
    - Visit to a Science library.
    - Visit to planetarium.
    - Participation in mathematics competition.

3. Self-learning topics:
   - Participate in MOOCs based Course on Matrix offered from Foreign University: Methods and Applications.
   - Participate in MOOCs based Course on Differential calculus: Methods and Applications.
   - Participate in MOOCs based Course on Probability and its Engineering applications.
   - Participate in MOOCs based Course on Statistics and its Engineering applications.
   - Watching videos on applications of coordinate geometry to Real world problems.

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

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

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

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

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

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

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

O) Suggested AssessmentTable for Laboratory (Practical):

SN	Laboratory Practical Titles	Relevant Cos Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.					

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	Processor Intel Core i7 with Compilers and Programming Languages; RAM 32 GB, DDR3/DDR4, HDD 500 GB, OS Windows 10.	All
2.	Software	Scientific Calculators, Graphing Calculator, SCILAB, GraphEq^2.13, Micro soft Mathematics, GeoGebra, Math3D	1,2,3,4,5
3.	Printer	High Speed Duplex Printer	
4.	Scanner	Handheld 3D scanner, Accuracy up to 0.1 mm, Resolution up to 0.2 mm, Wireless technology with an inbuilt touch screen and battery, Extended field of view for capturing both large and small objects.	

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Elementary Engineering Mathematics	B. S. Grewal	Khanna Publishers,15th Edition. ISBN: 978-81-7409-257-1
2.	Engineering Mathematics (Third edition)	Croft, Anthony	Pearson Education, New Delhi, 2014. ISBN 978-81-317-2605-1

3.	Calculus and Its Applications	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
4.	Calculus and Analytic Geometry	G. B. Thomas, R. L. Finney	Addison Wesley, 9th Edition, 1995. ISBN 978-8174906168
5.	Understanding Engineering Mathematics	John Bird	Routledge; First Edition ISBN 978-0415662840
6.	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publ., New Delhi,2014, ISBN: 978-0-470-45836-5
7.	Mathematics-I	Deepak Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
8.	Mathematics-II	Garima Singh	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3
9.	Consider Dimension and Replace Pi	M.P. Trivedi and P.Y. Trivedi	Notion Press; 1st edition (2018), ISBN: 978-1644291795

(b) Online Educational Resources:

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

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

(c) Others:

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

A) Course Code : **2400102A(T2400102A/P2400102A/S2400102A)**

B) Course Title : Applied Physics – A (ME, ME (Auto), CE, MIE, CRE, CHE, AE, FTS, RE)

C) Pre- requisite Course(s) :

D) Rationale :

As a subject Physics includes large numbers of diverse topics, related to materials, energy and their interactions that exists in the world around us, it empowers us to explain the different physical phenomena by observation and prediction. Engineering Diploma graduates are required to use of principles of physics in various fields of engineering and technology and same has been given prominence in the course content. This course will help the diploma engineers to apply the basic concepts and principles of physics for solving various broad-based engineering problems and comprehend different state of art technology-based applications.

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

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

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

CO-2 Apply the concepts and principles of rotational motion in various civil and mechanical engineering problems.

CO-3 Select relevant materials for industrial applications based on its physical and thermal properties.

CO-4 Apply the concept of waves for various engineering applications involving wave dynamics

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

F) Suggested Course Articulation Matrix (CAM):

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

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

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

G) Teaching & Learning Scheme:

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

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

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

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

Legend:

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

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

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

Note:

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

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

J) Theory Session Outcomes (TSOs) and Units: T2400102A

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Distinguish between fundamental and derived physical quantity. *TSO 1b.* Estimate the errors in the measurement of given physical quantity. *TSO 1c.* Derive dimensional formula of a given physical quantity. *TSO 1d.* Apply dimensional analysis for inter conversion of units. *TSO 1e.* Establish relation between physical quantities using dimensional analysis. *TSO 1f.* Use dimensional analysis to check the correctness of a given equation.	**Unit-1.0 Unit and Measurements** 1.1 Physical quantities, fundamentals and derived units and system of units 1.2 Accuracy, precision and errors (systematic and random) in measurements, Method of estimation of errors (absolute and relative) in measurement, propagation of errors, significant figures 1.3 Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimension in an equation 1.4 Applications of dimensions: conversion from one system of units to other, corrections of equations and derivation of simple equations	**CO1**
TSO 2a. Explain circular motion and various terms related to circular motion. *TSO 2b.* Apply the concept of centripetal and centrifugal forces in a given situation. *TSO 2c.* Distinguish between translational and rotational motion. *TSO 2d.* Explain the terms torque and angular momentum. *TSO 2e.* Apply the principle of conservation of angular momentum in a given situation. *TSO 2f.* Find the moment of inertia of a given regular shape body.	**Unit-2.0 Circular and Rotational Motion** 2.1 Circular motion, angular displacement, angular velocity, frequency, time period, angular acceleration, relation between angular & linear velocity, linear acceleration & angular acceleration 2.2 Centripetal and centrifugal forces: banking of roads and bending of cyclist 2.3 Translational and rotational motion, torque and angular momentum, conservation of angular momentum and its applications 2.4 Moment of inertia and its physical significances, radius of gyration of rigid body, theorem of parallel and perpendicular axes (statements only), moment of inertia of rod, ring, disc and sphere (hollow and solid)	**CO2**
TSO 3a. Explain the stress-strain curve of a given elastic or plastic body. *TSO 3b.* Interrelate different coefficient of elasticity. *TSO 3c.* Apply the concepts of surface tension and viscosity to solve a given engineering	**Unit-3.0 Physical Properties of Matter and Heat** 3.1 Elasticity: Hooke's law, Coefficient of elasticity; Young's modulus, Bulk Modulus and modulus of rigidity and their inter-relation (No derivation), Poisson's ratio, stress-strain curve, elastic	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
problem. *TSO 3d.* Explain the behavior of given fluids on the basis of their viscosity. *TSO 3e.* Determine the various modes heat transfer in a given engineering problem. *TSO 3f.* Establish relation between coefficients of thermal expansion.	potential energy 3.2 Surface tension: Intermolecular Force, cohesive and adhesive forces, Surface Tension, Surface Energy, angle of contact, Ascent formula (No derivation), applications of surface tension, capillary action, effect of temperature and impurity on surface tension 3.3 Viscosity: Fluid, Viscosity and coefficient of viscosity, Critical Velocity, Reynold's number, streamline and turbulent flow, Terminal velocity, Stokes law and effect of temperature on viscosity. 3.4 Heat: Concept of Heat and Temperature and it's difference, modes of heat transfer: conduction, convection, radiation, coefficient of thermal conductivity, thermal expansion of solid, liquid and gas, coefficient of linear, surface and cubical expansions and relation amongst them.	
TSO 4a. Differentiate among periodic, oscillatory and simple harmonic motion. *TSO 4b.* Explain the various terms related to SHM. *TSO 4c.* Derive the expression for time period of given Bar pendulum. *TSO 4d.* Distinguish between mechanical and electromagnetic waves with examples *TSO 4e.* Differentiate between longitudinal and transverse waves with examples *TSO 4f.* Find the relation between the terms used to describe wave motion. *TSO 4g.* Explain the principle of Superposition of waves and beat formation with examples.	**Unit-4.0 Simple Harmonic Motion and Wave Motion** 4.1 Periodic and Oscillatory Motion 4.2 Simple Harmonic Motion (SHM): Displacement, Amplitude, phase, velocity, acceleration, time period, frequency and their interrelation, Conservation of energy in SHM, Compound pendulum: Bar pendulum 4.3 Types of waves: Mechanical and Electromagnetic waves, Transverse and longitudinal waves, wave velocity, frequency and wave length and their relationship, wave equation, amplitude, phase, phase difference, superposition of waves, Beats formation	**CO4**
TSO 5a. Apply the concept of photoelectric effect to explain the of photonic devices. *TSO 5b.* Explain Laser, components of laser and its various engineering applications. *TSO 5c.* Explain propagation of light in optical fiber and its engineering applications. *TSO 5d.* Describe the properties of nanomaterials and its various applications.	**Unit-5.0 Modern Physics** 5.1 Photoelectric effect; Photon, threshold frequency, work function, Stopping Potential, Einstein's photoelectric equation. 5.2 Lasers: Properties, Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, types of lasers: Ruby laser, He-Ne Laser, engineering and medical applications of lasers. 5.3 Optical fibers: Total internal reflection, acceptance angle and numerical aperture, Optical fiber types, applications of optical fibers 5.4 Nanotechnology: Properties (optical, magnetic and dielectric properties) of Nanomaterials and its application	**CO5**

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use Vernier caliper to measure the known and unknown dimensions of a given small object. *LSO 1.2.* Estimate the mean absolute error up to two significant figures.	1.	Vernier caliper	**CO1**
LSO 2.1. Use screw gauge to measure the diameter/ thickness of a given object. *LSO 2.2.* Estimate the mean absolute, relative and percentage errors up to three significant figures.	2.	Screw gauge	**CO1**
LSO 3.1. Use Spherometer to measure radius of curvature of given convex and concave mirror/surface. *LSO 3.2.* Estimate errors in the measurement.	3.	Spherometer	**CO1**
LSO 4.1. Determine the spring constant of a given spring.	4.	Spring Oscillator	**CO4**
LSO 5.1. Determine the time period of oscillation of given bar pendulum. *LSO 5.2.* Determine the radius of gyration and moment of inertia about an axis perpendicular to the plane of oscillation and passing through its center of mass of given bar pendulum.	5.	Bar Pendulum	**CO2, CO4**
LSO 6.1. Determine the coefficient of linear expansion of material of a given rod.	6.	Pullingger's apparatus	**CO3**
LSO 7.1. Use Searle's apparatus to determine the Young's modulus of a given wire.	7.	Searle's apparatus	**CO3**
LSO 8.1. Apply Stokes law to determine the coefficient of viscosity of a given viscous liquid.	8.	Stokes law	**CO3**
LSO 9.1. Determine the inverse square law relation between the distance of photocell and light source v/s intensity of light source.	9.	Photo-electric cell experiment	**CO5**
LSO 10.1. Determine the Numerical Aperture (NA) of a given step index optical fiber.	10.	Numerical Aperture of an optical fiber	**CO5**
LSO 11.1. Measure wavelength of a He-Ne/diode laser by using a plane diffraction grating.	11.	He-Ne/diode laser	**CO5**
LSO 11.2. Find the moment of inertia of a given flywheel	12	Fly wheel	**CO2**
LSO 11.3. Plot the graph between KE of Photo electron v/s frequency of incident light *LSO 11.4.* Determine the value of Plank's Constant (*h*) from the graph between KE v/s frequency of incident light. *LSO 11.5.* Determine the variation of stopping potential w.r.t frequency of incident *LSO 11.6.* photon	13	Photo electric effect (virtual lab experiment)	**CO5**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 11.7. Determine the wave length of different spectral lines of Hydrogen spectra	14	Emission Spectra of Hydrogen (virtual lab experiment)	**CO5**

L) Suggested Term Work and Self Learning: **S2400102A** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

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

b. Micro Projects:

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

c. Other Activities:

1. Seminar Topics:
   - Needs of measurements in engineering and science.
   - Applications of circular motions in daily life.
   - LASER: Production & applications in science, industry, medical and defense, holography.
   - Optical fibers: Construction and application in communication systems.
   - Synthesis and applications of nanomaterials.
   - CNT, Graphene and fullerene(C_{60})
   - Application of modes of different heat transmission in daily life.

2. Visits:
   - Visit nearby industry with Instrumentation, production and Laser/optical fibers facilities. Prepare report of visit with special comments Instrumentation technique and material used.
   - Visit planetarium, Science city and research institutions for exploring the experimental and research facilities available.

