Zeal Education Society's

ZEAL COLLEGE OF ENGINEERING & RESEARCH, PUNE – 41

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

*NBA Accredited, NAAC Accredited with **A**+ Grade / ISO 21001:2018*

DEPARTMENT OF ELECTRICAL ENGINEERING

Curriculum Structure and Syllabus of

F.Y. B. Tech. – Electrical Engineering

(With effect from - Academic Year 2026- 27)

(2026 Course)

VISION OF THE INSTITUTE

To be a premier institute in technical education by imparting academic excellence, research, social and entrepreneurial attitude.

MISSION OF THE INSTITUTE

- To achieve academic excellence through innovative teaching and learning process.
- To imbibe the research culture for addressing industry and societal needs.
- To inculcate social attitude through community engagement initiatives.
- To provide conducive environment for building the entrepreneurial skills.

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION:

To be premier institute in technical education by imparting academic excellence, research, social and entrepreneurial attitude.

MISSION:

M1: To achieve academic excellence through innovative teaching and learning process
M2: To imbibe the research culture for addressing industry and societal needs.
M3: To inculcate social attitude through community engagement initiatives.
M4: To provide conducive environment for building the entrepreneurial skills.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Graduates will be able to apply their technical skill sets and knowledge to solve engineering-based problems in industry, academic and diverse fields of Electrical Engineering.
PEO2: Graduates will demonstrate ethical and social responsibility while engaging in research, innovative practices and entrepreneurial activities, contributing positively to society and technological advancement.
PEO3: Graduates will embrace lifelong learning and adaptability, staying updated with emerging technologies, industry trends and advancements in electrical engineering.

PROGRAM OUTCOMES (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8)
PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

PO6: The Engineer and the World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

PO8: Individual and Collaborative Team Work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: To apply knowledge to build ability to design analyses and solve problems in the field of electrical engineering through power systems, electrical machines, control systems, electronics and automation.

PSO2: To develop solution to real time problems through appropriate techniques, modern engineering hardware and software tools related Electrical engineering.

LIST OF ABBREVIATIONS

Abbreviation	Description
BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Program Core Course
PEC	Program Elective Course
MDM	Multidisciplinary Minor
OE	Open Elective - Other than a particular program
VSEC	Vocational and Skill Enhancement Course
AEC	Ability Enhancement Course
ENTR	Entrepreneurship
EC	Economics
MC	Management Courses
IKS	Indian Knowledge System
VEC	Value Education Courses
RM	Research Methodology
CEP	Community Engagement Project
FP	Field Project
PROJ	Project
INT	Internship
OJT	On Job Training
CC	Co-curricular Courses
HSSM	Humanities Social Science and Management
ELC	Experiential Learning Course
B. Tech	Bachelor of Technology
L	Lecture
P	Practical
T	Tutorial
H	Hours
CR	Credits
CIE	Continuous Internal Evaluation
ETE	End Term Evaluation
TW	Term Work
OR	Oral
PR	Project

DEPARTMENT OF ELECTRICAL ENGINEERING

First Year B. Tech. – Electrical Engineering: Semester - I

Course Code	Course Type	Course Name	Teaching Scheme (hrs/Week)							Evaluation Scheme					
			L	P	T	H	CR			CIE	ETE	TW	PR	OR	Total
							TH	PR/ Tut	Total						
26EEBS101	BSC	Engineering Mathematics- I	3	-	-	3	3	-	3	40	60	-	-	-	100
26EEBS102	BSC	Engineering Physics	2		-	2	2	-	2	40	60		-	-	100
26EEBS102P	BSC	Engineering Physics Lab	-	2		2	-	1	1	-	-	-	-	25	25
26EEES101	ESC	Basic Electrical Engineering	3		-	3	3	-	3	40	60	-	-	-	100
26EEES101P	ESC	Basic Electrical Engineering Lab	-	2		2	-	1	1	-	-	50	25	-	75
26EEES102	ESC	Electrical Energy Generation System	2	-	-	2	2	-	2	40	60	-	-	-	100
26EEES103	ESC	Electrical Workshop-I	-	2		2	-	1	1	-	-	50	--	-	50
26EEVS101	VSEC	IT Proficiency	1	2	-	3	1	1	2	-	-	25	-	-	25
26EECC101	CC	Professional Development - I	1	2	-	3	1	1	2	-	-	50	-	-	50
26EECC102	CC	Liberal Learning - I	-	2	-	2	-	1	1	-	-	25	-	-	25
26EEIK101	HSSM - IKS	Indian Knowledge System & Financial Literacy	2	-	-	2	2	-	2	-	-	50	-	-	50
Total			**14**	**12**	**0**	**26**	**14**	**6**	**20**	**160**	**240**	**275**	**25**	**-**	**700**

