Curriculum

of

Diploma Programme

in

Electronics Engineering

State Board of Technical Education (SBTE)

Bihar

Semester – II
Teaching & Learning Scheme

Board of Study	CourseCodes	Course Titles	Teaching & Learning Scheme (Hours/Week)					
			Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
	2421101	**Basic Electronics Engg.**	3	-	4	2	9	6
	2420102	**Electric Circuits and Machines** (ELX, ELX (R))	3	-	4	2	9	6
	2400104	**Communication Skills (English)** (Common for all Programmes)	3	-	4	2	9	6
	2400105C	**Applied Mathematics -C** (EE, ELX, ELX (R))	2	1	-	2	5	4
	2418105	**Fundamentals of IT and C Programming** (EE, ELX, ELX (R), FCT)	3	-	4	2	9	6
	2400107	**Professional Ethics** (Non-exam course) (CE, CSE, ELX, ELX (R), FTS, ME, ME (Auto), AIML, MIE, CHE, CRE, FPP, GT)	1	-	-	-	1	1
	2400008	**Sports, Yoga and Meditation** (Common for All Programmes)	-	-	1	1	2	1
Total			**15**	**1**	**17**	**11**	**44**	**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)

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

Semester - II

Assessment Scheme

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)	
	2421101	**Basic Electronics Engg.**	30	70	20	30	20	30	200
	2420102	**Electric Circuits and Machines** (ELX, ELX (R))	30	70	20	30	20	30	200
	2400104	**Communication Skills (English)** (Common for all Programmes)	30	70	20	30	20	30	200
	2400105C	**Applied Mathematics -C** (EE, ELX, ELX (R))	30	70	20	30	-	-	150
	2418105	**Fundamentals of IT and C Programming** (EE, ELX, ELX (R), FCT)	30	70	20	30	20	30	200
	2400107	**Professional Ethics** (Non-exam course) (CE, CSE, ELX, ELX (R), FTS, ME, ME (Auto), AIML, MIE, CHE, CRE, FPP, GT)	25	-	-	-	-	-	25
	2400008	**Sports, Yoga and Meditation** (Common for All Programmes)	-	-	10	-	06	09	25
Total			**175**	**350**	**110**	**150**	**86**	**129**	**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 like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

A) Course Code : **2421101(T2421101/P2421101/S2421101)**

B) Course Title : Basic Electronics Engineering

C) Pre- requisite Course(s) : Applied Physics- B

D) Rationale :

As our dependency on electronic devices grows, so does the need for workforce trained in electronics engineering who can manipulate various types of electronic circuits to achieve specific outputs. Semiconductor device like diodes and transistors has revolutionized the capabilities of electronic equipment, and electronic components are constantly advancing. For students pursuing a diploma in electronics, understanding the fundamental principles of electronic circuits is essential for effective operation and maintenance of electronic systems. This course aims to equip students with the knowledge and skills necessary to apply basic electronic circuit principles to solve a wide range of engineering problems.

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

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

CO-1. Apply the concept of semiconductor physics to electronic circuits.

CO-2. Use a PN junction diode in any given electronic circuit.

CO-3. Use zener diode as voltage regulators and protection devices.

CO-4. Build rectifier circuits comprising diodes.

CO-5. Use special types of diodes in different electronic circuits.

CO-6. Analyze BJT operation and use it as an amplifier in electronic circuits.

F) Suggested Course Articulation Matrix (CAM):

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

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

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

G) Teaching & Learning Scheme:

Board of Study	Course Code	Course Title	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				
	2421101	Basic Electronics	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)	
	2421101	Basic Electronics	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 the classroom (includes class test, mid-term test, and quiz using online/offline modes)PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

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

Note:

- 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 assignments, micro-projects, seminars, and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria for internal as well as external assessment may vary as per the requirement of the respective course. For valid and reliable assessment, the internal faculty should prepare checklists & rubrics for these activities.

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

J) Theory Session Outcomes (TSOs) and Units: T2421101

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Explain the energy band structure of semiconductors and their importance in determining their electrical properties. *TSO 1b.* Describe the effect of temperature on the behavior of semiconductors and their electrical conductivity. *TSO 1c.* Distinguish between intrinsic and extrinsic semiconductors. *TSO 1d.* Compare the properties of n-type and p-type semiconductors, including their conductivity and doping. *TSO 1e.* Explain the effect of E-waste on environment.	**Unit-1: Semiconductor Physics** 1.1 Introduction, types of Materials, Energy Band of material. 1.2 Types of Semiconductors, Intrinsic, Extrinsic, N-type, P-type, Comparison of n-type and p-type SC 1.3 Effect of temperature on semiconductor 1.4 Transport phenomenon in Semiconductor, Mobility, Drift velocity, Resistivity and conductivity 1.5 E-Waste	**CO1**
TSO 2a. Describe the behavior of PN junction diodes under different biasing conditions, including open circuit, forward bias, and reverse bias. *TSO 2b.* Describe the mechanisms of diffusion and drift current in PN junction diodes, and their effects on diode behavior. *TSO 2c.* Establish the mathematical relationship between voltage and current of a PN junction diode. *TSO 2d.* Explain the working principle of the Zener diode with the help of its characteristic curve. *TSO 2e.* Analyze the Voltage stabilization circuit containing Zener diode. *TSO 2f.* Differentiate Zener and avalanche breakdown.	**Unit-2 Semiconductor Diodes** 2.1 PN junction diode: Construction of PN junction diode, Depletion region, Barrier potential, Working of PN junction under open circuit, Forward Bias & Reverse Bias, Diffusion & drift current, Diode current equation, V-I characteristics of PN junction diode, and applications of PN junction diode 2.2 Zener Diode: Construction, working & VI characteristics of Zener diode, Application of Zener Diode as a voltage regulator, Avalanche and Zener Breakdown.	**CO2, CO3**
TSO 3a. Describe a half-wave rectifier circuit's construction and basic operation. *TSO 3b.* Analyze the rectified output's waveform and understand the rectifier parameters' significance, such as the peak voltage, average voltage, and rectification	**Unit-3. Applications of Diode** 3.1 Half-wave Rectifiers: Construction, Working, input-output Waveform, Rectifier parameters (Derivation not required) 3.2 Full wave rectifier (Centre tap & Bridge rectifier): Construction, Working, input,	**CO4**

efficiency. *TSO 3c.* Describe the construction and basic operation of full-wave rectifier circuits, including center-tap and bridge rectifiers, using diodes. *TSO 3d.* Describe the behavior of different types of filters, including their effects on ripple voltage and load regulation, and how they can be optimized for specific applications. *TSO 3e.* Design Clipper and clamper circuit for given data.	and output Waveform, Rectifier parameters (Derivation not required) 3.3 Rectifier with Filter-C, LC, CLC (Analysis not required) 3.4 Basics of Clipper and Clamper Circuits	
TSO 4a. Describe the behavior and properties of LEDs, including their light output, efficiency, and color characteristics. *TSO 4b.* Explain the principles of operation of laser diodes and describe their characteristics and applications in optical communication and industrial processes. *TSO 4c.* Identify the unique characteristics of the varactor, tunnel, PIN, photodiode, Schottky barrier, and solar diodes, and evaluate their application in specific electronic circuits and systems.	**Unit-4. Special Types of Diodes:** Construction, working, characteristics, and Application of each type of diode: Light Emitting Diode (LED), Laser Diode, Varactor Diode, Tunnel Diode, PIN Diode, Photodiode, Schottky Barrier Diode, Solar Diode	**CO5**
TSO 5a. Describe the working of NPN and PNP transistors. *TSO 5b.* Calculate the terminal current and terminal voltage of the given circuit. *TSO 5c.* Draw the input and output characteristics of CE, CB, and CC BJT amplifiers. *TSO 5d.* Calculate the current gain α, β, and γ of the given circuit. *TSO 5e.* Identify methods for preventing and mitigating thermal runaway, such as thermal management techniques, current limiting, and thermal shutdown circuits.	**Unit-5: Bipolar Junction Transistor** 5.1 Bipolar Junction Transistor (BJT)- Construction, symbol, and Types 5.2 Mode of operation of BJT, Working of NPN and PNP 5.3 Transistor configuration, Input, output characteristics, and current gain of CE, CB, and CC amplifier. 5.4 Relationship between the current gain of CE, CB, and CC configuration 5.5 Comparison of CE, CB, and CC configuration	**CO6**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2421101