3. Self-learning topics:
    - Vectors and its properties with applications
    - Types of fundamental units, system of units
    - Newton's Laws of motion, momentum, inertia, impulse
    - Inertial and non-inertial frame of reference
    - Derivation of formula for moment of inertia
    - Force, work, energy, power, work-energy theorem, law of conservation of energy
    - Frictions and its types
    - Pressure, density, Pascal's law, atmospheric and gauge pressure
    - Work done in various Processes, Adiabatic constant (Cp/Cv = ϒ), Mayer's formula (Cp - Cv = R)
    - CO_2 Laser, Semiconductor LASER.
    - Interference and Diffraction of light

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	12%	12%	20%	20%	10%	30%	20%
CO-2	18%	18%	20%	20%	10%	10%	20%
CO-3	30%	30%	30%	20%	30%	30%	20%
CO-4	15%	15%	15%	20%	20%	10%	20%
CO-5	25%	25%	15%	20%	30%	20%	20%
Total Marks	**30**	**70**	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Unit and Measurements	6	CO1	8	4	2	2
Unit-2.0 Circular and Rotational motion	10	CO2	12	4	4	4
Unit-3.0 Physical Properties of Matter and Heat	12	CO3	20	4	8	8

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

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Vernier caliper	CO1	60	30	10
2.	Screw gauge	CO1	60	30	10
3.	Spherometer	CO1	60	30	10
4.	Spring Oscillator	CO3	50	40	10
5.	Bar Pendulum	CO2	50	40	10
6.	Pullingger's apparatus	CO3	60	30	10
7.	Searle's apparatus	CO3	50	40	10
8.	Stokes law	CO3	60	30	10
9.	Photo-electric cell experiment	CO5	40	50	10
10.	Numerical Aperture of an optical fiber	CO5	50	40	10
11.	He-Ne/diode laser	CO5	60	30	10
12.	Fly wheel	CO2	60	30	10
13.	Photo electric effect (virtual lab experiment)	CO5	70	20	10
14.	Emission spectra of Hydrogen (virtual lab experiment)	CO5	70	20	10

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

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment / Practical Number
1.	Vernier-Caliper	Range: 0-15 cm, Resolution 0.01 cm.	1,8
2.	Micrometer screw gauge	Range 0-25 mm, Resolution 0.01 mm	2,7,8
3.	Spherometer	Vertical scale range -10mm to 10 mm, Graduation resolution 0.01 mm	3
4.	Spring oscillator	A spring, a measuring ruler, mass hanger and variable masses (50 gram, 100 gram) .	4
5.	Bar pendulum	Bar pendulum, meter scale a knife–edge with a platform, sprit level, precision stop watch	5
6.	Pullingger's apparatus	Linear-expansion apparatus with steam generator, thermometer 0-100^{o}C range, rubber tubes, metal rods of aluminum, iron, copper, brass and steel	6
7.	Searle's apparatus	Two long steel wires of the same length and diameter, Brass rods, stopwatch, meter scale, 0.5 kg slotted masses, hanger	7
8.	Stokes's law apparatus	A long cylindrical glass jar, Transparent viscous fluid, stop watch, bob, glycerin, tube clamp stand, Meter scale, Spherical ball, Thread	8
9.	Photo-electric cell experiment	Photo cell mounted in the metal box, Lamp holder with 60W bulb, analog meters (500µA & 1000mV), wooden bench fitted with scale and connecting wires	9
10.	Numerical aperture of an optical fiber	Laser Diode (2- 3 mW, 632mm) Objective (10X), Optical fiber (1-meter-long), detector with BNC connector, Auto arranging Multimeter, Screen with circular graduations, one circular base with linear and circular motion, optical bench	10
11.	He-Ne/diode laser	He-Ne Laser (output 0.5 –5.0mW, wavelength 632.8 nm power supply 240V, 50Hz) Or diode laser (2- 3 mW, 632mm), Transmission grating 15000 lines/inch, photo detector with BNC connector and holder, screen with clamp type holder, knife edge with micrometer movement, digital multimeter, scale with mount	11
12.	Fly wheel	Fly wheel setup, (Fly wheel 200 mm diameter with axial support on bearing, hanger 100g+9x100g slotted weight	12
13.	Photo electric effect (virtual lab experiment)	https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1	13
14.	Emission Spectra of Hydrogen (virtual lab experiment)	https://vlab.amrita.edu/?sub=1&brch=195&sim=359&cnt=1	14

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Concept of physics-1	H.C. Verma	Bharti Bhawan Publications, 2021 ISBN: 8177091875, 978-8177091878
2.	Concept of physics-2	H.C. Verma	Bharti Bhawan Publications, 2021 ISBN: 8177092324, 978-8177092325
3.	Text Book of Physics for Class XI (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-508-3(Part-I) & ISBN: 81-7450-566-0 (Part-II)
4.	Text Book of Physics for Class XII (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN: 81-7450-631-4 (Part-I) & ISBN: 81-7450-671-3 (Part II)

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
5.	Engineering Physics	P. V. Naik	Pearson Education Ltd., 1993 ISBN: 817758362X,978-8177583625
6.	Applied Physics-I	Dr. Mina Talati & Vinod Kumar Yadav	Khanna Book Publishing (2021) ISBN : 978-93-91505-43-1
7.	Applied Physics-II	Dr. Hussain Jeevakhan	Khanna Book Publishing (2021) ISBN: 978-93-91505-57-8
8.	Engineering Physics	D. K. Bhattacharya & Poonam Tandon	Oxford University Press, ISBN: 0199452814, 978-0199452811

(b) Online Educational Resources:

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

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

(c) Others:

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

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A) Course Code : **2425103(T2425103/P2425103/S2425103)**

B) Course Title : Fundamentals of Mechanical Engineering (CE, CHE, CRE, CT&M)

C) Pre- requisite Course(s) :

D) Rationale :

Now a days as an advancement of technology interdisciplinary knowledge is must for the engineering diploma holders. An engineering diploma holder expected to look after many activities at work place, which may be of interdisciplinary. Knowledge other than own discipline plays important role in the development of individual as well as society. This course mainly encompasses the major areas of mechanical engineering which are being used by engineering diploma holders and are required to perform tasks such as selection of hand tools, power tools, welding, cutting, manufacturing processes, IC engines, refrigeration and air conditioning and power transmission drives used for various purposes. Such skills can be developed by knowing the basic principles of mechanical engineering. The motive of this subject is to enhance the knowledge & skill level in the interdisciplinary area. This course is designed in such a way that practical performed in this course will develop these basic skills to perform well in industry as well as in field work.

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. Interpret laws of thermodynamics
CO-2. Calculate brake thermal efficiency for the given data of an IC engines.
CO-3. Select relevant material and mechanical tools for a given job.
CO-4. Use relevant manufacturing process for a given component.
CO-5. Select relevant power transmission drives in real life application.

F) Suggested Course Articulation Matrix (CAM):

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

Board of Study	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				
Mechanical Engineering	2425103	Fundamental of Mechanical Engineering	03	-	04	02	09	06

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Board of Study	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)	
	2425103	Fundamentals of Mechanical Engineering	30	70	20	30	20	30	200

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

Legend:

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

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

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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: T2425103

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the role of thermodynamics in engineering. *TSO 1b.* Explain thermodynamics systems and its types. *TSO 1c.* Interpret laws of thermodynamics *TSO 1d.* Describe thermodynamic properties, process and cycle *TSO 1e.* Describe different modes of Heat transfer. *TSO 1f.* Use modes of heat transfer for the given situation.	**Unit-1.0 Introduction to Thermodynamics** 1.1 Role of thermodynamics in engineering and science, 1.2 Types of thermodynamics systems 1.3 Specific volume, enthalpy, pressure, temperature, thermodynamic work thermodynamic equilibrium 1.4 First law, second law and zeroth of thermodynamics 1.5 Enthalpy of wet steam, superheated steam, dryness fraction, degree of superheat 1.6 Modes of heat transfer: conduction-composite walls, combined conduction, convection, radiation, application of heat transfer modes	**CO1**
TSO.2a Differentiate between two stroke and four stroke engines *TSO.2b* Describe construction and working of a given diesel engine. *TSO.2c* Describe construction and working of a given petrol engine *TSO.2d* Calculate brake thermal efficiency of an IC engines. *TSO.2e* Identify simple faults in the given engine. *TSO.2f* Suggest remedial measures to rectify the given fault *TSO.2g* Calculate coefficient of performance and of tonnage capacity of an air conditioning system *TSO.2h* Explain construction and working of a given refrigeration system. *TSO.2i* Describe the troubleshooting procedure of a given refrigeration system and air-conditioning system.	**Unit-2.0 Internal Combustion Engine and Refrigeration** 2.1 Types of internal combustion engines- S.I. and C.I. Engines, 2.2 Construction and working two stroke and four stroke petrol engines and two stroke and four stroke diesel engines 2.3 BP, heat supplied and brake thermal efficiency of IC engines. 2.4 Common faults in IC engines, remedial measures to rectify the faults 2.5 Air pollution due to IC engines. 2.6 Heat engine, concept of refrigeration, ton of refrigeration, unit of refrigeration, COP 2.7 Major components of vapor compression systems, heat pump, Carnot cycle, Carnot efficiency, 2.8 Types of refrigerants 2.9 Types of air conditioning systems - window, package, central air-conditioning systems 2.10 Domestic refrigerator. 2.11 Basic fault finding in refrigerator and window air-conditioner. 2.12 Methods of energy saving in refrigeration and air-conditioning systems.	**CO2**
TSO 3a. Classify engineering materials. *TSO 3b.* Select engineering materials as per the given situation *TSO 3c.* Describe different properties of the given material.	**Unit-3.0 Engineering Materials** Introduction to engineering materials, classification of materials 3.1 **Metallic materials**	**CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3d. Identify the properties of a given material. *TSO 3e.* Differentiate between metallic and nonmetallic material	• Ferrous alloys- carbon steel, low-alloy steel, tool steel, stainless steel, cast iron • Aluminum alloys, nickel alloys, copper alloys, titanium alloys, • Magnetic, dielectric and superconducting materials 3.2 **Non-metallic materials** • Ceramics – types and applications • Polymers-thermoplastic polymers, thermosetting polymers, elastomers • Metallic glasses: types, glass forming ability of alloys, melt spinning process • Composites-particulate composites, fibrous composites, laminated composites 3.3 **Mechanical properties** Tensile strength, elasticity, plasticity, hardness, toughness, brittleness stiffness, ductility, malleability, cohesion, impact strength, fatigue, creep, hooke's law, poisson's ratio 3.4 **Magnetic properties of materials** Intensity of magnetization, magnetic field (h) or magnetic intensity, magnetic susceptibility, retentivity, coercivity 3.5 **Optical properties of materials-** elastic properties of materials, dielectric properties of materials 3.6 **Physical properties of materials** Electrical conductivity, melting temperature of material, semiconductors, thermal conductivity, fusibility, reluctance (as magnetic properties), density, melting point and boiling point.	

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO.4a Select machine tool as per the given job. *TSO.4b* Use machine tools for the given job. *TSO.4c* Explain different operation performed on the given machine tool. *TSO.4d* Select welding equipment for the given job *TSO.4e* Explain working of arc and gas welding *TSO.4f* Explain brazing and soldering process *TSO.4g* Describe the procedure for casting of given job. *TSO.4h* Explain concept of various metal forming processes. *TSO.4i* Identify metal forming process for the given job. *TSO.4j* Prepare a simple job with ABS material using 3D printer *TSO.4k* Select suitable 3D Printer and software for the given application with justification.	**Unit-4.0 Manufacturing Processes and machine tools** 4.1 Basic machine tools. • Introduction to lathe, drill, milling and grinding machines. • Types of operations / jobs which can be performed on machine tools listed above. 4.2 Metal joining processes. • Welding-types, working setup of arc and gas welding, precautions and safety during arc and gas welding. • Brazing and soldering-general set up, applications. 4.3 Foundry- concept, process of casting a component, applications. 4.4 Basic metal forming processes-bending, rolling, forging and extrusion –concept and its application 4.5 Additive manufacturing techniques-introduction to various additive manufacturing processes-stereo-lithography, LOM, FDM, SLS, SLM, Binder Jet technology, Direct Energy Deposition 4.6 FDM based 3D printer, its working and construction, Process parameters	**CO4**
TSO.2a Identify different mode of power transmission. TSO.2b Select suitable power transmission mode for given application. TSO.2c Identify the different types of Brake, Clutch and Coupling. TSO.2d Explain with sketches construction and working of given brake, clutch and coupling TSO.2e Explain the types of belts and its velocity ratio.	**Unit-5 power transmission** 5.1 Belt drives - flat belt and v– belt drive, ropes and chain, velocity ratio slip, length of the belt, open belt and cross belt drives the ratio of friction tensions, centrifugal tension in a belt Power transmitted by belts and ropes Initial tensions in the belt 5.2 Gear drives-classification, simple, compound – reverted and epicyclic gear trains, their selection for different applications, gear trains velocity ratio, velocity ratio, gear ratio, 5.3 Couplings- muff coupling and flange coupling joints-cotter joint and knuckle joint 5.4 Helical springs (closed and open coil) 5.5 Friction clutches: single plate, multi plate, cone clutch, variable speed clutch, positive drive clutches: claw and jaw clutch. (construction and working) 5.6 Brakes: shoe brake, internal expanding and disc brakes. (construction and working) 5.7 Fasteners: keys, nut-bolt connections, screws, rivets	**CO5**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2425103

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Calculate thermal conductivity for thick &composite slab	*1*	Determine the thermal conductivity of a thick slab	CO1
	2	Determine the thermal conductivity of Composite Wall.	CO1
LSO 2.1. Dismantle and assemble given engines	*3*	Dismantle and Assemble two stroke and four stroke petrol engines.	CO2
LSO 2.2. Identify the various component in IC engines	*4*	Identify the various processes and components of two stroke and four stroke petrol engines.	CO2
LSO 2.3. Use trainer to Design and assemble given circuit	*5*	Design and assemble a circuit that extends and retracts a single acting (spring return) and double acting cylinder on a given trainer.	CO2
LSO 2.4. Determine the properties and coefficient of performance.	*6*	Determine properties of air (Dry bulb temperature, Wet bulb temperature, Humidity)	CO2
	7	Determine of coefficient of performance and of tonnage capacity of an Air conditioning system	CO2
LSO 2.5. Identify components of refrigeration system.	*8*	Identify the components of refrigeration system and air conditioning system	CO2
LSO 3.1. Identify the microstructure of different materials	*9*	Use microscope to identify microstructure of material	CO3
LSO 3.2. Use hardness testing machine	*10*	Measure hardness of given material using given hardness tester.	CO3
LSO 3.3. Use tensile testing machine	*11*	Measure tensile strength of given metallic materials using tensile test method.	CO3
	12	Determination of tensile properties of composite	CO3
LSO 3.4. Use compressive testing material	*13*	Determination of compressive properties and shear properties of unidirectional lamina	CO3
LSO 3.5. Use charpy impact machine	*14*	Use the charpy impact test to measure the values of the impact energy (also called notch toughness) of steel samples.	CO3
LSOs 4.1 Use lathe machine	*15*	Prepare a plain turning and taper turning job as per the given drawing.	CO4
LSOs 4.2 Use milling machine	*16*	Prepare a job on the milling machine as per the given drawing.	CO4
LSOs 4.3 Use of gas & arc welding for given metal.	*17*	Perform gas welding operation on the given job.	CO4
	18	Perform arc welding operation on the given job	CO4
LSOs 4.4 Use soldering and brazing equipment	*19*	Perform soldering and brazing operation on the given job.	CO4
LSOs 4.5 Use sheet metal operation for the given job.	*20*	Prepare a sheet metal product (Funnel) and report the various parameters for the various passes during the rolling of the given metal piece.	CO4
LSOs 4.6 Use different foundry tools and equipment's	*21*	Select different foundry tools and equipment's for a given job	CO4
LSOs 4.7 Prepare sand mold	*22*	Identify various stages of casting through demonstration of Sand-Casting Process.	CO4