*** Liberal Learning – I: Choose any one from the following:**

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	26EECC102A	Guitar	6.	26EECC102F	Basketball
2.	26EECC102B	Singing	7.	26EECC102G	Cricket
3.	26EECC102C	Cinematography	8.	26EECC102H	Rifle and Pistol Shooting
4.	26EECC102D	Dance	9.	26EECC102I	Volleyball
5.	26EECC102E	Synthesizer	10.	26EECC102J	Football

BoS Chairman

ZES's Zeal College of Engineering & Research Narhe, Pune-41 PU/PN/Engg./285/2007

Director
ZES's Zeal College of Engineering & Research
Narhe, Pune - 411041.

DEPARTMENT OF ELECTRICAL ENGINEERING

First Year B. Tech. – Electrical Engineering: Semester - II

Course Code	Course Type	Course Name	Teaching Scheme (hrs/Week)				Evaluation Scheme							
			L	P	T	H	CR			CIE	ETE	TW	PR	OR	Total
							TH	PR/ Tut	Total						
26EEBS203	BSC	Engineering Mathematics II	3	-	-	3	3	-	3	40	60	-	-	-	100
26EEBS204	BSC	Engineering Chemistry	2		-	2	2	-	2	40	60		-	-	100
26EEBS204P	BSC	Engineering Chemistry Lab	-	2		2	-	1	1	-	-	-	-	25	25
26EEES204	ESC	Basic Electronics Engineering	3		-	3	3	-	3	40	60	-	-	-	100
26EEES205	ESC	Introduction to Electrical Engineering Materials	3	-	-	3	3	-	3	40	60	-	-	-	100
26EEES205P	ESC	Introduction to Electrical Engineering Materials Lab	-	2		2	-	1	1	-	-	-	-	25	25
26EEPC201	PCC	Fundamentals of Electrical Measurements	3		-	3	3	-	3	40	60	-	-	-	100
26EEPC201P	PCC	Fundamentals of Electrical Measurements Lab	-	2		2	-	1	1	-	-	25	25	-	50
26EEVS202	VSEC	Electrical CAD and Python Programming	-	2	-	2	-	1	1	-	-	25	-	-	25
26EEVS203	VSEC	Electrical Workshop-II		2		2		1	1	-	-	25			25
26EECC203	CC	Professional Development - II	1	2	-	3	1	1	2	-	-	25	-	-	25
26EECC204	CC	Liberal Learning - II	-	2	-	2	-	1	1	-	-	25	-	-	25
Total			**14**	**14**	**0**	**28**	**14**	**7**	**22**	**200**	**300**	**175**	**25**	**0**	**700**

*** Liberal Learning – II: Choose any one from the following:**

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	26EECC204A	Guitar	6.	26EECC204F	Basketball
2.	26EECC204B	Singing	7.	26EECC204G	Cricket
3.	26EECC204C	Cinematography	8.	26EECC204H	Rifle and Pistol Shooting
4.	26EECC204D	Dance	9.	26EECC204I	Volleyball
5.	26EECC204E	Synthesizer	10.	26EECC204J	Football

BoS Chairman

ZES's Zeal College of Engineering & Research PU/PN/Engg./285/2007 Narhe, Pune-41

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SYLLABUS

SEMESTER - I

DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)									**Semester:** I
Course: Engineering Mathematics – I									**Code:** 26EEBS101
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
3	-	-	3	40	60	-	-	-	100

Prerequisites:

Basic concept of Differentiation, Integration, Maxima and Minima, Matrices and Determinants

Course Objectives:

1. To acquaint the students to rank of matrix, solution of simultaneous equations, Eigen values and Eigen vectors.
2. To acquire techniques of the expansion of functions about any point and to evaluate the indeterminate forms of limits.
3. To make students familiar with multivariable differentiation and its applications.
4. To introduce to student awareness of concept of Fourier series.