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Measure the Hall coefficient, mobility, and resistivity of a given semiconductor sample and compare the results with the known values. *LSO 1.2.* Measure the energy bandgap of a given semiconductor material.	1.	Characterization of Semiconducting Materials: Use a spectrometer to measure the energy bandgap of a given semiconductor material and compare the results with the known values	CO1
LSO 2.1. Interpret the V-I characteristics of different types of diodes under forward	2.	Use a diode testing setup to measure the electrical parameters of different types of diodes and analyze the results.	CO2

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
and reverse bias conditions and compare the results. *LSO 2.2.* Measure the circuit parameters of the LED blinker circuits such as frequency response, gain, and sensitivity.			
LSO 3.1. Measure the current and voltage across the Diode using multimeter. *LSO 3.2.* Interpret the V-I characteristics of the PN Junction Diode.	3.	Verify the performance and measure the cut in voltage of the given PN Junction.	CO3
LSO 4.1. Measure the current and voltage across the Zener Diode. *LSO 4.2.* Verify the V-I characteristics of the Zener diode.	4.	Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage.	CO3
LSO 5.1. Verify the ripple factor of the HWR with and without a filter.	5.	Construct a Half Wave Rectifier and obtain regulation characteristics – With & without Filters. Compare the results.	CO4
LSO 6.1. Verify the ripple factor of the FWR with and without a filter.	6.	Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters. Compare the results	CO4
LSO 7.1. Verify the ripple factor of the FWR with and without a filter.	7.	Construct Full Wave Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters. Compare the results	CO4
LSO 8.1. Test and troubleshoot a filter circuit using multimeters, oscilloscopes, and other testing tools.	8.	Test the performance of the different types of filters such as C-filter and LC-filter.	CO5
LSO 9.1. Verify the transfer characteristics of the CE amplifier circuit	9.	Test the performance of the input-output characteristic of CE amplifier circuit.	CO6
LSO 10.1 Measure the gain of the CS amplifier circuit.	10.	Build the circuit of the CS amplifier on Bread Board and calculate the gain cs amplifier circuit.	CO6

L) Suggested Term Work and Self-Learning: **S2421101** 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. Calculate the current gain, voltage gain, input impedance, and output impedance of the given CE amplifier circuit.
2. Calculate R.M.S current and average current of HWR and FWR.
3. Calculate the ripple factor of the CLC filter.

b. Micro Projects:

1. Build a full wave bridge rectifier with a capacitor filter for 6 V, 500 mA output current on general-purpose PCB.
2. Undertake a market survey of different semiconductor components and prepare the report.
3. LED Blinker Circuit: Design and build a simple LED blinker circuit using a 555 timer IC and a few other basic components.
4. Build a simple light sensor circuit using an LDR (Light Dependent Resistor).
5. Design 12V or 5V battery charging system.
6. Design electronics water level controller device.
7. Design a rain-sensing automatic car wiper.

c. Other Activities:

1. Seminar Topics:
   - Solar technology.
   - Handling electronic waste.
   - PCB Design.

2. Visits: Visit nearby electronic shops/industries having sufficient electronic equipment with a maximum number of measuring instruments.

3. Self-learning topics:

   - Atomic structure of the semiconductor.
   - Introduction to Mobility, Drift velocity.
   - Drift current, diffusion current & thermal current.

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/MidSem Test	End Theory Assessment (ETA)	Term Work & Self-LearningAssessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	20%	20%	20%	20%	20%	15%	15%
CO-2	10%	10%	10%	10%	10%	15%	15%
CO-3	10%	10%	10%	10%	10%	20%	20%
CO-4	15%	15%	15%	15%	15%	25%	25%
CO-5	15%	15%	15%	15%	15%	15%	15%
CO-6	30%	30%	30%	30%	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: The specification table represents the reflection of sample representation of assessment of the cognitive domain of the full course.

Unit Title and Number	Total Classroom Instruction Hours (CI)	Relevant COs Number (s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0: Semiconductor Physics	9	CO1	14	4	4	6
Unit-2.0: Semiconductor Diodes	11	CO2, CO3	15	4	5	6
Unit-3.0: Applications of Diode	8	CO4	10	4	3	3
Unit-4.0: Special Types of Diodes	8	CO5	10	4	3	3
Unit-5.0: Bipolar Junction Transistor	12	CO6	21	4	8	9
Total	**48**	**-**	**70**	**20**	**23**	**27**

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

O) Suggested Assessment Table for Laboratory (Practical):

S.No.	Laboratory Practical Titles	Relevant CO Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Characterization of Semiconducting Materials: Investigating the Energy Band Structure, and Transport Phenomenon.	CO1	40	50	10
2.	Voltage-current characteristics and Electrical Characterization of special Diodes Using a Diode Testing Setup.	CO2	40	50	10
3.	Construct the circuit and test the performance of the PN Junction diode and measure the cut in voltage.	CO3	40	50	10
4.	Construct the circuit and test the performance of a Zener Diode and also calculate the breakdown voltage.	CO3	40	50	10
5.	Construct a Half Wave Rectifier and obtain regulation characteristics – With & without Filters. Compare the results.	CO4	40	50	10
6.	Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters. Compare the results.	CO4	40	50	10
7.	Construct Full Wave Bridge Rectifier and obtain regulation characteristics Without Filters and with Filters. Compare the results.	CO4	40	50	10
8.	Test the performance of the different types of filters such as C-filter and LC-filter.	CO5	40	50	10
9.	Test the performance of the input-output characteristic of CE amplifier circuit.	CO6	40	50	10
10.	Build the circuit of the CS amplifier on Bread Board and calculate the gain cs amplifier circuit.	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/ ImplementationStrategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved Lectures, Tutorials, Case Methods, Group-Discussion, Industrial visits, Industrial Training, Portfolio Based Learning, Role Play, Live Demonstrations in Classrooms, Labs, Field, Information and Communications Technology (ICT) Based Teaching Learning, Blended or flipped mode, Brainstorming, Expert Sessions, Video Clippings, Use of Open Educational Resources (OER), MOOCs, etc.