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
	23	Prepare of a sand mold with a simple pattern	CO4
LSOs 4.8 Prepare solid pattern	*24*	Produce wooden solid pattern as per given drawings.	CO4
LSOs 4.9 Produce a component using available 3D printer	*25*	Print one single component on available 3D printer with PLA/ABS material	CO4
LSO 5.1. Identify the various component in Clutches.	*26*	Dismantle and assemble different clutches as per the given instruction	CO5
LSO 5.2. Select different drives for the given job	*27*	Use belt, chain and gear drive for the given job.	CO5
LSO 5.3. Determine velocity ratio of given drives	*28*	Calculate the velocity ratio for given compound gear train	CO5
	29	Determine the velocity ratio of a flat belt drive.	CO5
	30	Determine the velocity ratio of simple gear drive.	CO5
LSO 5.4. Identify the various component in brakes and couplings	*31*	Dismantle and Assemble different brakes and couplings as per the given instruction	CO5

L) Suggested Term Work and Self Learning: **S2425103** 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.

a. Calculate the refrigeration capacity of a given room in ton.
b. Write 05 uses of sheet metal in detail in our daily life
c. Identify the types of manufacturing process used in a given 10 samples.
d. Select the power transmitting element for the five situations with reason.
e. Draw and Study circuit diagram for starting motor of IC engines and Battery Ignition system.
f. Collect videos, animations showing working of different types of air compressors.
g. Make a troubleshooting chart for Domestic refrigerators.
h. Collect manufacturer's specifications for various refrigeration controls.

b. Micro Projects:

- Print two pieces of same components using ABS and PLA and compare their strength, surface roughness, weight, cost.
- Build model of different gears from cardboard.
- Build model of IC Engine parts from cardboard.
- Prepare cast product with wax material
- Make models of controls demonstrating their functions at least 3 under guidance of instructor/teacher in lab/ workshop.
- Prepare a given product using arc welding/gas welding.
- Market survey on gears and collect information of different types of gear used in machine equipment, prepare a chart showing different gears and its uses.
- Prepare a report on refrigerant used in domestic refrigeration, car refrigeration system etc.
- Prepare a report on emission of petrol engine and diesel engine.

c. Other Activities:

1. Seminar Topics:
   - Refrigerants used in Commercial air conditioning & Refrigeration system
   - Properties of PLA and ABS 3D printing materials.
   - Sheet metal operations and its application.
   - Recent advancement in brake and its advantages.
   - Classification of engineering materials and its properties.
   - Application of solar energy as a power source.
   - Future scope of renewable energy source as power generation system.
2. Visits:
   - Visit nearby workshop/industry with sheet metal facilities. Prepare report of visit with special comments on different operation performed and material used in production.
   - Visit nearby workshop/industry with welding facilities. Prepare report of visit with special comments on different joining process used and material.
   - Visit a nearby dairy plant and prepare a report on process involve in storage of diary product.
   - Visit a nearby power plant and prepare a report on step involve/equipment used in power generation.
   - Visit nearby tool room/industry with 3D Printing facilities. Prepare report of visit with special comments of 3D printing technique used, material used, single component/batch production/mass production and cost of printed component.
3. Self-learning topics:
   - 3D printing of micro/mini components.
   - Conversion of CAD file formats into IGES.
   - Types of nut-bolt/coupling devices/rivets used in industry.
   - Refrigerant used in commercially available refrigeration and air conditioning system.
   - Different types of energy sources available in India.

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	15%	15%	15%	-	-	20%	20%
CO-2	10%	10%	10%	25%	-	10%	20%
CO-3	15%	15%	15%	25%	33%	15%	20%
CO-4	30%	30%	30%	25%	33%	15%	20%
CO-5	30%	30%	30%	25%	34%	40%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (Cl) Hours	Relevant COs Number (s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application& above (A)
Unit-1.0 Introduction to Thermodynamics	9	CO1	10	4	4	2
Unit-2. 0 Internal Combustion Engine and Refrigeration	10	CO2	15	4	6	5
Unit-3.0 Engineering Materials	9	CO3	15	4	5	6
Unit-4.0 Manufacturing processes and machine tool	10	CO4	15	4	5	6
Unit-5.0 Power transmission	10	CO5	15	4	4	7
Total Marks	**48**	-	**70**	**20**	**24**	**26**

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1	Determine the thermal conductivity of a thick slab	CO1	40	50	10
2	Determine the thermal conductivity of Composite Wall.	CO1	40	50	10
3	Dismantle and Assemble two stroke and four stroke petrol engines.	CO2	40	50	10
4	Identify the various processes and components of two stroke and four stroke petrol engines.	CO2	40	50	10
5	Design and assemble a circuit that extends and retracts a single acting (spring return) and double acting cylinder on a given trainer.	CO2	40	50	10
6	Determine properties of air (Dry bulb temperature, Wet bulb temperature, Humidity)	CO2	40	50	10
7	Determine of coefficient of performance and of tonnage capacity of an Air conditioning system	CO2	40	50	10
8	Identify the components of refrigeration system and air conditioning system	CO2	40	50	10
9	Use microscope to identify microstructure of material	CO3	40	50	10
10	Measure hardness of given material using given hardness tester.	CO3	40	50	10
11	Measure tensile strength of given metallic materials using tensile test method.	CO3	40	50	10
12	Determination of tensile properties of composite	CO3	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
13	Determination of compressive properties and shear properties of unidirectional lamina	CO3	40	50	10
14	Use the charpy impact test to measure the values of the impact energy (also called notch toughness) of steel samples.	CO3	40	50	10
15	Prepare a plain turning and taper turning job as per the given drawing.	CO4	40	50	10
16	Prepare a job on the milling machine as per the given drawing.	CO4	40	50	10
17	Perform gas welding operation on the given job.	CO4	40	50	10
18	Perform arc welding operation on the given job	CO4	40	50	10
19	Perform soldering and brazing operation on the given job.	CO4	40	50	10
20	Prepare a sheet metal product (Funnel) and report the various parameters for the various passes during the rolling of the given metal piece.	CO4	40	50	10
21	Select different foundry tools and equipment's for a given job	CO4	40	50	10
22	Identify various stages of casting through demonstration of Sand-Casting Process.	CO4	40	50	10
23	Prepare sand mold with a simple pattern	CO4	40	50	10
24	Produce wooden solid pattern as per given drawings.	CO4	40	50	10
25	Print one single component on available 3D printer with PLA/ABS material	CO4	40	50	10
26	Dismantle and assemble different clutches as per the given instruction	CO5	40	50	10
27	Use belt, chain and gear drive for the given job.	CO5	40	50	10
28	Calculate the velocity ratio for given compound gear train	CO5	40	50	10
29	Determine the velocity ratio of a flat belt drive.	CO5	40	50	10
30	Determine the velocity ratio of simple gear drive.	CO5	40	50	10
31	Dismantle and Assemble different brakes and couplings as per the given instruction	CO5	40	50	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Experimental setup for the measurement of thermal conductivity of thick slab and composite wall	Guarded Hot Box, Solar Calorimeter, Large Diameter Integrating Sphere, Environmental Chambers, Heat Flow Meters, Computer Simulation Software, Guarded Hot Plate (ASTM C177), Guarded-Comparative–Longitudinal Heat Flow Meter, Comparative-axial-heat-flow (cut-bar) Method, Transient Hot Wire, Laser Flash Diffusivity	1,2
2.	Single cylinder two stroke petrol engine	Two stroke single cylinder horizontal petrol engine Power:3- 4.5 HP, Speed: 4000-6000 rpm, bore: 70-80 mm, stroke length:66.7-70mm, starting: rope & self-starting, working cycle: four strokes, Engine cooling: forced air cooled, V C R head cooling: water cooled, Method of ignition: spark ignition, Orifice dia: 20mm, Compression ratio: 2.5:1 to 8:1, Spark plug	3,4
3.	Single cylinder four stroke diesel engine test rig	Bore: 85-90 mm, Stroke: 80-85 mm, RPM: 1500-1700, BHP: 5 -5.5 HP, 3.7 KW, Fuel: High Speed Diesel oil, Sp. Gr.: 0.83, C.V: 10,833 Kcal/k	3,4
4.	Single cylinder four stroke petrol engine test rig	Four stroke single cylinder vertical petrol engine Power: 2.9 KW, Speed: 3000 -4000 rpm, Air cooled Engine, Bore: 70-75mm, Stroke: 66.7-7 mm, Capacity: 256 cc, Fuel: Petrol, Sp. Gr: 0.71	3,4
5.	Pneumatic trainer and hydraulic trainer	Pneumatic and hydraulic trainer	5
6.	Air conditioning system test rig	Compressor unit, condenser, evaporator, cooling chamber, controlling and measuring instrument control panel	7
7.	Refrigeration system test rig	Compressor unit, condenser, evaporator, cooling chamber, controlling and measuring instrument control panel	8
8.	Hardness testing machine	• **Rockwell harness tester** - JIS B 7726 ISO 6508-2 ASTM E18-10, preliminary test force 98.07N (10kgf), 29.42 (3kgf) Manual (with automatic brake-start), Test Force Rockwell-588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf) Automatic (loading, duration) Maximum Specimen Ht. 7.1-7.5", Maximum Depth 6.5-7" • **Brinell hardness tester**- Brinell scale load range of 612N – 29.42 KN (62.5 kgf – 3000 kgf.), display- Hardness HB value (after entering diagonal length into keypad calculator); Mean diagonal length; Test force; Dwell time; Ball diameter; Conversion; Limits, hardness Resolution 0.1 unit if HB < 100; else 1.0 unit, Standards Compliant ISO 6506, ASTM E10, JIS, Test Load Type -Load Cell Closed-Loop Control System, Test Cycle-Automatic, Test Loads-62.5, 187.5, 250, 500, 750, 1000, 1500, 3000kgf	10
9.	Tensile testing machine	Motor: ¼ HP Single Phase 220 / 110 V AC Supply Speed: 100 mm/min and 200 mm/min (Changeable through	11,12

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
		Belt & Pulley mechanism), Display: Digital (LED), Accuracy: ± 2% at Full Load (with master load) Grip to Grip separation: Min 25mm and Max. 700mm	
10.	Compressive testing machine	1000 KN - for load cell calibration - fully automatic - servo controlled	13
11.	Impact testing machine	Impact tester should confirm to the Standards: ASTM D 256 & ASTM D 6110, ISO 180 & ISO 179, Microprocessor Controlled equipment with possibility to modify and create test parameters according to standard and store templates, Possibility to save data and export selected data with customized format, Real time display of impact energy, resilience, pendulum angle, impact speed and statistical analysis Pendulum Impact Energy Range- 0-25 Joules, Least Count of Indication- 0.01 Joules, Release Angle of Pendulum -150˚, Striking velocity range of Pendulum -2.5 – 3.8 m/s, Hammers -Hammers for Izod Impact Tests –2.75 J, 5.5 J,11.0 J ,Hammers for Charpy Impact Tests – 1.0 J, 2.7 J, 5.4 J (ASTM D 6110), Hard chrome plated vice , Notch cutting device, Digital Notch depth measuring device (0 to 12 mm), specimens for Izod & Charpy impact test as per ASTM & ISO specification, Motor driven, attached with constant profile tungsten carbide knife, "V" notch (45^o), Type A, Type B and Type C Comply to ASTM D 256	14
12.	Hand tools	Different spanners (Wrench), Pliers, Screw drives, Chisel, Hand hacksaw, Hammers.	15,16
13.	Power tools-	Portable Drilling and grinding machine, Electric power saw, portable electric cutter, electric demolition hammer, power screw driver.	15,16
14.	Belt arrangement	Working models of different belts in different arrangement.	27,28
15.	Belt and gear drives	Working models of belt drives, chain and sprocket, various gear drives.	27, 29,30
16.	Cut section models of brakes	Working and cut section models of various types of brake assemblies.	31
17.	Models of clutch	Models (Wooden/Plastic/Metallic) of various clutch (suitable for dismantling)	26
18.	Models of coupling	Models (Wooden/Plastic/Metallic) of various coupling. (suitable for dismantling)	
19.	Center Lath	Medium Duty Lathe Machine, Bed Width-240 to 350 mm, Universal Gear Box Center lathe machine (length between centers:1200mm), Max Spindle Speed-1600 to 2000 RPM, Spindle Bore 40 mm to 55 mm, Layout-Horizontal, Automation Grade, Number of Spindle Speeds- 8 to 12, Power 2.2 kW to 5.5 kW, Drive Type-Geared	15
20.	Milling machine	Automatic for Multi-purpose, Table size of Vertical Drive Milling Machine - 325 x 1470 approx, Longitudinal Travel-700-800, Vertical Travel-480-500, cross travel- 350-400, power feed – 700-800, head and ram rotate parallel on body -360-degree, Ram travel – 400-500, Motor, 3 to 3.5 HP, No. of Speeds- 8 Min 75 RPM, Max 3000-4000 RPM	16
21.	Arc welding machine	Arc Welding machine welding current 20-400A. Arc welding tools-electrode holder, cable connector, cable lugs, earthing clamp, wire brush.	18

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
22.	Gas welding machine	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators. welding torch, welding tip, spark lighters.	17
23.	Brazing and soldering kit	Brazing kit with suitable silver and copper brazing alloy rods for ¼ '' to 7/8'' tubes- cu to cu, cu to steel, cu to brass and appropriate flux.)	19
24.	Sheet metal tools	• Cutting Tools- Chisels, Snips or Shears • Striking Tools- Hammers and Punches • Supporting Tools- Stakes, Anvils, Swage Block • Marking and Measuring Tools- Steel rule, Scriber, Trammel, Divider, Swing Blade Protractor, Wire Gauge • Bending and Folding Tools • Other Tools- Grooving Tools, Bench Plate	20
25.	Foundry tools	Hand tools- Hand riddle, Shovel, Rammers- Hand rammer, Peen rammer, Floor rammer, Pneumatic rammers, Sprue pin, strike off bar, Mallet, Draw spike, Vent rod, Lifters, Trowels, Slicks, Smoothers, Swab, Spirit level, Gate cutter, Gaggers, Spray-gun, Nails and wire pieces, Wire pieces, spring and nails, Bellows, Clamps, cotters and wedges Kinds of molding sand- Green sand, Dry sand, Loam sand, facing sand, Backing sand, System sand, Parting sand, Core sand	21
26.	Casting and molding	Hand riddle, Shovel, Rammer, Sprue pin, Strike of bar, Mallet, Draw spike, Vent rod, Lifter, Travels, Slicslick, Smoother, Swabs, Spirit level, Gate cutter, Daggers, Bellows, Clamps, cutters, and wedges	22,23
27.	3D printer	Fused Deposition Modelling system with complete accessories; Build Volume-300 x 300 x 300mm or Higher; Layer Thickness-0.1 – 0.4 OR Available with CoE	25

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Basic Mechanical Engineering	Pravin Kumar	Pearson Education, India, 2018 ISBN: 9789386873293
2.	Basic Mechanical Engineering	S. C. Sharma & M.P. Poonia	Khanna Publishing,2018 ISBN:9789386173331
3.	Theory of machine	R S Khurmi & J K Gupta	Eurasia Publishing House (Pvt.) Ltd. New Delhi,2020, ISBN: 9788121925242
4.	Elements of Mechanical Engineering	Manglik, V. K.	PHI Learning Pvt. Ltd., New Delhi, 2013, ISBN: 9788120346291
5.	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing	Lan Gibson, David W. Rosen, Brent Stucker	Springer, 2010, ISBN: 9781493921133
6.	Understanding Additive manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing	Andreas Gebhardt,	Hanser Publisher, 2011 ISBN: 156990507X, 9781569905074
7.	Manufacturing Technology, Volume-1	P N Rao	McGraw Hill Education, 2018 ISBN-1259062570, 978-1259062575
8.	Manufacturing Technology, Volume-2	P N Rao	McGraw Hill Education, 2018 ISBN-9789353160524, 978-9353160524

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
9.	Internal Combustion Engines	R.P. Mathur, M.L. & Sharma	Dhanpat Rai Publications ISBN-9383182423
10.	Getting Started with 3D Printing: A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution	Liza Wallach Kloski, Nick Kloski	Make Community, LLC; 2nd edition, 2021 ISBN: 9781680450200
11.	3D Printing and Design	Sabrie Soloman	Khanna Publishing House, Delhi, 2020 ISBN: 9789386173768

(b) Online Educational Resources:

a) https://all3dp.com/1/types-of-3d-printers-3d-printing-technology/

b) https://archive.nptel.ac.in/courses/112/103/112103262/

c) http:/nptel.iitm.ac.in/

d) https://www.khanacademy.org/

e) http://learnerstv.in/

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:

- 3D Printing Projects DK Children; Illustrated edition, 2017
- Lab Manuals
- Users guide
- Material science magazine
- Manufactures manual

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A) Course Code : **2400104(T2400104/P2400104/S2400104)**

B) Course Title : Communication Skills (English) (Common for all Programmes)

C) Pre- requisite Course(s) :

D) Rationale

Communication forms a crucial element in success of any organization or industry in the globalized economy. The global village gives due weightage to English language and it enjoys a privileged status. Engineering students with English as a communicative language open for many opportunities across the globe. This course will develop Listening, Speaking, Reading and Writing Skills (LSRW) in the students for effective dissemination of their ideas, projects, patents and researches in the form of presentations, reports, research papers, memos, circular etc. Additionally, it will help students of diploma in engineering to present concepts and designs in effective manner along with writing CVs, Group Discussions, Mock Interview sessions in placements and job recruitments. Though communication skills in SBTE, Bihar largely emphasizes to communicate effectively in english but communication in hindi is also focused to some extend at diploma level.

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 Communicate contextually in different situations.
CO-2 Use Verbal Communication effectively
CO-3 Deploy Non-Verbal Communication contextually.
CO-4 Write various texts using vocabulary and correct grammar.
CO-5 Draft effective business correspondence with brevity and clarity.

F) Suggested Course Articulation Matrix (CAM):

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

Board of Study	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				
	2400104	Communication Skills (English)	03	-	04	02	09	06

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

Legend:

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

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

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

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

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

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

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

H Assessment Scheme:

Board of Study	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)	
	2400104	Communication Skills (English)	30	70	20	30	20	30	200

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

Legend:

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

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

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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: **T2400104** The details of TSOs and units for communication in english is mentioned in Part – A while communication in hindi is mentioned in Part – B in the following table.

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
Part -A (English) *TSO 1a* Define communication and its different forms. *TSO 1b.* Explain the elements of communication with examples. *TSO 1c.* Explain the linkages between different stages of communication with the help of a diagram. *TSO 1d.* Apply the principles of effective communication and state two examples of communication. *TSO 1e.* State eight examples for explaining different types of barriers to communication. *TSO 1f.* Identify the barriers of communication. *TSO1g.* Suggest the ways to overcome/minimise barriers to communication.	**Unit-1.0 Communication** **1.1** Communication: Role, Relevance, Elements (Context-Sender-Message-Channel-Receiver-Feedback) **1.2** Process / Stages: Ideation- Encoding, Selecting Proper Channel, Transmission, Receiving, Decoding, Giving Feedback **1.3** 7 Cs / Principles of Effective Communication: Considerate, Correct, Concrete, Concise, Clear, Complete. Courteous **1.4** Barriers to Communication: Physiological, Physical, Psychological, Mechanical, Semantic/Language, Cultural. Overcome/ minimize Barriers	**CO1** **CO2**
TSO 2a. Distinguish formal and informal communication. *TSO 2b.* Illustrate the types of Formal Communication with examples. *TSO 2c.* Define verbal & non-verbal communication. *TSO 2d.* Explain advantage of oral and written Communication. *TSO 2e.* Interpret non-verbal codes. *TSO 2f.* Explain the role of tables, charts & graphs in communication. *TSO 2g.* Differentiate Intrapersonal and Interpersonal Communication with examples. TSO 2h. List the advantages and disadvantages of Group Communication.	**Unit- 2.0 Types of Communication** **2.1** On the basis of organizational structure: Formal (Vertical, Horizontal, Diagonal), Informal (Grapevine) 2.2 On the basis of method of expression: Verbal-Oral & Written communication. Non-Verbal Communication and its Codes- Kinesics, Chronemics, Proxemics, Haptics, Vocalics/Paralanguage, Artifacts, Graphic and Visual Communication 2.3 On the basis of number of people involved: Intrapersonal Communication, Interpersonal Communication, Group Communication	**CO3**
TSO 3a. Prepare a glossary of new words from the given texts. *TSO 3b.* Summarize the given texts in your own words. *TSO 3c.* Recognize the types of sentences in the given texts. *TSO 3d.* Find out idioms and phrases used in the	**Unit-3.0 Reading Comprehension** Comprehension, vocabulary enhancement and grammar exercises based on the reading of the following texts: **Section-1 (Prose)**	**CO4** **CO5**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
given texts. *TSO 3e*. Write a short biography of the given writers. *TSO 3f.* Identify the figures of speech used in the given texts. *TSO 3g.* Classify the forms of poetry. *TSO 3h.* Elaborate the central idea / theme of the given poems in your own words.	3.1 An Astrologer's Day by R K Narayan 3.2 Indian Civilization and Culture by M K Gandhi 3.3 The Secret of Work by Swami Vivekanand 3.4 My Struggle for an Education by Brooker T Washington **Section-2 (Poetry)** 3.5 Where the Mind is without Fear by R N Tagore 3.6 Ode on Solitude by Alexander Pope 3.7 Stopping by Woods on a Snowy Evening by Robert Frost 3.8 A Psalm of Life by H W Longfellow	
TSO 4a. Form new words adding prefix and suffix to the given root words. *TSO 4b.* Write synonyms and antonyms of the given words. *TSO 4c.* Use the given idioms and phrases in your own sentences. *TSO 4d.* Distinguish between acronym and abbreviation. *TSO 4e.* Prepare a list of technical jargons of your respective branch. *TSO 4f.* Identify the parts of speech of the specific words in the given sentences. *TSO 4g.* Fill in the blanks with suitable verb forms in the given sentences. *TSO 4h.* Transform the given sentences as directed. *TSO 4i.* Punctuate the given paragraphs.	**Unit-4.0 Vocabulary and Grammar** 4.1 Word Formation: Prefix, Suffix, Acronym 4.2 Synonyms, Antonyms, Homonyms, One Word Substitution, Idioms and Phrases 4.3 Technical Jargons -Related to the respective program 4.4 Parts of speech 4.5 Time and Tense 4.6 Transformation: Voice, Narration, Removal of 'Too', Question Tag 4.7 Punctuation	**CO4, CO5**
TSO 5a. Write the precis of the given passage with suitable title. *TSO 5b.* Draft letters and applications for the given purpose. *TSO 5c.* Compose E-mails, Notices, Memos, and Circulars. *TSO 5d.* Prepare reports of the projects of your respective branch. *TSO 5e.* Write a report on the events organized in your institute.	**Unit-5.0 Professional Writing** 5.1 Precis Writing 5.2 Business Letters / Applications 5.3 Drafting E-mails, Notices, Memos, Circulars 5.4 Report Writing: Project and Event/ Incident Report Writing	**CO5**
Part -B (हिंदी) *TSO 1a* सम्प्रेषण कौशल का अर्थ स्पष्ट कर सकेंगे. *TSO 1b* भाव एवं सम्प्रेषण में अंतर बता पाएँगे. *TSO 1c* सम्प्रेषण की प्रक्रिया का उल्लेख कर सकेंगे. *TSO 1d* श्रवण अविव्यक्ति, वाचन और लेखन की अवधारणा को स्पष्ट कर सकेंगे. *TSO 1e* सम्प्रेषण कौशल के निर्धारक तत्वों का विवेचन कर सकेंगे. *TSO 1f* प्रभावशाली सम्प्रेषण के सिद्धांतों का समावेश अपने वार्तालाप में कर सकेंगे.	**Units-1: सम्प्रेषण सिद्धान्त एवं व्यवहार** 1.1 सम्प्रेषण : परिचय , अर्थ एवं परिभाषा 1.2 सम्प्रेषण की प्रक्रिया एवं तत्व 1.3 सम्प्रेषण के प्रकार : औपचारिक एवं अनौपचारिक, शाब्दिक एवं अशब्दिक 1.4 प्रभावशाली सम्प्रेषण के सिद्धांत एवं सम्प्रेषण व्यवधान	**CO1** **CO2** **CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 2a तकनीकी कौशल एवं व्यव्हार कौशल में अन्तर बता पाएँगे . *TSO 2b* व्यव्हार कौशल का महत्व स्पष्ट कर पाएँगे . *TSO 2c* आत्मा जागरूकता एवं आत्मा विश्लेषण का विवेचन सोदाहरण कर पाएँगे . *TSO 2d* भावनात्मक बुद्धिमत्ता एवं करुणा, अनुकूलनशीलता एवं लचीलापन का विकास कर पाएँगे. *TSO 2e* दैनिक जीवन में अनुकूलनशीलता एवं लचीलापन को आत्मसात कर पाएँगे .	**Unit-2 : व्यावसायिकउत्कृष्टता हेतु व्यव्हार कौशल** 2.1 परिचय : तकनीकी कौशल एवं व्यवहार कौशल 2.2 व्यवहार कौशल का महत्त्व 2.3 जीवन कौशल : आत्म जागरूकता एवं आत्म विश्लेषण 2.4 भावनात्मक बुद्धिमत्ता एवं करुणा, अनुकूलनशीलता एवं लचीलापन व्यवहार कौशल का उपयोग	CO1
TSO 3a पठित गद्यांश एवं पद्यांश से प्राप्त नयी शब्दावली विकसित कर पाएँगे *TSO 3b* दिए गये कहानियों, कविताओं एवं निबंधों का सारांश अपने शब्दों में लिख पाएँगे. *TSO 3c* दिए गये कहानियों, कविताओं एवं निबंधों में प्रयुक्त मुहावरों एवं अलंकारों को बता पाएँगे . *TSO 3d* कविताओं का भावार्थ स्पष्ट कर पाएँगे .	**Unit-3 : पाठ-बोध : शब्दावली परिवर्धन एवं व्याकरण अभ्यास** 3.1 नमक का दरोगा , ईदगाह - मुंशी प्रेमचंद 3.2 बात (निबंध)- प्रताप नारायण मिश्र 3.3 वह प्रदीप जो दिख रहा है झिलमिल दूर नहीं है - रामधारी सिंह दिनकर 3.5 नर हो न निराश करो मन को - मैथिलीशरण गुप्त 3.6 कबीर के दोहे -काल्ह करे सो आज कर , जाति न पूछो साधू की , ऐसी वाणी बोलिए	CO4
TSO 4a अपनी शाखा से सम्बन्धित तकनीकी शब्दावली का चयन कर पाएँगे . *TSO 4b* पर्यायवाची एवं विलोम शब्दों से सम्बंधित शब्दावली तैयार कर सकेंगे . *TSO 4c* दिये गये गद्यांशों में विराम चिह्नों का सही प्रयोग कर पाएँगे .	**Unit-4 : शब्दावली एवं व्याकरण** 2 Hrs 4.1 सामान्य शब्दावली 4.2 प्रशासनिक शब्दावली 4.3 शब्द भेद, अनेक शब्दों के लिए एक शब्द 4.4 विराम चिन्ह 4.5 मुहावरें एवं कहावतें	CO4 CO5
TSO 5a दिए गये दिए गये गद्यांशों का संक्षेपण कर पाएँगे . *TSO 5b* विभिन्न प्रकार के पत्रों, आवेदनों ,सूचनाओं, विज्ञप्तियों को लिख पाएँगे . *TSO 5c* अपनी शाखा से सम्बंधित प्रतिवेदन लेखन कर पाएँगे . *TSO 5d* अपने संस्थान में हुए आयोजनों का प्रतिवेदन लिख पाएँगे.	**Unit-5 : लेखन कौशल** 5.1 सार- लेखन 5.2 औपचारिक एवं व्यवसायिक पत्र लेखन 5.3 प्रारूप लेखन - सूचना, निविदा लेखन, प्रतिवेदन लेखन, बायोडाटा	CO5

Note: One major TSO may require more than one theory session/period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2400104 These practical are common for both Part – A and Part -B.