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

S. No.	Name of Equipment, Tools, and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	C.R.O.	Dual Channel 100MHz	All
2.	Function generator	100MHz Function & Arbitrary Generator,500 MSa/s-DG4102	3,4,5,6,7,8,9
3.	Dual Power supply	Digital Dual Output DC Power Supply, Input Voltage: 230 V AC, Output Voltage: 0 To 128 V	All
4.	Bread Board	MB 102 Breadboard with Power Supply Module, Jumper Wires, Battery Clip,830 & 400 Tie-Points	All
5.	Digital Multimeter	DM-86 Digital Multimeter AC Frequency Response: 40-400Hz Low Battery Display: Approx. < 7.5V	All
6.	Electronic Work Bench	Bread Board 840 -1000 contact points: Positive and Negative power rails on opposite side of the board, 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO: 0-30 MHz, Digital Multimeter	All

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Fundamentals of Electrical and Electronics Engineering (with Lab Manual)	Susan S. Mathew, Saji T. Chacko	Khanna Book Publishing,1st edition, 2022, ISBN: 9789391505592
2.	Analog Circuits	A.K. Maini	Khanna Publishing House 2018, ISBN: 978-93-86173-584
3.	Electronic Devices and Circuits	S. Salivahanan and N. Suresh Kumar	McGraw Hill Education; 4th edition 2017, ISBN: 978-9339219505
4.	Electronics Devices and Circuit Theory	Boyestad & Nash-elsky	Pearson Education India; 11th edition, 2015, ISBN: 978-9332542600
5.	Electronic Principles	Albert Malvino and David Bates	Tata McGraw Hill Publication, 2010, ISBN: 978-0070634244
6.	Electronics Devices & Circuits	Jacob Millman	McGraw Hill Education; 4th edition ,2015, ISBN: 978-9339219543
7.	Fundamentals of Electronic Devices and Circuits	David Bell	Oxford University Press, International edition, USA, 2015, ISBN: 9780195425239
8.	Electronic Devices and Circuit: An Introduction	Allen Mottershead	PHI Learning, New Delhi, ISBN: 9788120301245

(b) Online Educational Resources:

1. nptel.ac.in/courses/122106025
2. www.datasheetcafe.com
3. www.futurlec.com/
4. www.onlinecourses.nptel.ac.in/noc21_ee55/preview
5. www.youtube.com/watch?v=HQ9pHFvq5do&list=PLm_MSClsnwm8EdADExAUnwdEM51R3Yhfc
6. www.youtube.com/watch?v=xhn188JafbM&list=PL350612601E2DBFDE
7. www.youtube.com/playlist?list=PLMksOeFI6x39hw7SMZp9xb_Np0ClVPzpA

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

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A) Course Code : **2420102(T2420102/P2420102/S2420102)**

B) Course Title : Electric Circuits and Machines (ELX, ELX (R))

C) Pre- requisite Course(s) : Basics of Physics, Basic Engineering Mathematics and Applied Mathematics

D) Rationale :

Electric Circuits and Machines course is a basic core course which provides a solid theoretical and practical foundation for future courses in the field of applications of electronics engineering. An electronics diploma holder works often with the hardware that involves electric circuits. Hence analyzing the circuit and its behavior is very important and becomes the base for understanding various phenomena in electrical and electronic system. An electronics e diploma holder should also have the knowledge of basic electrical machines. This will enable him/her to get introduced to the terminology that will be used in the industry. This course is designed in such a way that the knowledge and skill set developed through the theory and practical experiences will help him/her efficiently in any industry and also will provide a solid foundation for the advanced electronics engineering courses in higher semesters.

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-

CO1: Apply basic laws to simplify the electrical circuits and networks.

CO2: Apply principles of network theorems to determine various parameters in a given electrical circuit and networks.

CO3: Apply the concepts of transient and steady state response to various electrical circuits.

CO4: Use two port networks to determine the circuit parameters.

CO5: Use basic electrical machines for the industrial applications.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes(POs)							Programme SpecificOutcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Developmentof Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	2	2	3	1	1	1		
CO-2	3	2	2	3	-	-	1		
CO-3	3	2	2	3	-	1	1		
CO-4	3	2	2	-	-	-	1		
CO-5	3	2	2	3	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				
	2420102	Electrical Circuits and Machines	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)	
	2420102	Electrical Circuits and Machines	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: T2420102

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Classify the different network elements on the basis of V-I characteristics. TSO 1b. Determine the current, voltage power in a given linear circuit using Ohm's Law. TSO 1c. Obtain current and voltage for open and close loop circuit. TSO 1d. Simplify the complex circuit using star-delta and source transformation. TSO 1e. Determine the current and voltage using nodal and mesh analysis in the given circuit. TSO 1f. Determine the mesh currents and nodal voltage by applying KVL and KCL in the given circuit.	**Unit-1.0 Basics of Electrical Circuits** 1.1 Resistor, Inductor, Capacitor 1.2 Ohm's Law 1.3 Network elements • Unilateral and Bilateral • Linear and non-linear • Active and Passive • Lumped and Distributed 1.4 Open circuit, closed circuit, Short circuits. 1.5 Node, Branch, Loop, Mesh Equivalent resistance, capacitance and inductance and Star delta transformations, Source Transformation 1.6 Kirchhoff's Voltage and Current law 1.7 Mesh Analysis and Nodal Analysis of Networks	**CO1**
TSO 2a. Apply Superposition Theorem to a given electric circuit having more than one voltage and current source to calculate the current in any branch of the circuit. TSO 2b. Apply Thevenin's Theorem to calculate Vth, Rth and in turn load current in a given branch of an electric circuit (both independent and dependent sources). TSO 2c. Apply Norton's Theorem to calculate I_N, R_N and load current in the given branch of an electric circuit (both independent and dependent sources). TSO 2d. Apply Maximum Power Transfer theorem to optimize the power transmission in a given electric circuit by having load resistance equivalent to source resistance. Also determine the maximum current in the load of the circuit. TSO 2g. Apply Reciprocity Theorem to single source network containing dependent source by interchanging the excitation and response along with simple examples.	**Unit-2.0 Network Theorems** 2.1 Super Position Theorem 2.2 Thevenin's Theorem 2.3 Norton's Theorem 2.4 Maximum Power Transfer Theorem 2.5 Reciprocity Theorem	**CO1, CO2**
TSO 3a. Represent a first order circuit by 1st order differential equation for R-L and R-C series and parallel circuit and solve the same. *TSO 3b.* Represent a second order circuit by 2nd order differential equation for R-L and R-C	**Unit-3.0 AC Circuit and Transient Analysis** 3.1 First and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits 3.2 AC Analysis • Series and parallel AC Circuits: R-L, R-C, R-	**CO1, CO3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
series and parallel circuit and solve the same. *TSO 3c.* Calculate reactance, equivalent impedance/ admittance and power factor of the given ac circuit. *TSO 3d.* Determine the conditions of resonance in the given circuit *TSO 3e.* Establish the relationship between Q-factor and bandwidth. *TSO 3f.* Calculate initial and final values of the given network elements. *TSO 3g.* Calculate steady state and transient response of a given circuit. *TSO 3h.* Convert a given circuit into Laplace domain and find out its response.	L-C, Impedance, Impedance triangle, Power factor • Resonance -Series and Parallel resonance in R-L-C Circuit 3.3 Transient Analysis: • Initial and Final conditions in network elements • Steady State and Transient State Response, Time constants	
TSO 4a. Describe the Relationship between input current, voltage with output current, voltage in a two-port network. *TSO 4b.* Determine the two port parameters (Z, Y, ABCD and h) and draw its equivalent circuit. *TSO 4c.* Establish the relationship between different two port network parameters. *TSO 4d.* Explain the condition for reciprocity and symmetricity for Two Port network. *TSO 4e.* Draw graph for the given circuit *TSO 4f.* Draw possible number of Tree and Twig for the given graph. *TSO 4g.* Make Incidence matrix and reduced incidence matrix for the given graph. *TSO 4h.* Apply graph theory principle to simplify the given network circuit.	**Unit-4.0 Two Port Network** 4.1 Terminal and Ports 4.2 Two port network parameters • Open Circuit Impedance Parameters(Z) • Short Circuit Admittance Parameters(Y) • Transmission Parameters (ABCD) • Hybrid Parameters (h) 4.3 Condition of Reciprocity and Symmetricity for Two port network. 4.4 Introduction to Graph Theory • Graph of network • Tree and Twig • incidence matrix	**CO1, CO4**
TSO 5a. Describe the construction of the given type of transformer with the help of a neat sketch. *TSO 5b.* Explain the working principle of the given type of transformer. *TSO 5c.* Derive the voltage equation and voltage and current ratio of the given type of transformer. *TSO 5d.* Classify the transformers on the basis of the given criteria. *TSO 5e.* Differentiate between single phase and three phase transformers. *TSO 5f.* Describe the construction of the given type of DC motor with the help of a neat cut section sketch. *TSO 5g.* Explain the working principle of the given type of DC motor	**Unit-5.0 3D Basics of Electrical Machines** 5.1 Transformers (single and three phase) • Construction and Operating principle. • Classification and applications- Power, Distribution, Rectified and Resonant • Voltage and current ratio, emf equation 5.2 Applications of 3 phase transformers 5.3 D.C. Motors • Construction and Operating principle. • Types - Series, shunt and compound motor and applications 5.4 Single Phase induction motor • Construction and Operating principle. • Types and its applications 5.5 Three Phase Induction Motors • Construction and Operating principle. • Types – Squirrel cage and slip ring and their applications	**CO5**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 5h. Describe the construction of the given type of induction motor with the help of a neat sketch. *TSO 5i.* Describe the working principle of the given type of induction motor.		