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO1.a Identify the emotions of the speakers.	1	Emotions of the speakers.	CO1
LSO2.a Interpret instructions of audio transcripts.	2	Instructions of audio transcripts.	CO1
LSO3.a Solve the language puzzles based on the audio transcript.	3	Language puzzles.	CO1
LSO4.a Repeat words on language lab software after listening to them.	4	Repetition of words	CO1
LSO5.a Summarize the excerpt in their own words.	5	Summarize the excerpt.	CO1
LSO6.a Answer the questions based on the listening excerpt	6	Listening excerpt	CO2
LSO7.a Differentiate the sounds of minimal pairs, syllables and words etc.	7	Sounds of minimal pairs, syllables and words etc.	CO2
LSO8.a Pronounce the words/ sentences correctly based on the phonetic transcription.	8	Phonetic transcription.	CO2
LSO9.a Read out the words and sentences on the basis of stress and intonation marks put.	9	Stress and intonation.	CO2
LSO10.a Apply the paralanguage codes in verbal dialogues to show the different emotions.	10	Paralanguage Codes	CO2
LSO11.a Integrate the non-verbal codes in their verbal dialogues.	11	Non-verbal Codes	CO2
LSO12.a Correct the verbal and non-verbal presentations of their peer while giving feedback.	12	Feedback on Presentations	CO2
LSO13.a Differentiate the sounds of minimal pairs, syllables and words etc.	13	Syllables and Words	CO2
LSO14.a Locate the dictated words from the excerpt.	14	Dictated words	CO3
LSO15.a Arrange the correct and logical sequence of the jumbled sentences.	15	Jumbled Sentences.	CO3
LSO16.a Read the given the texts aloud with proper pause and proper pronunciation.	16	Pronunciation.	CO3
LSO17.a Compare the point of view with their peers.	17	Point of view of Self and Peers	CO4
LSO18.a Identify the main ideas of the excerpt	18	Main ideas of the excerpt	CO4
LSO19.a Prepare a list of technical jargons and register specific to their program /industry.	19	Technical Jargons	CO5
LSO20.a Write the specifications of the machines/ equipment available in the workshops / labs.	20	Specifications of the machines/ equipment	CO5
LSO21.a Write a report on the projects of their respective branches.	21	Report on the Projects	CO5

L) Suggested Term Work and Self Learning: S2400104 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.

1. Visit your institute's library/ web search and enlist the books, journals and magazines related to your respective branches to prepare bibliography consisting name of the authors, title of the books, publication and place of publication.
2. SWOT Analysis: Analyze yourself with respect to your strength and weaknesses, opportunities and threats with respect to your communication.
3. Conduct interview of an eminent personality and write a report on it.
4. Deliver a seminar for 10-12 minutes using PPT on the topic given.
5. Prepare your individual time-table for a week and prioritize your activities.
6. Visit any historical places/ offices / farms/ industries / development sites etc. nearby your city and prepare a report on it.

b. Micro Projects:

a) Book review – students should read a book and then write his reviews about the book and present it in the class.
b) Interview of any successful person in your locality in context with his life journey, inspiration social contribution, role model and keys to success.
c) Prepare register of technical jargons of the industry related to their specific branch.
d) Prepare a presentation on environmental issues of their locality with their solution.

c. Other Activities:

1. Arrange a Blood Donation Camp in collaboration with a blood bank and prepare a communication plan for the same.
2. Organize a cleanliness campaign in your campus premises and nearby places prepare hoardings, boards, collages, posters for the same.
3. Organize a campaign on educational awareness in the nearby places prepare advertising campaign for the same.

4. Self- learning topics:

- Collect new words from daily newspapers.
- Observe negotiation skills in the nearby shops.
- Watch educational channels for improving English communication

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**. This matrix has been prepared considering both Part – A and Part -B.

COs (Includes in Part -A & B)	**Course Evaluation Matrix**						
	Theory Assessment (TA)**		**Term Work Assessment (TWA)**			**Lab Assessment (LA)#**	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	**End Theory Assessment (ETA)**	**Term Work & Self Learning Assessment**			**Progressive Lab Assessment (PLA)**	**End Laboratory Assessment (ELA)**
			Assignments	**Micro Projects**	**Other Activities***		
CO-1	15%	20%	15%	20%	-	20%	20%
CO-2	10%	15%	10%	20%	25%	10%	20%
CO-3	20%	25%	15%	20%	25%	15%	20%
CO-4	25%	20%	30%	20%	25%	15%	20%
CO-5	30%	20%	30%	20%	25%	40%	20%
Total Marks	**30**	**70**	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number (s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
(Part - A) Unit-1.0 Communication Theory and Practice	5	CO1, CO2	10	3	3	4
Unit- 2.0 Types of Communication	5	CO3	8	2	2	4
Unit-3.0 Reading Comprehension	8	CO4, CO5	12	3	3	6
Unit-4.0 Vocabulary and Grammar	7	CO4, CO5	10	3	3	4
Unit-5.0 Professional Writing	7	CO5	10	3	4	3
(Part-B) **Units-1: सम्प्रेषण सिद्धान्त एवं व्यवहार**	2	CO1, CO2	3	1	1	1
Unit-2: व्यावसायिक उत्कृष्टता हेतु व्यव्हार कौशल	2	CO3	3	1	1	1
Unit-3: पाठ-बोध :शब्दावली परिवर्धन, एवं व्याकरण अभ्यास	5	CO4, CO5	5	1	1	3
Unit-4: शब्दावली एवं व्याकरण	4	CO5	5	1	1	3
Unit-5: लेखन कौशल	3	CO5	4	2	1	1
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	Emotions of the Speakers.	CO1	30	60	10
2	Instructions of Audio Transcripts.	CO1	30	60	10
3	Language Puzzles.	CO1	30	60	10
4	Repetition of Words.	CO1	30	60	10
5	Summarize the Excerpts.	CO1	30	60	10
6	Listening Excerpts.	CO2	30	60	10
7	Sounds of minimal Pairs, Syllables and Words etc.	CO2	30	60	10
8	Phonetic Transcription.	CO2	30	60	10
9	Stress and Intonation.	CO2	30	60	10
10	Paralanguage Codes	CO2	30	60	10
11	Non-Verbal Codes	CO2	30	60	10
12	Verbal and Non-Verbal Presentations	CO2	30	60	10
13	Sounds of minimal pairs, syllables and words	CO2	30	60	10
14	Locate the Dictated Words	CO3	30	60	10
15	Jumbled Sentences.	CO3	30	60	10
16	Pronunciation.	CO3	30	60	10
17	Compare the Point of view with their Peers.	CO4	30	60	10
18	Main Ideas of the Excerpt	CO4	30	60	10
19	Technical Jargons	CO5	30	60	10
20	Specifications of the machines/ equipment	CO5	30	60	10
21	Report on the Projects	CO5	30	60	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical 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	Intel® Core™ i5-9400 (6-Core, 9MB Cache, up to 4.1GHz with Intel® Turbo Boost Technology) RAM: 8GB DDR 4 HDD: 3.5" 1TB 7200RPM SATA Hard Drive OS: Windows 10 Pro 64bit OEM License Other ports: Gigabyte LAN card	1 to 21
2.	Language Lab software	Teacher console supporting audio-visual language lab	1 to 21
3.	Printer	LaserJet printer	1 to 21
4.	Head Phones with microphones	Logitech H111 wired on headphones	1 to 21
5.	Computer Furniture	Computer Desk, chair	1 to 21
6.	Smart Projector	Standard Specification	1 to 21

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Communication Skills In English (AICTE Prescribed Text Book)	Dr. Anjana Tiwari	Khanna and Khanna, New Delhi
2.	Business Communication	Dr. Nishith Rajaram Dubey, Anupam Singh	Publisher: Indra Publishing House, 2023 ISBN- 978-93-93577-69-6
3.	Communication Skills	Sanjay Kumar & Pushap Lata	Oxford University Press, India
4.	Employability Skills	Dr. Nishith Rajaram Dubey, Anupam Singh	Indra Publishing House, 2023 ISBN - 978-93-93577-68-9
5	Technical Communication for Engineers	Shalini Verma	S. Chand
6.	English Grammar	Raymond Murphy	S. Chand
7.	British English Grammar and Composition	Dr. Ashok Kumar Singh	Student's Friends
8.	A Textbook of English Phonetics	T. Balasubramanian	Macmillan Publishers
9.	Thesaurus of English Words and Phrases	Roget	Simon and Schuster
10	Better English Pronunciation	J. D. O'Connor	Cambridge: Cambridge University Press, 1980
11	An English Grammar: Comprehending Principles and Rules	Lindley Murray.	London: Wilson and Sons, 1908.
12	Effective Communication Skills	Kulbhushan Kumar	Khanna Publishing House, New Delhi (Revised Edition 2018)
13	Examine your English	Margaret M. Maison	Orient Longman: New Delhi, 1964

14	Collin's English Dictionary	Harper Collins	Harper Collins, Glasgow
15	संप्रेषण कौशल	डॉ प्रवीण कुमार अग्रवाल , डॉ अवनीश कुमार मिश्रा	साहित्य भवन पब्लिकेशन : आगरा
16	आधुनिक हिंदी व्याकरण और रचना	डॉ वासुदेवनंदन प्रसाद	भारती भवन पब्लिकेशन

(b) Online Educational Resources:

1. https://www.academia.edu/37871134/COMMUNICATION_SKILLS_1ST_YR_2_pdf
2. https://socialsci.libretexts.org/Courses/Butte_College/Exploring_Intercultural_Communication_(Grothe)/05%3A_Nonverbal_Processes_in_Intercultural_Communication/5.02%3A_Types_of_Nonverbal_Communication
3. http://muhamadjaelani35.blogspot.com/2014/11/inquiry-letter-order-letter-complaint.html?m=1
4. https://www.slideshare.net/sundaredu/barriers-of-communication-53545680
5. https://allpoetry.com/where-the-mind-is-without-fear
6. https://www.poetryfoundation.org/poems/46561/ode-on-solitude
7. https://www.poetryfoundation.org/poems/44644/a-psalm-of-life
8. https://www.poetryfoundation.org/poems/42891/stopping-by-woods-on-a-snowy-evening
9. https://www.hindisamay.com/content/
10. http://kavitakosh.org/
11. https://bundelkhand.in/maithilisharan-gupt/nar-ho-na-nirash-karo-man-ko
12. https://etc.usf.edu/lit2go/92/up-from-slavery/1575/chapter-3-the-struggle-for-an-education/
13. https://oursmartstudy.com/english-chapter-1-class-12-pdf-download/
14. https://ve-iitg.vlabs.ac.in/Listening%20Skills(Procedure).html
15. https://nptel.ac.in/courses/109104031

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

(b) Others:

1. https://nptel.ac.in/courses/

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A) Course Code :**2415105(P2415105/S2415105)**

B) Course Title : Engineering Drawing & Graphics
(CE, EE, ELX, ELX (R), MIE, FTS, AE, CHE, TE, CRE, CT&M)

C) Pre- requisite Course(s) : Knowledge of standard geometries

D) Rationale :

With the emergence of computer-aided drafting and design (CAD) tools the traditional engineering drawing practices has undergone significant change as the emphasis has shifted from drawing board-based engineering practices to Computer aided based drafting and modeling which has the advantages of speed, modification, storage and convenience of drawing complex 2D and 3D entities. Still to develop ability of visualization, understanding of drawing standards and free hand sketching on one side and to take advantage of digital drafting tools on other, this course addresses both the aspects. The course covers the knowledge & application of drawing instruments, familiarizes the learner about Bureau of Indian standards related to engineering drawing, developing the ability to draw and read various engineering curves, projections and dimensioning styles and finally make him able to use computer aided drafting software for developing engineering drawings related to different fields.