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2420102

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. Use multimeter to measure voltage and current. *LSO 1.2.* Plot the graph between voltage and current.	1.	Perform experiment to verify Ohm's law for two different resistors in series and parallel circuits.	CO1
LSO 2.1. Construct the resistive circuits on breadboard with appropriate resistors. *LSO 2.2.* Use a multimeter to measure the voltage across the terminals, the current flowing in the circuit and the resistance of the load.	2.	Measurement of current through the given branch of electric network.	CO1
LSO 3.1. Construct the resistive circuits on breadboard with appropriate resistors. *LSO 3.2.* Identify AC/DC supply terminals and tabulate the measured voltage between terminals.	3.	Measurement of voltage through the given branch of electric network using KVL.	CO1
LSO 4.1. Construct the resistive circuits with appropriate resistors/rheostat. *LSO 4.2.* Take readings using multimeter or ammeter and voltmeter and calculate the Thevenin resistance and power transfer to the load.	4.	Perform experiment to determine load resistance using maximum power transfer theorem.	CO1, CO2
LSO 5.1. Construct the resistive circuits with appropriate voltage source. *LSO 5.2.* Measure the current flowing through the circuit.	5.	Measurement of current through the given branch of circuit by applying superposition theorem.	CO1, CO2
LSO 6.1. Connect the resistive circuits with appropriate electrical circuit elements. *LSO 6.2.* Measure the Thevenin equivalent impedance and Thevenin voltage	6.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem	CO1, CO2
LSO 7.1. Construct the resistive circuits on breadboard with appropriate electrical circuit elements. *LSO 7.2.* Measure the Norton's equivalent impedance and Norton's current source.	7.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Norton's theorem.	CO1, CO2
LSO 8.1. Measure the basic electrical quantities such as voltage, current and power and power factor for variable R-load.	8.	Measurement of power and power factor of single-phase load and plot the graph.	CO1, CO3

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 8.2. Measure the apparent power reading using ammeter and voltmeter.			
LSO 9.1. Assemble the series resonance circuit with appropriate circuit components. *LSO 9.2.* Measure the frequency using audio frequency generator and record the different readings. *LSO 9.3.* Calculate the frequency at which voltage attains its maximum value.	9.	Plot frequency response of series R-L-C resonant Circuit.	CO1, CO3
LSO 10.1. Measure the value of the resistor R, capacitor and inductor. *LSO 10.2.* Calibrate the function generator and oscilloscope. *LSO 10.3.* Measure the function generator voltage and frequency with the oscilloscope.	10.	Plot frequency response of parallel R-L-C resonant Circuit	CO1, CO3
LSO 11.1. Construct the circuit with proper location of supply, switch and load. *LSO 11.2.* Measure the currents and voltage at different time instants.	11.	Plot and analyze the transient response of a series R-L circuit.	CO1, CO3
LSO 12.1. Assemble the circuit with proper location of supply, switch and load. *LSO 12.2.* Measure the currents and voltage at different time instants.	12.	Plot and analyze the transient response of a series R-C circuit.	CO1, CO3
LSO 13.1. Design the desired network by proper morphology for different two port network parameters. *LSO 13.2.* Measure the parameters for respective circuit.	13.	Perform experiment to determine different parameters of Two-port network.	CO1, CO4
LSO 14.1. Identify the terminals of a single-phase transformer *LSO 14.2.* Connect Voltmeter and Ammeter to measure voltage and current	14.	Measurement of voltage ratio and current ratio of a given single-phase transformer	CO1, CO5
LSO 15.1. Identify the various parts of a DC motor. *LSO 15.2.* Identify the material of different parts of a DC motor.	15.	Assemble the various parts of a cut section model of a DC Motor.	CO1, CO5
LSO 16.1. Identify the various parts of a 3-phase induction motor. *LSO 16.2.* Identify the material of different parts of a 3-phase induction motor.	16.	Assemble the various parts of a cut section model of a 3-phase induction motor.	CO1, CO5

L) Suggested Term Work and Self-Learning: S2420102Some 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 numericals by applying KCL, KVL to different circuits,
2. Analyze the electrical circuit by solving numericals using mesh and nodal analysis.
3. Solve numericals by applying various network theorems to the electrical circuit.
4. Prepare a report on applications and limitations of different network theorems.
5. Write the practical applications of resonant circuits.
6. List the practical applications of single and 3 phase transformer, induction motor and DC motor.

b. Micro Projects:

1. Use simulation software such as LTspice, Multisim, or Circuit Lab to create and analyze circuits using nodal or mesh analysis. Furthermore, online calculators such as Circuit Solver, Nodal Analysis Calculator, or Mesh Analysis Calculator can be used to check answers or solve circuits.
2. Use Scilab /MATLAB or any other software to verify network theorems.
3. Simulate different combination of series and parallel circuits to determine currents, Voltages in a DC circuit and also determine Power and power factor in an AC circuit.
4. Prepare a mobile charger using a step-down transformer, a full wave bridge rectifier and a voltage regulator.

c. Other Activities:

1. Seminar Topics:
    - Use of Mesh and nodal analysis.
    - Single phase power and power factor.
    - Network theorems, applications and limitations
    - Types of transformer and its applications
2. Visits: Visit a nearby under construction residential project and study the series, parallel combination of wiring and estimate the load and its distribution, and prepare a report on it.
3. Self-learning topics:
    - Super mesh analysis for huge and complex circuits with example.
    - Application of 2 port networks
    - Softwares used to solve electrical circuits 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%	34%	25%	25%	20%	20%
CO-2	20%	15%	34%	25%	25%	20%	20%
CO-3	20%	20%	16%	25%	10%	20%	20%
CO-4	20%	15%	-	-	20%	20%	20%
CO-5	20%	30%	16%	25%	20%	20%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Basics of Electrical Circuits	10	CO1	15	4	6	5
Unit-2.0 Network Theorems	10	CO1, CO2	10	3	4	3
Unit-3.0 AC Circuit and Transient Analysis	10	CO3	15	4	6	5
Unit-4.0 Two Port Network	8	CO4	10	3	4	3
Unit-5.0 Basics of Electrical Machines	10	CO1, CO5	20	6	8	6
Total	**48**	**-**	**70**	**20**	**28**	**22**

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

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
1.	Perform experiment to verify of Ohm's law for two different resistors in series and parallel circuits.	CO1	50	40	10
2.	Measurement of current through the given branch of electric network .	CO1	60	30	10
3.	Measurement of current through the given branch of electric network using KVL.	CO1	60	30	10
4.	Perform experiment to determine load resistance using maximum power transfer theorem.	CO1, CO2	50	40	10
5.	Measurement of current through the given branch of circuit by applying superposition theorem.	CO1, CO2	50	40	10
6.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.	CO1, CO2	50	40	10
7.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Norton's theorem.	CO1, CO2	50	40	10
8.	Measurement of power and power factor of single-phase load and plot the graph.	CO1, CO3	50	40	10
9.	Plot frequency response of series R-L-C resonant Circuit.	CO1, CO3	50	40	10
10.	Plot frequency response of parallel R-L-C resonant circuit.	CO1, CO3	50	40	10
11.	Plot and analyze the transient response of a series R-L circuit.	CO1, CO3	50	40	10
12.	Perform experiment to determine different parameters of two-port network.	CO1, CO4	50	40	10
13.	Measurement of voltage ratio and current ratio of a given single-phase transformer,	CO1, CO5	50	40	10
14.	Assemble the various parts of a cut section model of a DC Motor.	CO1, CO5	50	40	10
15.	Assemble the various parts of a cut section model of a 3-phase induction motor.	CO1, CO5	50	40	10

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

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/Practical Number
1.	Power Supply	Regulated Power Supply 0-30V DC, 0-20 Amp Input Voltage AC 220V ±5%, Output voltage:0-30 V, Output current:0-20 Amp, Voltage display: 3½ Digit LED, Current display: 3½ Digit LED	All
2.	Digital Multimeter	3½ Digit with R,V& I measurement with diode and BJT testing	All
3.	Components Box	Max dev+-5 percent	All
4.	Test bench with proper wiring	Ground connections and shock absorber hand wrist.	All
5.	Digital Function Generator	3 ½ Digit display 0.01Hz (1-500 MHz)	All
6.	DSO	• Ana-log bandwidth: 100MHz * 2 • Number of channels: 2 channels • Maximum real time sampling rate: 1GSa/s • Vertical sensitivity: 50 mV/div ~ 500 V/div • Horizontal time base range: 50S/div ~ 10nS/div • Maximum test voltage: 40 V (1X probe), 400 V (10X probe) • Input resistance: 1MΩ • Coupling mode: AC/Direct Current • Trigger mode: Single, Normal, Auto • Trigger edge: Rising edge/Falling edge	All
7.	Breadboard	• Distribution Strips are two, Wire Size is 21 to 26 AWG wire, Tie Points are two hundred, Withstanding Voltage is 1,000V AC Tie points within IC are 630, Insulation Resistance is DC500V or 500MΩ, Dimension is 6.5*4.4*0.3-inch, Rating is 5Amps ABS plastic through colour legend ABS heat, Distortion Temperature is 183° F (84° C) Hole or Pitch Style is 2.54mm	All
8.	High end computers	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
9.	Simulation software	MATLAB/SIMULINK, LTspice, Multisim, or Circuit Lab /Opensource software	All
10.	Single phase transformer	230V/115V, 1 kVA single phase transformer	14
11.	Ammeter	0-5/10/20 Ampere MI portable	14
12.	Voltmeter	0-75/150/300 V MI Portable	14
13.	DC motor	Cut section model	15
14.	Three phase Induction motor	Cut section model	16

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Network and System	Choudhury D. Roy	New Age International (UK) Ltd ISBN: 9781906574246
2.	Network Analysis	M.E. Van Valkenburg, T.S. Rathore	Pearson Publisher ISBN: 9789353433123
3.	Schaum's Outline of Electric Circuits (Schaum's Outline Series)	Nahvi, M; Edminister, Joseph	Tata McGraw Hill Education Private Ltd. ISBN: 978-1260011968
4.	Network Analysis and Synthesis	SP Ghosh, AK Chakraborty	McGraw Hill Education India ISBN:9780070144781
5.	Circuit Theory	Abhijit Chakrabarti	Dhanpat Rai Publishing Co Pvt Ltd ISBN:9788177000009
6.	Engineering circuit Analysis	William H. Hayt, J E Kemmerly, J D Phillips, SM Durbin	McGraw Hill Education India ISBN:9789390185139
7.	A Text Book of Electrical Engineering	J.B. Gupta	S.K. Kataria & Sons ISBN: 978-93-5014-344-5
8.	A Text book of Electrical Technology, Volume-I	Theraja, B.L.	S. Chand and Co. New Delhi ISBN-13: 978-8121924405
9.	Network and System	Hussain Ashfaq	Khanna Publishers ISBN-13: 978-8187522089

(b) Online Educational Resources:

1. https://nptel.ac.in/courses/108104139
2. https://archive.nptel.ac.in/courses/108/104/108104139/
3. https://archive.nptel.ac.in/courses/117/106/117106108/
4. https://alison.com/course/advanced-diploma-in-basic-electrical-circuits
5. https://archive.nptel.ac.in/courses/108/105/108105159/

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. UNSW Handbook on Electric Circuits,2021
2. Introduction to Electric Circuits by Eur lng RG Powell
3. Electric Circuits Simulation Lab Manuals

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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

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number (s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
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

S. No.	Laboratory Practical Titles	Relevant COs Number (s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
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 : **2400105C (T2400105C /S2400105C)**

B) Course Title : Applied Mathematics- C (EE, ELX, ELX (R))

C) Pre- requisite Course(s) : Basic Engineering Mathematics

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 in a variety of career paths. Integral calculus and differential equations are fundamental tools in the study of mathematics and are used in a wide range of fields, especially including problems related to electrical and electronic engineering applications. Numerical methods provide a way to solve problems quickly and easily compared to analytic solutions. Laplace Transform methods have a key role to play in the modern approach to the analysis and design of engineering system. Laplace Transform is also widely used by Electronic Engineers to solve quickly differential equations occurring in the analysis of electronic circuits and to simplify calculations in system modeling. Complex numbers are used by Electrical & Electronic Engineers to define the AC concept of Impedance, and in Fourier analysis they are used in the processing of radio, telephone and video signals. Fourier series is used in designing electrical circuits, signal processing, signal analysis, image processing & filtering. Fourier Transform has wide applications in cell phones, LTI system & circuit analysis and also in solving differential equations.

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 integration.

CO-2 Use differential equations as a tool to solve problems related to electrical and electronic engineering.

CO-3 Select suitable method to solve nonlinear equations based on engineering applications.

CO-4 Use Laplace transforms to solve given differential equation based on engineering applications.

CO-5 Apply Fourier series and Fourier transform to solve broad based electrical and electronic engineering related problems.

F) Suggested Course Articulation Matrix (CAM):

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	1	-	-	-	-	-		
CO-2	3	2	-	-	-	-	-		
CO-3	3	2	-	-	-	-	-		
CO-4	3	3	2	1	-	-	1		
CO-5	3	3	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				
	2400105C	Applied Mathematics - C	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/ implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

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

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

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

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

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

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of 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)	
	2400105 C	Applied Mathematics- C	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: T2400105C