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 drawing instruments, drawing codes, dimensioning, conventions and symbols as per IS SP-46(2003) in engineering drawing.

CO-2 Draw geometrical figures, curves and engineering scales.

CO-3 Draw the views of objects using principles of orthographic projection.

CO-4 Draw isometric views of components directly or from orthographic projections.

CO-5 Draw free hand sketches of engineering elements, their orthographic and isometric views.

CO-6 Use computer aided drafting software to draw 2D and isometric geometric entities.

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	2	1	-		
CO-2	3	-	-	3	-	1	-		
CO-3	3	1	1	3	-	1	2		
CO-4	3	1	1	3	-	1	2		
CO-5	3	-	1	3	-	-	2		
CO-6	3	-	1	3	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:

Board of Study	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				
	2415105	Engineering Drawing and Graphics	-	-	04	02	06	03

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Board of Study	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)	
	2415105	Engineering Drawing and Graphics	-	-	20	30	20	30	100

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

Legend:

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

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

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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)
TSO 1a. Use Drawing Instruments to prepare 2D drawings manually. *TSO 1b.* Use different lines and annotations for a given situation. *TSO 1c.* Draw engineering scale for the given situation. *TSO 1d.* Choose appropriate scale factor for the drawing as per given situation. *TSO 1e.* Dimension the given geometric figure using IS SP-46 standard. *TSO 1f.* Draw the given regular geometric figure with tangents and normal. *TSO 1g.* Draw selected engineering curve.	**Unit-1.0 Basic Elements of Drawing** 1.1 Methods to use different Drawing Instruments and supporting materials. 1.2 Different lines and conventions in engineering drawing. 1.3 Engineering scales and applications: Reduced, enlarged & full size (only Plain scale) 1.4 Dimensioning techniques: types and applications of chain, parallel and coordinate dimensioning as per SP-46. 1.5 Regular Geometrical figures, Tangency constructions. 1.6 Engineering Curves: only Ellipse and Parabola using concentric circle method, rectangular method and Eccentricity method when focus and directrix are given.	**CO1, CO2**
TSO 2a. Explain the different types of projections & their uses. *TSO 2b.* Draw the orthographic projections of different objects *TSO 2c.* Convert pictorial views into orthographic views	**Unit-2.0 Orthographic Projections** 2.1 Concept and applications of Orthographic, Perspective, Isometric and Oblique Projections. 2.2 Orthographic Projection: First and Third angle 2.3 Draw orthographic views of simple 3D entities containing lines, circles and arcs with axis/orientation parallel and/or perpendicular to the projection planes only. Problems should be restricted up to three views Front view/Elevation, Top view/Plan and Side views only using First Angle Method only. 2.4 Conversion of simple pictorial views into orthographic views. (Domain specific illustrative problems to be given by the teacher)	**CO1, CO2, CO3**
TSO 3a. Explain the Isometric Projection, Isometric view and Isometric Scale. *TSO 3b.* Draw isometric dimensioning on the given isometric view. *TSO 3c.* Explain the Methods of constructing isometric drawing *TSO 3d.* Draw Isometric View of the given object	**Unit-3.0 Isometric Projection** 3.1 Introduction to isometric projection. 3.2 Isometric scale and Natural Scale. 3.3 Isometric view and isometric projection. 3.4 Illustrative problems limited to Isometric projection of objects containing rectangular,	**CO1, CO3, CO4**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
containing elements like rectangular, circular, cylindrical shapes and slots on sloping and plane surfaces. *TSO 3e.* Convert the given orthographic views into isometric View/Projection.	circular, cylindrical shapes and slots on sloping and plane surfaces. 3.5 Conversion of orthographic views into isometric View/projection.	
TSO 4a. Sketch the given straight line, square, rectangle, circle and arc. *TSO 4b.* Sketch the given simple orthographic and isometric views of the given part. *TSO 4c.* Sketch the given domain specific engineering element/component.	**Unit-4.0 Free Hand Sketches of Engineering Elements** 4.1 Materials for Sketching. 4.2 General Guidelines for Freehand Sketching. 4.3 Freehand sketching of straight lines, square, rectangle, circles and arcs. 4.4 Free hand sketches of orthographic views. 4.5 Free hand sketches of isometric views. 4.6 Freehand sketching of domain specific engineering elements/components (e.g. Bolt, Nut, Washer, Stud, Screw, simple machine parts, etc. in case of mechanical, production, automobile, electrical engineering).	**CO5**
TSO 5a. Use computer aided drafting software for creating the institute Drawing Template. *TSO 5b.* Use computer aided drafting software for creating the given simple 2D entity.	**Unit-5.0 Basic Computer aided Drafting** 5.1 Basics of AutoCAD or any other drafting software–interface, screen layout, starting commands from menus, command line. 5.2 Coordinate system, Angular measurements, Point specification. 5.3 Drawing aids - Grid, Snap, Ortho, Osnap, Units, Limits, Layers, Linetype. 5.4 Opening and Saving drawing files. 5.5 Creating User Defined Templates. 5.6 Methods of Selecting and deleting Objects. 5.7 Undo and Redo. 5.8 Creating basic drawings objects - lines, arc, circles, ellipses, polyline and polygons.	**CO1, CO2, CO6**
TSO 6a. Use computer aided drafting software for creating orthographic views of the given object. *TSO 6b.* Use computer aided drafting software for creating isometric views of the given object. *TSO 6c.* Print the given drawing (using institute template) on A4/A3 sheet.	**Unit-6.0 Advanced Computer aided Drafting** 6.1 Modify commands - erase, copy, move, rotate, scale, stretch, 6.2 Array: concept and applications. 6.3 Controlling Drawing display 6.4 Text and Dimensioning 6.5 Layers: concept and application 6.6 Drawing orthographic vies using drafting software with principles mentioned in Unit 2. 6.7 Drawing isometric views using drafting software with principles mentioned in Unit 3. 6.8 Printing and plotting of drawings.	**CO1, CO2, CO3, CO4, CO6**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2415105

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use manual drawing instruments *LSO 1.2.* Draw simple 2D entities using manually drawing instruments.	1.	Geometric Construction: • Draw set of lines with different conditions (two problems). • Draw circle and arcs with different geometric conditions and constraints (two problems). • Draw polygons by general methods (Triangle, square, pentagon, hexagon, heptagon) (Three problems).	**CO1, CO2**
LSO 2.1. Draw conic sections using manually drawing instruments. *LSO 2.2.* Use different methods of construction of ellipse and parabola.	2.	• Construct ellipse using four center method, arc of circle method and rectangle method. • Construct parabola using rectangular method, and parallelogram method.	**CO2**
LSO 3.1. Apply concepts of orthographic projection in drawing the given simple object on drawing sheet. *LSO 3.2.* Visualize the three views related to the given object based on its shape and orientation.	3.	Draw Orthographic projections of following using first angle method: • A pentagonal pyramid is placed in first quadrant with its axis parallel to H.P. and V.P • A frustum of a hexagonal is placed in first quadrant with its axis perpendicular to H.P. and parallel to V.P • Different objects having cylindrical surfaces, ribs. (three views of each object, total six problems)	**CO3**
LSO 4.1. Apply concepts of orthographic projection to draw three views of given domain specific object/ component.	4.	Draw Orthographic projections of domain specific objects (three views of each object) (Two problems).	**CO3**
LSO 5.1. Use concepts of Isometric projection to draw the given simple object with slant surface.	5.	Draw Isometric view of simple objects having plain and slanting surface by using natural scale. (Three problems)	**CO4**
LSO 6.1. Visualize the 3D shape of the given object. *LSO 6.2.* Convert the given 2D figures/views into 3Dobject.	6.	Convert the orthographic views of an object to isometric view. (Two problems)	**CO3, CO4**
LSO 7.1. Draw free hand sketches of the given domain specific object/component	7.	Draw free hand sketches/conventional representation of your domain specific components (Six problems)	**CO5**
LSO 8.1. Draw 3D free hand sketches from the given isometric shape.	8.	Draw free hand sketch of isometric drawings (prepared in Sr. No. 05) without using any instruments.	**CO5**
LSO 9.1. Draw 3D free hand sketches of the given real object/component.	9.	Given the 3D model of an object, student will try to imagine the three views and draw them with free hand in the sketch book.	**CO5**
LSO 10.1. Use computer aided drafting software to create and modify a template. *LSO 10.2.* Insert any picture in the existing AutoCAD drawing *LSO 10.3.* Insert text in the existing AutoCAD	10.	Prepare a template for your institute of A-4 size with title block and institute logo.	**CO6**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
drawing			
LSO 11.1. Use computer aided drafting software to create and modify simple 2D entities. *LSO 11.2.* Use computer aided drafting software to create and modify circles and arcs with different geometric conditions and constraints	11.	Computer Aided Drafting: Use the software to draw following simple 2-D entities using Draw commands individually • Draw circle and arcs with different geometric conditions and constraints (two problems). • Draw polygons (Triangle, square, pentagon, hexagon, heptagon) (Three problems).	**CO6**
LSO 12.1. Use computer aided drafting software to calculate Area, Perimeter, and Centroid of the given 2D entity	12.	Use the software to estimate Area, Perimeter, and Centroid for the given 2D entities like Circle, Pentagon, Trapezium, hexagon and 2D entity with arcs and spline curves using 'Enquiry' and 'List' commands.	**CO6**
LSO 13.1. Use computer aided drafting software to draw complex 2D entities.	13.	Use the software to draw four domain specific complex 2-D entities assigned by the teacher using Draw, Edit and Modify commands	**CO6**
LSO 14.1. Use computer aided drafting software to create and modify 2D entities. *LSO 14.2.* Use computer aided drafting software to create and modify the given orthographic views.	14.	Use the software to draw orthographic views of • A pentagonal pyramid is placed in first quadrant with its axis parallel to H.P. and V.P • A frustum of a hexagonal is placed in first quadrant with its axis perpendicular to H.P. and parallel to V.P • Different objects having cylindrical surfaces, ribs. (three views of each object, total six problems)	**CO3, CO6**
LSO 15.1. Use computer aided drafting software to create and modify the given isometric entities.	15.	Use the software to draw isometric views of three 3D objects containing lines, arcs, circles, holes, ribs and slots	**Co4, CO6**

L) Suggested Term Work and Self Learning: **S2415105** Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. Assignments:

1. Sketch progressive and parallel dimensioning.
2. Prepare a list of industrial and household components in which conic curves are used and justify the utility of these curves.
3. Write the equations for parabola in different quadrants and observe the effect of changing eccentricity in case of parabola.
4. Exercises on drawing orthographic views of engineering domain specific simple parts.
5. Exercise on drawing isometric views of different objects.
6. Exercises on converting the orthographic views of an object to isometric view.
7. Exercise on missing views.
8. Exercises on creating simple digital drawings, orthographic views and isometric views.
9. Each student should explain at least one problem for construction and method of drawing in sheet/computer to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.
10. Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.

b. Micro Projects:

1. Through experimentation, justify that the eccentricity of an ellipse is 1.
2. Cut a Cardboard/Thermocole cone with various section planes to get circle, ellipse, parabola and hyperbola.
3. Explore the applications of engineering curves in different fields of engineering and prepare a short report.
4. List the shapes and curves you are observing around you in real life with name of place and item. (For Ex. ellipse, parabola, hyperbola, cycloid, epicycloids, hypocycloid, involute, spiral helix).
5. Cut triangular, square, rectangular and circular shaped Cardboard/Thermocole pieces and observe them by placing in different positions with respect to the protection planes.
6. Take a medium sized hexagonal nut and draw its isometric projection.
7. The teacher will assign one set of orthographic projections and ask the student to develop 3D Thermocol models of the same.
8. Prepare an A4 digital drawing template of your institute with title block and institute logo.
9. Each batch will collect 5 components/circuits/items specific to their branch and draw their orthographic views using AutoCAD software.
10. Download 5 videos on shortcuts used in AutoCAD, watch them and write a report to detail out the steps involved, Commands used.

c. Other Activities:

1. Seminar Topics:
   - Standard symbol and conventions used in engineering drawings related to your branch/domain.
   - Commercially available other Computer Aided Drafting Software.
   - Compatibility of AutoCAD drawings compared to Conventional Drawing.

2. Visits: Collect production/construction/circuit drawings from nearby industries/shop/builders and observe the type of orthographic projection, symbol of projection and various views used.

3. Self-learning topics:

   - Types of lines and dimensioning in engineering drawing.
   - Different methods of drawing Arcs and Circles in AutoCAD software.