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Use standard forms of integration to find the integral of given simple functions. *TSO 1b.* Apply suitable Trigonometric transformation to solve given Integration problem. *TSO 1c.* Solve given problems using the properties of definite integral. *TSO 1d.* Invoke the concept of Integration to solve the problems based on area and volume of irregular shapes.	**Unit-1.0 Integral Calculus and its Applications** 1.1 Concept and Definition of Integration. 1.2 Working rules and Integral of standard Functions. 1.3 Method of Substitution, Trigonometric transformation, Integration by parts and Partial fraction. 1.4 Applications: Area and volume.	**CO1**
TSO 2a. Find the order and degree of given differential equations. *TSO 2b.* Solve differential equations using variable separable method. *TSO 2c.* Obtain the solution of given homogeneous differential equation. *TSO 2d.* Solve the given linear differential equation based on engineering application. *TSO 2e.* Solve the given Bernoulli differential equation. *TSO 2f.* Solve the homogeneous linear differential equations of second order with constant coefficient.	**Unit-2.0 Differential Equations** 2.1 Concept and Definition, Order and Degree of Differential equation. 2.2 Differential equation of first order and first degree, variable separable Method. 2.3 Homogeneous, linear Differential equation and Bernoulli equation. 2.4 Homogeneous linear differential equations of second order with constant coefficient.	**CO2**
TSO 3a. Find the root of given equation using iterative methods up to desired accuracy. *TSO 3b.* Calculate the root of given equations using Newton-Raphson Method. *TSO 3c.* Apply Newton-Raphson Method for engineering applications.	**Unit-3.0 Numerical Solution of Nonlinear Equations** 3.1 Algebraic and Transcendental equations. 3.2 Iterative Methods. 3.3 Newton-Raphson Method.	**CO3**
TSO 4a. Solve given problems based on algebra of complex numbers. *TSO 4b.* Use Laplace transform to solve the given problems. *TSO 4c.* Solve the given problems based on properties of Inverse Laplace transform for engineering applications. *TSO 4d.* Apply Laplace transform to solve differential equations occurring in the analysis of electronic circuits.	**Unit-4.0 Complex Numbers and Laplace Transform** 4.1 Complex numbers: Cartesian, Polar and Exponential form, Algebra of complex numbers. 4.2 Laplace transform of standard functions (without proof). 4.3 Properties of Laplace transform such as linearity, first and second shifting properties (without proof).	**CO4**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
	4.4 Inverse Laplace transforms using partial fraction method. 4.5 Laplace transforms: applications to differential equations.	
TSO 5a. Find the Fourier series of Square wave and triangular wave function. *TSO 5b.* Obtain Fourier transform of given functions. *TSO 5c.* Plot the graph of the Fourier series of the given function. *TSO 5d.* Plot the graph of the Fourier transform of the given function.	**Unit-5.0 Fourier Series and Fourier Transform** 5.1 Periodic and Non-Periodic Functions. 5.2 Fourier series. 5.3 Fourier Transforms. 5.4 Fourier Transform of Simple functions.	**CO5**

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

K) Suggested Laboratory (Practical)/ Tutorials and Outcomes:

Outcomes	S. No.	Laboratory (Practical)/ Tutorials Titles	Relevant COs Number(s)
LSO 1.1. Calculate the area of hexagon using integration. *LSO 1.2.* Calculate the average temperature of a city over a certain period of time. *LSO 1.3.* Measure the current-voltage characteristics of a semiconductor diode using integration. *LSO 1.4.* Determine the total power consumed by an electrical device using Integration techniques. *LSO 1.5.* Apply the concept of definite integration to find volume.	1.	• Area of irregular shape using integration. • Average value of a function using integration. • Analysis of the performance of a diode through integration. • Calculation of power consumption using integration. • Volume of an irregular shape using integration.	**CO1**
LSO 2.1. Solve population dynamics using first-order ODEs. *LSO 2.2.* Use first-order ODEs to calculate the charging and discharging of a capacitor in an electrical circuit. *LSO 2.3.* Calculate the concentration of a reactant in a chemical reaction over time. *LSO 2.4.* Calculate mechanical vibrations using second-order ODEs.	2.	• Analysis of a population model through differential equations. • Analysis of charging and discharging in an electrical circuit through differential equations. • Analysis of chemical system using ODEs • Vibrations of a mass-spring system.	**CO2**
LSO 3.1. Use Newton's method to find the roots of a non-linear equation in one variable. *LSO 3.2.* Use the concept of Newton's method to solve financial modeling related problems based on Black-Scholes model.	3.	• Applications of iterative techniques. • Application of Newton Raphson's method. • Iterative scheme using Newton's method.	**CO3**

Outcomes	S. No.	Laboratory (Practical)/ Tutorials Titles	Relevant COs Number(s)
LSO 3.3. Calculate the electric field (that satisfies Maxwell's equations) around a wire with a given shape and current, using Newton Raphson's method.			
LSO 4.1. Use Laplace transforms techniques to compare the performance of given control systems. *LSO 4.2.* Use Laplace transform to calculate the response of a given system to a step input. *LSO 4.3.* Use Laplace transform to analyze the dynamic behavior of given circuits.	4.	• Performance of control systems using Laplace transforms techniques. • Analysis of the performance through Laplace transforms techniques. • Analysis of circuit's dynamic behavior through Laplace transforms techniques.	**CO4**
LSO 5.1. Model Square wave and triangular wave as a Fourier series. *LSO 5.2.* Analyze the frequency content of signals using Fourier series and Fourier transform.	5.	• Representation of waves through Fourier series. • Frequency distribution through Fourier series.	**CO5**

L) Suggested Term Work and Self Learning: S2400105C 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. Find the area of the region enclosed between two curves; also verify the obtained result geometrically using any open source software.
2. Evaluate the Integral of functions using open source software.
3. Consider an RLC circuit with resistance R (measured in ohms) Inductance (measured in Henries) Capacitance C (measured in Faraday) and varying Voltage V(t) measured in Volts. Its current I(t) measured in Amperes) satisfies L I''(t) + RI'(t)+1/c I(t)= V'(t). Solve the second order differential equation with initial value conditions using open source software.
4. Use open source software to plot the family of curves and computes its differential equation.
5. Write down a program to compute the roots of transcendental equations by Newton-Raphson method and execute the result.
6. Write down a program to compute the roots of a nonlinear equations using Iterative method and execute the result.
7. Graphical representation of Addition, Subtraction and Multiplication of Complex numbers through any open source software.
8. Use Fourier Transform to transform a signal sampled in time or space to the same signal sampled in temporal or spatial frequency with the help of any open source software.
9. Use the concept of Fourier Series to transform a signal from time domain to the frequency domain.
10. Prepare notes on Application of Fourier Series in Control Theory.
11. Apply Fourier Transform for solving a differential equation that relates the input and output of a system.

b. Micro Projects:

1. Prepare charts displaying various standard integration formulas.
2. Explore the use of Integral calculus to calculate the velocity and acceleration of a particle.
3. Prepare charts showing area and volume of various geometrical shapes using Integral calculus.
4. Prepare a model as Differential equations to calculate the electric potential in a region.
5. Prepare model showing the applications of differential equation for Newton's law of cooling.
6. Prepare a simulating environment to study the motion of a particle under the influence of gravity.

7. Prepare a comparative chart showing convergence of various iterative techniques.
8. Prepare a chart consisting of 8-10 nonlinear equations made of real-world problems.
9. Download 5-7 videos based on applications of Laplace transform using ordinary differential equations in the analysis of electronic circuits, watch them and write a report to detail out the mathematical steps involved.
10. Make a short video of duration 5-7 minutes for the use of Laplace transform to calculate the response of a system to an input signal.
11. Download 5-7 videos based on applications of Fourier transform for cell phones, LTI system & circuit analysis, watch them and write a report to detail out the mathematical steps involved.
12. Make a short video of duration 10-15 minutes on engineering applications of Fourier series and Fourier transform especially related to the transmission of electromagnetic waves.

c. Other Activities:

1. Seminar Topics:
    - Applications of Integral calculus in control systems, dynamics and vibrations.
    - Applications of Integral calculus in production and cost analysis.
    - Applications of Integral calculus in algorithms and optimization.
    - Applications of Integral calculus in population dynamics and bio-mathematics.
    - Applications of Integral calculus in filtering and feature extraction.
    - Solving Differential Equations through SCILAB.
    - Applications of Differential Equations in population dynamics and epidemiology.
    - Applications of Numerical Methods for electrical and electronics engineering.
    - Numerical Solution of Nonlinear Equations using Root-Finding Algorithms: Techniques and Applications.
    - Complex Numbers and its engineering applications: Electrical and electronics engineering.
    - Differential Equations with discontinues input via Laplace Transform: Techniques and Applications.
    - Laplace Transform in Control Systems: Applications in feedback systems, transfer function and stability analysis.
    - Laplace Transform in Electrical Engineering: Applications in circuit analysis and network theory.
    - Fourier series in Signal Processing: Applications in filtering and feature extraction.
    - Fourier Transform in Engineering: Applications in control systems and dynamics.
    - Fourier Transform in Financial Mathematics: Applications in option pricing and portfolio optimization.