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	-	-	05%	-	-	05%	16%
CO-2	-	-	05%	20%	20%	05%	16%
CO-3	-	-	20%	20%	20%	15%	16%
CO-4	-	-	20%	20%	20%	15%	16%
CO-5	-	-	15%	20%	20%	20%	16%
CO-6	-	-	35%	20%	20%	40%	17%
Total Marks	-	-	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

O) Suggested AssessmentTable for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Geometric Construction: • Draw set of lines with different conditions (two problems). • Draw circle and arcs with different geometric conditions and constraints (two problems). • Draw polygons by general methods (Triangle, square, pentagon, hexagon, heptagon) (Three problems).	CO1, CO2	30	60	10
2.	• Construct ellipse using four center method, arc of circle method and rectangle method • Construct parabola using rectangular method, and parallelogram method	CO2	30	60	10
3.	Draw Orthographic projections of following using first angle method: • A pentagonal pyramid is placed in first quadrant with its axis parallel to H.P. and V.P • A frustum of a hexagonal is placed in third quadrant with its axis parallel to H.P. and V.P • Different objects having cylindrical surfaces, ribs. (three views of each object, total six problems)	CO3	30	60	10
4.	Draw Orthographic projections of domain specific objects (three views of each object) (Two problems).	CO3	30	60	10
5.	Draw Isometric view of simple objects having plain and slanting surface by using natural scale. (Three problems)	CO4	30	60	10
6.	Convert the orthographic views of an object to isometric view (Two problems)	CO3, CO4	30	60	10
7.	Draw free hand sketches/conventional representation of your domain specific components (Six problems)	CO5	30	60	10
8.	Draw free hand sketch of all above isometric drawings (prepared in Sr. No. 06) without using any instruments.	CO5	30	60	10
9.	Given the 3D model of an object, student will try to imagine the three views and draw them with free hand in the sketch book.	CO5	40	50	10
10.	Prepare a template for your institute of A-4 size with title block and institute logo.	CO6	40	50	10
11.	Computer Aided Drafting: Use the software to draw following simple 2-D entities using Draw commands individually • Draw circle and arcs with different geometric conditions and constraints (two problems). • Draw polygons (Triangle, square, pentagon, hexagon, heptagon) (Three problems).	CO6	40	50	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
12.	Use the software to estimate Area, Perimeter, and Centroid for the given 2D entities like Circle, Pentagon, Trapezium, hexagon and 2D entity with arcs and spline curves using 'Enquiry' and 'List' commands.	CO6	40	50	10
13.	Use the software to draw four domain specific complex 2-D entities assigned by the teacher using Draw, Edit and Modify commands	CO6	40	50	10
14.	Use the software to draw orthographic views of • A pentagonal pyramid is placed in first quadrant with its axis parallel to H.P. and V.P • A frustum of a hexagonal is placed in first quadrant with its axis perpendicular to H.P. and parallel to V.P • Different objects having cylindrical surfaces, ribs. (three views of each object, total six problems)	CO3, CO6	40	50	10
15.	Use the software to draw isometric views of three 3D objects containing lines, arcs, circles, holes, ribs and slots	CO4, CO6	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.	Drawing Table with Drawing Board	Drawing Table with Drawing Board of Full Imperial/ A1 size.	1 to 9
2.	Models and Charts	Normal and cut sectioned Models and Charts of objects for orthographic / isometric projections	1 to 9
3.	Drawing equipments and instruments	Drawing equipments and instruments for class room teaching-large size: • T-square or drafter (Drafting Machine). • Set squires (450 and 300-600) • Protector. • Drawing instrument box (containing set of compasses and dividers). • Drawing sheets, Drawing pencils, Eraser. • Drawing pins / clips	1 to 9
4.	Sample production/construction drawings	From nearby industries, construction companies and developed by senior teachers of the state	All

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
5.	Interactive board (165 x 130 cm)	Supports dual touch, dual write and intuitive gestures, such as toss, rotate and zoom with multitouch operating systems, such as Windows®	All
6.	Computer aided drafting software like AutoCAD	Latest educational licensed network version	9 to 15
7.	CAD workstations	latest configuration 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	9 to 15
8.	Printer/plotter	A3 size	9 to 15

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Engineering Drawing	N.D. Bhatt	Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93- 80358-17-8.
2.	Engineering Drawing	R.K. Dhawan	S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.
3.	Engineering Drawing	P.J. Shah	S. Chand & Company, New Delhi, 2008, ISBN:81-219-2964-4.
4.	Engineering Graphics with AutoCAD	A.K. Sarkar, A.P. Rastogi, D.M. Kulkarni	PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
5.	Engineering Drawing and Graphics using AutoCAD	T. Jeyapoovan	Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
6.	Engineering Graphics	S. K. Pradhan K.K. Jain	Khanna Book Publishing Company Pvt. Ltd., New Delhi ASIN : B0BM5BMMXT ISBN-10 : 9355381891 ISBN-13 : 978-9355381897

(b) Online Educational Resources:

1. Scales: https://youtu.be/YSEZu3Ch26k
2. Dimensioning: https://youtu.be/_OSY04TnlEM
3. Simple Orthographic Projections: https://youtu.be/DW7dpKdxVrA
4. Orthographic Projections of objects with slant and curved surfaces: https://youtu.be/dCWjBvZBpjM
5. Illustrative Example: https://youtu.be/MR5de9EC940
6. Illustrative Example: https://youtu.be/mahh-WONNHA
7. Isometric Projection of 3D objects: https://youtu.be/0K-5URiyi50
8. Isometric Projection-Object with slant surfaces: https://youtu.be/qSPJOiXKv98
9. Isometric Projection-Object with curved surfaces: https://youtu.be/qSPJOiXKv98
10. Missing lines and missing views: https://nptel.ac.in/courses/105/104/105104148/
11. Launching AutoCAD and Opening drawing: https://youtu.be/aoo-t0-gEfw
12. AutoCAD Main Screen: https://youtu.be/D0YyEiCjwpk
13. Draw and Modify Toolbars: https://youtu.be/T_RN_RBFk7o
14. Illustrative Example-1: https://youtu.be/_Bheo9MzeVk

15.	Block creation:	https://youtu.be/ZguZZVjxaek
16.	Rectangular and Polar array :	https://youtu.be/YgYZgbrUJ_M
17.	Illustrative Example-2: Array:	https://youtu.be/yJf_IsWX4gM
18.	Dimensioning:	https://youtu.be/sEiRsi14u0U
19.	Use of layers:	https://youtu.be/fdQqNdDtOI8
20.	Illustrative Example 3: Flywheel:	https://youtu.be/AU-Vsd2T0DA

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. Bureau of Indian Standards, Engineering Drawing Practice for Schools and Colleges IS: SP-46, BIS, Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. AutoCAD e manual

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A) Course Code : **2425106(P2425106/S2425106)**

B) Course Title : Mechanical Workshop
(CE, AE, ME, ME (Auto), MIE, CRE, CHE, CT&M)

C) Pre- requisite Course(s) :

D) Rationale:

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

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

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

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

F) Suggested Course Articulation Matrix (CAM):

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

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

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

G) Teaching & Learning Scheme:

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

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

Legend:

CI: Classroom instruction (Includesdifferentinstructional/implementationstrategiesi.e.Lecture(L), Tutorial(T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

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

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

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

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

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

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

H) Assessment Scheme:

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

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

Legend:

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

PLA: ProgressiveLaboratoryAssessment(includesprocessandproductassessmentusingratingScalesandrubrics)

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:

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

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

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1 Use relevant wood working tools and instruments as per given job. *LSO 1.2* Undertake wood working operations like marking, cutting, plaining and finishing etc. *LSO 1.3* Prepare given wooden joints as per given sketch / drawing.	1.	1.1 Prepare one simple job of wood working comprises of marking, cutting, plaining and finishing as per given drawing/sketch. 1.2 Prepare any two wooden joints safely as per given drawing using suitable tools- - Mortise joint - Dovetail joint - Half lap joint. - Cross joint - Tenon Joint - Bridle joint	**CO-1**
LSO 2.1 Prepare list of relevant tools, equipment, machines and measuring instruments used in fitting shop as per given situation. *LSO 2.2* Perform marking, cutting, filing, punching, drilling, and finishing operations as per given fitting job safely. *LSO 2.3*Select relevant single point cutting tool and associated parameters for a given turning job. *LSO 2.4* Undertake turning operations economically and safely in a given situation	2.	2.1 Selection of different fitting tools, equipment, machines and measuring instruments in a given situation. 2.2 Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at Centre) comprises of marking, filing, punching, drilling, and finishing as per given drawing/sketch. 2.3 Prepare given step turning / taper turning job as per given sketch/ drawing.	**CO-2**
*LSO 3.1*Select suitable joining process in a given situation. *LSO 3.2* Use Personal Protective Equipment in welding shop. *LSO 3.3* Perform gas welding operations in a given situation to prepare joint safely. *LSO 3.4*Prepare given welding joint safely using arc welding in a given situation.	3.	3.1 Prepare simple job of joining by using suitable joining process as per given sketch. 3.2 Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely. 3.3 Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely. 3.4 Prepare simple job using soldering/ brazing operations as per given	**CO-3**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 3.5 Carryout soldering / brazing operation(s) as per given job.		drawing.	
LSO 4.1 Select suitable sheet metal tools, machinery / equipment for given used as per requirements. *LSO 4.2* Select suitable sheet metal operations in a given situation. *LSO 4.3* Perform relevant sheet metal operations such as shearing, bending, drawing, squeezing, snipping, riveting, grooving etc.to prepare utility jobs safely as given sketch/ drawing.	4.	4.1 Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing. 4.2 Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm. 4.3 Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.	**CO-4**
LSO 5.1 Select suitable black smithy tools and operations to complete jobs as per requirements. *LSO 5.2* Perform various operations safely to prepare given black smithy job(s). *LSO 5.3* Follow safety procedures and use personal safety equipment during black smithy.	5.	5.1 Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations. 5.2 Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop. 5.3 Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor	**CO-5**

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

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

b. Micro Projects:

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

c. Other Activities:

1. Seminar Topics:

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

2. Visits:

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

3. Self-learning topic:

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

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

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

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

O) Suggested AssessmentTable for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Prepare one simple job of wood working comprises of marking, cutting, plaining and finishing as per given drawing/sketch.	CO-1	50	40	10
2.	Prepare any two wooden joints safely as per given drawing using suitable tools- • Mortise joint • Dovetail joint • Half lap joint. • Cross joint • Tenon Joint • Bridle joint	CO-1	40	50	10
3.	Selection of different fitting tools, equipment, machines and measuring instruments in given situation.	CO-2	60	30	10
4.	Prepare one simple fitting job (square of 50 mm side /square of 40 mm side with 5mm drill at center) comprises of marking, filing, punching, drilling and finishing as per given drawing/sketch.	CO-2	50	40	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
5.	Prepare given step turning / taper turning job as per given sketch/ drawing.	CO-2	30	60	10
6.	Prepare simple job of joining by using suitable joining process as per given sketch.	CO-3	60	30	10
7.	Prepare a Butt joint / lap joint using gas welding as per given sketch / drawing safely.	CO-3	40	50	10
8.	Prepare a Butt joint / lap joint by arc welding using suitable welding parameters as per given sketch / drawing economically and safely.	CO-3	40	50	10
9.	Prepare simple job using soldering/ brazing operations as per given drawing.	CO-3	30	60	10
10.	Prepare one sheet metal job using cutting, bending, edging and joining operations as per given drawing.	CO-4	50	40	10
11.	Prepare a sheet metal rectangular tray of dimension of 300X100X50 mm.	CO-4	30	60	10
12.	Prepare any one utility job of sheet metal using suitable sheet metal tools and operations.	CO-4	30	60	10
13.	Selection of various black smithy tools, equipment, machines and measuring instruments used as per given situations.	CO-5	60	30	10
14.	Prepare S shaped hook from given MS rod of length 220mm and diameter 6 mm in black smithy shop.	CO-5	30	60	10
15.	Prepare a garden trowel, sickle, and shovel as per the instruction provided by the instructor.	CO-5	30	60	10

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

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Lathe machine	Capacity Light Duty Heavy Duty Height of center 165 mm 254 mm Swing Over Bed 325 mm 490 mm Swing Over Cross Slide 175 mm 290 mm Movement of Cross Slide 225 mm 300 mm Swing in gap 500mm 800 mm With suitable motor drive with all accessories.	All
2.	Drilling machine	Up to 15 mm drill cap with 1 HP motor 1000mm height	1,2

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
3.	Wood working tools	Marking and measuring tools, saw, claw hammer, mallet, chisels, planers, squares	1,2
4.	vice	Carpentry vice 200 mm, bench vice 100mm, pipe vice 100 mm	1,2,3,4,5,6,7,8,9,10,11
5.	Work benches	Size 2000x1000x750 mm	1,2,3,4,5,6,7,8
6.	Fitting tools	Ball pen Hammers(500g), cross pean hammer, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set of suitable sizes	3,4,5
7.	Surface plate	600x900 mm grade I	All
8	Welding machine	20 KV, 400 A Welding current, welding cable 400 amp, with all accessories	6,7,8
9	Soldering and brazing equipment	Solder. Soldering iron (35 W) soldering wick, magnifying glass, wire cutters, brazing torch, aluminum brazing rod,	9
10	Gas welding and hand tools	Welding torch, welding tip, pressure regulator, oxygen and acetylene gas cylinder and cutting kit with cylinder and regulator, spark lighter	7,8
11	Arc welding and hand tools	Electrode holder, cable connector, chipping hammer, earthing clamp, wire brush.	6,7,8
12	Sheet bending and cutting machine	Mild steel automatic metal sheet bending machine (size 0.5 mm-20 mm X 1000 mm -6300 mm), compound saw (blade diameter 305 mm, power consumption 1520 W, 4000 RPM)	10,11,12
13	Sheet metal and hand tools	Snip, shears sheet gauge, straight edge, L/T square scriber, divider trammel, punches, pliers, stakes, groovers, limit set	10,11,12
14	Black smithy tools and equipment	Anvil (WEIGHT-167 lbs, horn-73/4", face length-10", rear-71/2"), hammer (double face sledge hammer10 kg), scaling hammer, chipping hammer, tongs (500g ,flat nose size 15 inch) open hearth ,air blower (60 hp capacity 40000 m3/hr.), swage block (14X14X5 inch material iron)	13,14,15
15	Fire extinguisher	A, B, C type with capacity of 5 kg and 10 kg of CO_2 type	All

R) Suggested Learning Resources:

(a) Books:

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

(b) Online Educational Resources:

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

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

(c) Others:

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

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A) Course Code : **2400107(T2400107)**

B) Course Title : Professional Ethics (Non-Exam Course) **(Cisco/KYP/ST)**
(CE, CSE, ELX, ELX (R), FTS, ME, ME (Auto), AIML, MIE, CHE, CRE, FPP, GT, CT&M)

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, 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/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	3	3	3	3	3	3		
CO-2	3	3	3	3	3	3	3		
CO-3	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 Title	Scheme of Study (Hours/Week)				
	Classroom Instruction (CI)		Notional Hours (TW/ Activities+ SL)	Total Hours (CI+TW/ Activities)	Total Credits (C)
	L	T			
Professional Ethics	01	-	-	01	01

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

Legend:

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

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

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

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

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

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

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

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

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

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Define concepts-values and ethics and attitude, development of attitudes *TSO 1b.* Identify situations depicting values such as humanity, honesty, punctuality, respect, peace, empathy *TSO 1c.* 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**
TSO 2a. Identify the relevance of profession to society and environment *TSO 2b.* Identify the need of values and ethics in profession related activities *TSO 2c.* 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,	**CO1, CO2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	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	

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

J) 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

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

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

M) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	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.pdfcbseacademic.nic.in)
4. Knowledge Traditions & Practices of India (cbseacademic.nic.in) (ps://cbseacademic.nic.in/web_material/Circulars/2012/68_KTPI/Module_5.pdf)

(c) Others:

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A) Course Code : **2400008(P2400008/S2400008)**

B) Course Title : Sports, Yoga and Meditation (Common for all Programmes)

C) Pre- requisite Course(s) :

D) Rationale

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

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

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

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

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

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

F) Suggested Course Articulation Matrix (CAM):

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

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

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

G) Teaching & Learning Scheme:

Board of Study	Course Code	Course Title	Scheme of Study (Hours/Week)					
			Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
	2400008	Sports, Yoga and Meditation	-	-	01	01	02	01

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

Legend:

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

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

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

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

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

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

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

H) Assessment Scheme:

Board of Study	Course Code	Course Title	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
			Theory Assessment(TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
			Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
	2400008	Sports, Yoga and Meditation	-	-	10	-	06	09	25

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

Legend:

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

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

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

Note:

- Separate passing is must for progressive and end semester assessment for both theory and practical.
- 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)
TSO.1a Differentiate between given terms used in sports *TSO.1b* Discuss the different aspects of Mental Toughness *TSO.1c* Use Imagery Training for sports *TSO.1d* Apply motivation techniques to motivate students in sports. *TSO.1e* Use concentration techniques for playing and exercising. *TSO.1f* Manage Stress, Anxiety and Arousal during sports. *TSO.1g* Select sports and exercise for healing and developing health and mental wellness *TSO.1h* Discuss the impact of parents' involvement in their children's sports activities *TSO.1i* Select sports and exercises for physically challenged as per their need.	**Unit-1.0 Sports and Exercises** 1.1 Definition of play, game, sports, exercise, psychology, sports psychology and exercise psychology, psychology and common sense. 1.2 Mental toughness- mind, Imagery, use of imagery and imagery in sports, types of imagery (visual, kinesthetic, auditory and olfactory) 1.3 Motivation in sport and goalsetting in sports 1.4 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 1.5 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. 1.6 Adaptation of sports and exercises for physically challenged students in all levels.	**CO1**
TSO.2a Identify the physiology of yoga and meditation. *TSO.2b* Evaluate meditation and yoga as a healing modality. *TSO.2c* Select asanas and pranayama as per need. *TSO.2d* Discuss the effect of yoga and meditation on ageing, stress and hypertension. *TSO.2e* Select mediation techniques as per the need. *TSO.2f* Discuss Bandha, Mudra and Chakra *TSO.2g* Discuss the steps of Suryanamaskar. *TSO.2h* Select Yoga and Meditation for physically challenged as per their need.	**Unit-2.0 Yoga and Meditation** 2.1 Importance of Yoga & Mediation in daily life, Definition and meaning of the term Yoga and Meditation, Fundamentals Principles of Yoga & Fitness training 2.2 Difference between yoga asana and physical exercises, Difference between yoga and meditation 2.3 Role of Yoga and Meditation in Purificatory Process, in character building, developing concentration, will power and discipline 2.4 Types of Yoga Practices - Asanas, Pranayama, Meditation 2.5 Mindfulness – knowing the mind, training the mind, feeling the mind 2.6 Different Methods of meditation, Physiology of meditation, Mental, physical and emotional benefits of Asanas, Pranayama, Concentration and Meditation 2.7 Bandha, Mudra and Chakra 2.8 Effects of Asanas and pranayama on	**CO2**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	physiology of human body 2.9 Importance of "Suryanamaskar 2.10 Adaptation of Yoga and meditations for physically challenged students in all levels. 2.11 Yoga Asanas Do's and Don'ts for Beginners	
TSO.3a Identify the different factors affecting the fitness and wellness in the given situation *TSO.3b* Use different methods to maintain Health and Wellness *TSO.3c* Discuss the components of Balance Diet *TSO.3d* Identify the causes of stress and anxiety in the given situation *TSO.3e* Use stress reduction techniques to manage Stress and Anxiety *TSO.3f* Manage Stress, Anxiety and Depression in the given situation *TSO.3g* Select recovery process for energy replenishment after exercise.	**Unit 3.0 Fitness and Wellness** 3.1 Meaning, Importance, Definition and dimensions of Health and Wellness (WHO/Yoga) 3.2 Factors affecting Fitness and Wellness 3.3 Role of Physical Activities and Recreational Games in maintaining physiological and psychological wellbeing. 3.4 Different Methods to Maintain Health, Wellness and to enhance mood 3.5 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 3.6 Anxiety, Stress and Aging-Meaning of Anxiety, Stress and Aging, Types and Causes of Stress, 3.7 Stress, anxiety and depression reduction with exercise, yoga and meditation 3.8 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**

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

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

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Perform various sports activities for overall growth and development *LSO 1.2.* Select suitable sport activities as per your need.	1.	Track & Field: Running, Jumping, walking and Throwing, Cycling Event to develop Endurance, Speed, Strength, Agility, Flexibility etc	**CO1**
	2.	Aerobics and Gymnastics to develop Strength, Agility and Flexibility	
	3.	Net/Wall Sports – Volleyball and Basketball to develop Endurance, Speed, Strength, Agility and Flexibility	
	4.	Striking & Fielding sports like Cricket, bowling, Hockey, Football Baseball etc. to develop Endurance, Speed, Strength, Agility, Flexibility and Coordination	
	5.	Racket Game- Tennis, Badminton, Table tennis etc to develop Endurance, Speed, Strength, Agility and Flexibility	
	6.	Outdoor games: Kho-Kho and Kabaddi and cycling develop Endurance, Speed, Strength, Agility and Flexibility	
	7.	Indoor games: Chess and Carrom, Swimming, Boxing, Karate Weightlifting, Power Lifting, Physique Training, Archery, Roller Skating etc to develop concentration.	

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
	8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.	
LSOs 2.1 Perform various yogic techniques for internal purification and development.	9.	Shat Karmas: Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	**CO2**
	10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana	
	11.	Perform following asnas with correct posture: Vakrasana,Chakrasana,Paschimottanasana,Ugrasana,Gomukhasana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra	
	12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwsini-Mudra, Suriyanamaskar	
	13.	BANDHAS Jalandhara-Bandha, Jihva-Banda, Uddiyana Bandha, Moola-Bandha	
	14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari , Sitali , Kapalabhati	
	15.	MEDITATION -Silent Meditation	
	16.	MEDITATION – Mantra Meditation	
LSO 3.1. Prepare diet chart for optimal health and wellbeing	17.	Prepare a diet chart for the given sport.	**CO3**
LSO 3.2. Use health monitoring device	18.	Measure heart rate and heart function with health monitoring device	
	19.	Measure blood sugar and blood pressure	
LSO 3.3. Use different equipment's	20.	Use massage therapy equipment, Hot and cold therapy equipment, Ultrasound therapy equipment	
LSO 3.4. Identify your own threshold and identification level for different taste Stimulations	21.	Determine the taste threshold for three different sensations-sweet salty and sour	
LSO 3.5. Check the given sample for conformance to the standard for moisture content.	22.	Determine the moisture content in the given sample of oil/fat	
LSO 3.6. Purity tests of oils/fats	23.	Determine the impurities in the given sample of oil.	
LSO 3.7. Acidity test in given sample of fat/oil	24.	Determines the acid value and free fatty acids in the given sample of oil/fat.	
LSO 3.8. Check whether any given samples of oils/fats conform to the standard.	25.	Determine the peroxide value in the given sample of fat or oil.	

L) Suggested Term Work/ Activities and Self Learning: S2400008 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

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

- 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	-	-	35%	35%	35%	35%	35%
CO-2	-	-	35%	35%	35%	35%	35%
CO-3	-	-	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

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
8.	Prepare and organize Adapted Sports for various levels of physically challenged and impairments.		30	60	10
9.	Shat Karmas Tratakam, Jala-Neti, Sutra-Neti, Vamana Dhauti, Danda Dhauti, Agnisara, Nauli	CO2	40	50	10
10.	Perform following asanas with correct posture: Ardha-Padmasana [virasana], Ardha-Halasana, Pavana-Muktasana, Naukasana, Ardha-shalabhasana, Shalabhasana, Makarasan, Bhujangasana, Dhanurasana		40	50	10
11.	Perform following asnas with correct posture: Vakrasana,Chakrasana,Paschimottanasana,Ugrasana,Gomukhasana, Padmasana, Siddhasana, Bhadrasana, Swastikkasana, Vajrasana, Supta-Vajrasana, Yoga-Mudra		40	50	10
12.	MUDRAS & SURIYANAMASKAR Brahma-Mudra, Simha-Mudra, Shanmugi Mudra, Viparithakarani-Mudra, Ashwsini-Mudra, Suriyanamaskar		40	50	10
13.	BANDHAS Jalandhara-Bandha, Jihva-Banda, Uddiyana Bandha, Moola-Bandha		40	50	10
14.	PRANAYAMAS Nadi-Shuddhi, Nadi-Shodhana, Suryabhadana, Ujjayi, Bhastrika Pranayama, Bhramari Pranayama, Sitkari , Sitali , Kapalabhati		40	50	10
15.	MEDITATION -Silent Meditation		40	50	10
16.	MEDITATION - Mantra Meditation		40	50	10
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, Sigle 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
8.	Physique Training	Cardio Machines- Treadmills, Elliptical Trainers, Exercise Bikes, Rowing Machines, Indoor Bikes, Vibration Machines, Steppers Recumbents Dumbbells, Multi-Purpose Bench, power rack, Adjustable Dumbbell Set 2 x 3-10 kg, Exercise mat, resistance band, balance trainer	7
9.	Sports and wellbeing equipment's for physically challenged and impairments.	Fusion Wheel – all-in-one portable wheelchair gym, Pedal exerciser, Deluxe hand exerciser, Greeper sports shoelaces, Active Hands, Ramble Tag Guidance Aid, Cat Tongue Grip Tape **Adaptive Cycling**- Straps, Leg/ Foot Adapters, Prosthetics, Steering Dampener, Handlebar Adapters, HANDCYCLING-Wheelchairs, Bike-On Handcycles, Trikes, Racing Wheelchairs, Trikes, Recumbent Bikes, All-terrain Handcycles, Mono Cycling, Hand Bikes - Off-Road, Cross Country, Racing, Downhill **Archery -** Field Tripod and Quad Mounts (Archery & Gun), In-Line Draw-Loc, Mounts (Archery & Gun), Stands (Gun), Mounts (Archery & Gun) Binoculars and Rests (Gun), Crossbows (Archery), Wheelchair Platform Stabilizing Crutch Poles, Dampeners, Crossbows (Archery), Hands free shooting rest (Gun) Bowling: ramp, roll assist **Fitness**: Anti-Gravity Treadmill, LapMat for Wheelchairs, Strike Assist, Adaptive Treadmill	8

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
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 healt- 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 ± 1°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 ± 1°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: 978-1975150198
4.	Essentials of Strength Training and Conditioning	Javair Gillett	Human Kinetics, (2021) ISBN-13: 978-1718210868
5.	Practical Applications in Sports Nutrition	Heather Hedrick Fink, Alan E. Mikesky	Jones & Bartlett Learning, (2017) ISBN-13: 978-1284101393
6.	Health Fitness Management	Mike Bates, Mike Spezzano, Guy Danhoff	Human Kinetics, (2019) ISBN-13: 978-1450412230
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: 978-1739737009
8.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Ann Swanson	DK Publisher ,(2019) ISBN-13: 978-1465479358
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: 978-1786782786
10.	Principles and Methods of Adapted Physical Education & Recreation	Kristi Roth, Laurie Zittel, Jean Pyfer, David Auxter	Jones & Bartlett Learning, (2016) ISBN-13: 978-1284077810
11.	Adapted Physical Education and Sport Sixth Edition	Joseph P. Winnick, David L. Porretta	Human Kinetics, (2016) ISBN-13: 978-1492511533

S. No.	Titles	Author(s)	Publisher with ISBN
12.	Counselling Skills in Applied Sport Psychology: Learning How to Counsel	Paul McCarthy, Zoe Moffat	Routledge, (2023) ISBN-13: 978-1032592589
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: 978-0367111588
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: 978-9354407017

(b) Online Educational Resources:

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

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

(c) Others:

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

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