   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 mathematics museum.
    - Visit to a mathematics laboratory.
    - 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 library.
    - Participation in mathematics-based competition.

2. Self-learning topics:
    - Integration Techniques and Applications.
    - Participate in MOOCs on Ordinary Differential Equations: Methods and Applications.
    - The Newton-Raphson Method: rate of convergence.
    - Watching videos on Laplace Transformation: Concepts and Applications.
    - Watching video on Fourier series Representation of Periodic Functions.

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%	15%	-	-
CO-2	20%	20%	20%	20%	25%	-	-
CO-3	10%	10%	10%	20%	10%	-	-
CO-4	30%	30%	30%	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 (Cl) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1.0 Integral Calculus and its Applications	8	CO1	12	4	4	4
Unit-2.0 Differential Equations	12	CO2	14	4	6	4
Unit-3.0 Numerical Solution of Nonlinear Equations	6	CO3	08	2	4	2
Unit-4.0 Complex Numbers and Laplace Transform	12	CO4	20	6	8	6
Unit-5.0 Fourier Series and Fourier Transform	10	CO5	16	4	6	6
Total	**48**	**-**	**70**	**20**	**28**	**22**

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

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

P) Suggested Instructional/Implementation Strategies: Different Instructional/ Implementation Strategies may be appropriately selected, as per the requirement of the content/outcome. Some of them are Improved 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

(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 Animations.
8. Mathematics Simulations.
9. Mathematics Games.
10. Mathematics Puzzles.
11. Mathematics Brain Teasers.
12. Mathematics Apps.
13. Mathematics Blog.
14. Mathematics Challenges.

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A) Course Code : **2418105(T2418105/P2418105/S2418105)**

B) Course Title : Fundamentals of IT Systems and C Programming
(EE, ELX, ELX (R), FCT)

C) Pre- requisite Course(s) :

D) Rationale :

Information technology is a term that describes the entire range of information generation, storage, transmission, retrieval, and processing. Most organizations in the industry, business, non-profit organizations, and government departments now rely heavily on their information systems (IS) and information technology (IT). Thus, student must possess basic skills to use Information technology and Information systems.

Looking to the current IT practices in business it is also necessary for student to learn basic programming skills that includes building logic, develop algorithms and then write programs. The 'C' has been widely used as a general-purpose language to develop basic and advanced applications,
Hence this course is designed keeping in view the development of a basic understanding of programming skills in students with the help of the 'C' programing language. The course is designed to create a base to develop foundation skills in IT and programming languages.

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 Appraise computer systems and its applications for various educational, business, and industrial domain.

CO-2 Setup a small computer Network.

CO-3 Write 'C' Program to solve given arithmetic expression

CO-4 Develop 'C' program Using control structure

CO-5 Develop 'C' programs using arrays.

CO-6 Create functions in C programs for modular programming approach.

F) Suggested Course Articulation Matrix:

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

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

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

G) Teaching & Learning Scheme:

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				
	2418105	Fundamentals of IT and C Programming	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)	
	2418105	Fundamentals of IT and C Programming	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: T2418105

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 1a. Describe the anatomy of the Computer System. *TSO 1b.* List the different Input and Output devices. *TSO 1c.* Identify the different types of memory in computer systems. *TSO 1d.* Explain communication process between different components of a computer. *TSO 1e.* Describe the functionalities of a computer system. *TSO 1f.* Use Internet digital Platforms	**Unit-1.0 Basics of Computer System** 1.1 Computer System and its Components. - Generation of Computer - Anatomy of Computer Systems - Input and output device - Motherboard - Peripherals - Backend and Front end of System Unit 1.2. Storage device in Computer System - Primary Storage - Secondary Storage 1.3. CPU Components - Register - Control Unit - ALU 1.4. Types of Bus - Address Bus - Data Bus - Control Bus 1.5 Search Engine - Introduction - Search Query - Applications of Internet Digital Platforms (BHIM, Digi-Locker, m-paravian, NPTEL etc.)	**CO-1**
TSO 2a. Compare various computer network topologies *TSO 2b.* Differentiate types of networks. *TSO 2c.* Compare internet and intranet *TSO 2d.* Explain IP addressing system. *TSO 2e.* Explain functions of Networking Devices.	**Unit 2. Basic Network Concepts** 2.1 Network Topologies Bus, Mesh, Star, Ring, Hybrid 2.2 Types of Computer Networks LAN, WAN 2.4 Internet & Intranet IP Addressing system and URL, Internet, Intranet, Comparison between Intranet & Internet 2.3 DNS - Introduction, Need - Domain Names & its types 2.5 Networking Devices (Types and use) Switch, Router, Gateway, Modem, Repeater, Wireless Access Point, NIC	**CO-2**
TSO 3a. Write Algorithm to solve the given problem.	**Unit 3. Basics of 'C' Programming and control structures**	**CO-3**

Major Theory Session Outcomes (TSOs)	Units	Relevant COs Number(s)
TSO 3b. Write simple 'C' program to solve the given arithmetic expressions *TSO 3c.* Write a simple 'C' Program demonstrating the given data type conversion *TSO 3d.* Write I/O Statements for the given data. *TSO 3e.* Write a 'C' program using a decision-making structure for two-way branching to solve the given problem. *TSO 3f.* Write a 'C' program using a decision-making structure for multi-way branching to solve the given problem. *TSO 3g.* Apply loop statements to solve the given iterative problem in 'C' program. *TSO 3h.* Use appropriate statements to change the program flow in the given loop.	3.1 Fundamentals of algorithms: Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures. 3.2 Flowchart: Flowchart, Symbols of flowchart, Guidelines for preparing Flowchart 3.3 Introduction to C: General Structure of a 'C' program Data Concepts: Character set, tokens, keywords, Identifiers, Variables, Constant, data types, C operators, Arithmetic operators, Arithmetic expression, declaring variables, and data type conversion. 3.4 Basic Input output: Input and Output statements, using printf() and scanf(), character input/output statements, Input/output formatting, Use of comments 3.5 Decision making and branching**:** Relational and logical operators, if statement, if else statement, nested if-else, if-else ladder' The switch statement 3.6 Looping: While loop, Do… While loop For loop, Go to statement, Use of break and continue statements	
TSO 4a. Write statements to read, write the given array. *TSO 4b.* Manipulate the given array of characters and numbers. *TSO 4c.* Use pointers to access memory locations for solving the given problem.	**Unit 4. Array and Pointer** 4.1 Characteristics of an array, One dimension and two-dimension arrays, Array declaration and Initialization 4.2 Array of characters, Operation on array Character and String input/output **Concepts of pointers: declaring, initializing, accessing.**	**CO-4**
TSO 5a. Use the given Library function. *TSO 5b.* Develop user defined functions for the given problem. *TSO 5c.* Write 'C' codes to pass the given function parameters using "call by value" and "call by reference" approach. *TSO 5d.* Write recursive function for the given problem.	**Unit 5. Concept and Need of Functions** Library functions: Math functions, String handling functions, other miscellaneous functions. Writing User defined functions, scope of variables. Parameter passing: call by value, call by reference. Recursive functions	**CO-5**

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

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2418105

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 1.1. install device driver. *LSO 1.2.* Install given software on your system. *LSO 1.3.* Perform Registration process of digital India platform.	1.	1.1 Identify specifications of various types of computer systems available in your institute. 1.2 Install Printer, scanner driver. 1.3 Install any two freeware or open-source software/tool by using web browser 1.4 Use Digital India Platforms: BHIM, Dig-Locker, m-parivahan, NPTEL.	**CO-1**
LSO 2.1. List various types of networking devices in your Institute. *LSO 2.2.* make a small local area network.	2.	2.1 Connect two/three computers to form a network using wire/wireless connectivity and configure it.	**CO-2**
LSO 3.1. Write and execute simple 'C' program. *LSO 3.2.* Use scanf() and printf() functions in 'C' programs. *LSO 3.3.* Write C Program using Decision Making and two-way branching statements. *LSO 3.4.* Write C Program using "switch-case" statement for multi-way branching. *LSO 3.5.* Use the "if" and "Switch" statements appropriately for decision making in C Program. *LSO 3.6.* Write and execute C programs using various types of loop statements to solve iterative problems.	3.	3.1 Write 3 different C –Program to demonstrate use of Arithmetic expression, constant, variable and Increment/ decrement operators. 3.2 Write a program to- a. Determine whether a given year is a leap year or not. b. Determine whether a string is palindrome. c. Find the greatest of the three numbers using conditional operators. d. Find if a given character is vowel (use if-else ladder). 3.3 Using switch statement- Write program to: Print day of week by taking number from 1 to 7. 3.4 Write Program to: a. Find sum of digits of a given number. b. Find Fibonacci series for given number. c. Write a program to produce the following output: 1 2 3 4 5 6 7 8 9 10	**CO-3, CO-4**
LSO 4.1. Write and execute C programs using one-dimension array. *LSO 4.2.* Write and execute C program using two-dimensional array.	4	4.1 Develop a Program to: a. Sort list of 10 numbers. b. Perform addition of 3x3 matrix.	**CO-5**
LSO 5.1. Write C program using different types of library functions to solve given problem.	5.	5.1 Develop Program to demonstrate: a. Use of String handling functions. b. Use of Mathematical functions. c. Use of other miscellaneous functions.	**CO-6**

Practical/Lab Session Outcomes (LSOs)	S. No.	Laboratory Experiment/Practical Titles	Relevant COs Number(s)
LSO 5.2. Write C program to Create and use user defined functions		5.2 Develop a Program to: a. Create a function to find GCD of given number. Call this function in a program. 5.3 Find Factorial of given number using recursion.	

L) **Suggested Term Work and Self Learning:** **S2418105** 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. Identify specifications of various types of computer systems in your Institute .
2. Prepare a report on computer peripherals and its usage of your computer lab.
3. Prepare a presentation on network topology.
4. Prepare a survey report to identify various types of networking devices available in your Institute.
5. Make a calculator using 'C' programming.

c. Other Activities:

1. Seminar Topics: -
   - "Future of IT"
   - "Scope of 'C' programming in other Engineering disciplines"
2. Prepare a poster presentation on Computer hardware and peripherals.
3. Prepare a report on Open Source software available for Electronics Engineering.
4. Product Development: Development of projects for real life problem solution using 'C' programming.

d. Self-learning topics:

1. System and application software.
2. Scope of 'C' programming in real world.

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

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Term Work Assessment (TWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Term Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities*		
CO-1	10%	10%	10%	100%	100%	10%	-
CO-2	10%	10%	10%			10%	-
CO-3	10%	10%	15%			25%	**30%**
CO-4	25%	25%	25%			25%	**40%**
CO-5	25%	25%	20%			15%	**30%**
CO-6	20%	20%	20%			15%	
Total Marks	**30**	**70**	**20**	**20**	**10**	**20**	**30**
			50				

Legend:

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

**: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

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

N) Suggested Specification Table for End Semester Theory Assessment:

Specification table represents the reflection of sample representation of assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit-1. Basics of Information System	5	CO-1	7	3	3	1
Unit 2. Basic Network Concepts	5	CO-2	7	3	2	2
Unit 3. Basics of 'C' Programming and control structures	18	CO-3 and CO-4	28	8	8	12
Unit 4. Array and Pointer	12	CO-5	17	3	4	10
Unit 5. Concept and need of functions	8	CO-6	11	3	2	6
Total	**48**	**-**	**70**	**20**	**19**	**31**

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.	Identify specifications of various types of computer systems available in your institute.	CO-1	40	50	10
2.	Install Printer driver.	CO-1	40	50	10
3.	Install any two freeware or open-source software/tool by using web browser	CO-1	40	50	10
4.	Use Digital India Platforms: BHIM, Dig-Locker, m-parivahan, NPTEL.	CO-1	30	60	10
5.	Connect two/three computers to form a network using wire/wireless connectivity and configure it.	CO-2	40	50	10
6.	Write 3 different C –Program to demonstrate Arithmetic expression, constant, variable and Increment/decrement operator.	CO-3	50	40	10
7.	Write a program to- a. Determine whether a given year is a leap year or not. b. Determine whether a string is palindrome.	CO-3	50	40	10
8.	c. Find the greatest of the three numbers using conditional operators.	CO-3	50	40	10

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA /ELA		
			Performance		Viva-Voce (%)
			PRA* (%)	PDA** (%)	
	d. Find if a given character is a vowel (use if-else ladder).				
9.	Write Program to: (a) Find sum of digits of a given number. (b) Find Fibonacci series for given number. (c) Write a program to produce the following output: 1 2 3 4 5 6 7 8 9 10	CO-3	50	40	10
10.	Develop a Program to: a. Sort list of 10 numbers. b. Perform addition of 3x3 matrix.	CO-4	50	40	10
11.	Develop Program to demonstrate: a. Use of all String handling functions. b. Use of few Mathematical functions. c. Use of few other miscellaneous functions.	CO-5	50	40	10
12.	Develop a Program to: a. Create a function to find GCD of given number. Call this function in a program	CO-5	50	40	10
13.	Find Factorial of given number using recursion.	CO-5	50	40	10

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

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

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

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

S. No.	Name of Equipment, Tools and Software	Broad **Specifications** (No Generic) Give basic configuration or Latest	Relevant Experiment/Practical Number
1	Computer System	Any General-purpose Computer	All
5	Switch	4, 8, 12, 16 or 24 port switches with 100/1000 gbps data transfer speed	5
6	Ethernet cable	Cat 6, cat6e or above	5
8	Printer	Any printer dot matrix, inkjet or laser printer	2
9	C complier	Turbo C/ Dev C/Others	6-13

R) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1	Computer fundamentals and programming in C	Reema thareja	Oxford university press INDIA ISBN-10 : 9780199463732 ISBN-13 : 978-0199463732
2	Let us C	Yashavant Kanetkar	BPB publication, ISBN-10 : 8183331637 ISBN-13 : 978-8183331630
3	Programming in ANSI C	E. Balagurusamy	McGraw Hill education ISBN-10 : 935316513X ISBN-13 : 978-9351343202
4	Computer Fundamentals Concepts Systems and Applications 8th Edition (English, Paperback,	Priti Sinha, Pradeep Sinha	BPB Publications ISBN-13: 9788176567527 ISBN-10: 8176567523
5	Fundamentals of Computers	E Balagurusamy	McGraw Hill Education 2009, ISBN-10 : 9780070141605 ISBN-13 : 978-0070141605

(b) Open Educational Resources:

1. https://nptel.ac.in/courses/106104128
2. https://en.wikipedia.org/wiki/Networking_hardware
3. https://www.javatpoint.com/computer-fundamentals-tutorial
4. https://www.w3schools.com/c/

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

(c) Others:

1. Learning Header files
2. 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, avoiding cheating and dishonesty, showing gratitude towards others and encouraging them to work 2.3 Identification of activities and related ethical and unethical behavior for professional activities in their area of work 2.4 Examples of situations depicting values- based decisions and ethical behavior	**CO1, CO2**

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

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)						
			Theory Assessment(TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		Total Marks (TA+TWA+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
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

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

S. No.	Name of Equipment, Tools and Software	Broad Specifications	Relevant Experiment/ Practical Number
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
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

S. No.	Titles	Author(s)	Publisher with ISBN
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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