Course Outcomes: After completion of this course, students will able to -

CO1	Use of matrix method for solving system of simultaneous linear equations.
CO2	Find Eigen values and Eigen vectors of the matrix.
CO3	Describe the power series expansion of a given function and evaluate limits.
CO4	Understand the basic concepts of partial derivatives**.**
CO5	Evaluate partial derivatives to estimate maxima and minima of function of multiple variables.
CO6	Determine the Fourier series representation and harmonic analysis for design.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**System of Linear Equations:** Rank of a matrix, System of linear equations, Linear dependence and independence of vectors, Linear and orthogonal transformations, Application to problems in engineering.	07
2.	**Eigen Values and Eigen Vectors, Diagonalization:** Eigen values and eigen vectors, Cayley-Hamilton theorem, Diagonalization of a matrix, Reduction of quadratic forms to canonical form by linear and orthogonal transformations.	07
3.	**Differential Calculus:** Rolle's theorem, Mean value theorems, Taylor's series and Maclaurin's series, Expansion of functions using standard expansions, Indeterminate forms.	07
4.	**Partial Differentiation:** Partial derivatives of first and higher orders, Euler's theorem on homogeneous functions, Partial derivative of composite functions, Total derivative and Implicit differentiation.	07

5.	**Applications of Partial Differentiation:** Jacobians and their applications, Errors and Approximations. Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.	07
6.	**Fourier Series:** Definition, Dirichlet's conditions, Full range fourier series, Half range fourier series, Harmonic analysis.	07
	TOTAL	**42**

Text Books:

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. B. S. Grewal , "Higher Engineering Mathematics", Khanna Publication
3. Howard Anton & Chris Rorres , "Elementary Linear Algebra" , John Wiley & sons.
4. Seymour Lipschutz, Marc Lipson , "Schaum's outlines of Linear Algebra", 6th edition McGraw-Hill Education (India) Private Limited, New Delhi.

Reference Books:

1. Erwin Kreyszig , "Advanced Engineering Mathematics" , Wiley Eastern Ltd.
2. M. D. Greenberg , "Advanced Engineering Mathematics" , Pearson Education.
3. Peter V. O'Neil , "Advanced Engineering Mathematics" , Thomson Learning.
4. P. N. Wartikar and J. N. Wartikar , "Applied Mathematics (Vol. I & Vol. II)", Vidyarthi Griha Prakashan, Pune.
5. Ron Larson and David C. Falvo, "Elementary Linear Algebra" ,Houghton Mifflin Harcourt
   Publishing Company

E-Resources:

1. NPTEL Course on "Engineering Mathematics-I" IIT Khargpur - https://www.youtube.com/watch?v=4QFsiXfgbzM&list=PLbRMhDVUMngeVrxtbBzn8HvP8KAWBpI5
2. Paathshala Pandit , "Rank of Matrix | Vector Space | Engineering Mathematics" - https://www.youtube.com/watch?v=jHU3yasfpKw&list=PLU4tRlorU5wWPpemhfdG0Yc4zNiICSMVO&index=1
3. Eigenvalues and Eigenvectors | Properties and Important Result | Matrices- https://www.youtube.com/watch?v=1wjXVdwzgX8
4. Taylor Series | Numericals | Maths 1 | B.Tech 1st year | Engineering | BSc -
5. Partial Differentiation Example And Solution | Multivariable Calculus - https://www.youtube.com/watch?v=eTp5wqcSXY&list=PLU6SqdYcYsfLuIJdHwY92aGBg5-
   a. uRHBOb&index=1

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Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Engineering Physics								**Code:** 26EEBS102	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
2	-	-	2	40	60	-	-	-	100

Prerequisites:

Fundamentals of Physics, basic of interference, polarization, de-Broglie hypothesis, semiconductor and ultrasonic.

Course Objectives:

1. To make the students understand and study the basic principles of Physics.
2. To provide firm grounding to the students in the concept of physics to resolve many engineering and technological problems.
3. To impart the knowledge of the fundamentals of physics to the students through hands on experiments and extend it to relevant engineering applications.

Course Outcomes: At the end of the course, Student will be able to **-**

CO1	Explain basics of interference and polarization connected to engineering applications
CO2	Make use of Laser technology and Optical fiber in various disciplines.
CO3	Outline the fundamentals of Quantum Physics and relate it to engineering applications
CO4	Apply basics of semiconductors for solving the engineering problems.
CO5	Extend the understanding of Ultrasonic and NDT in engineering.
CO6	Interpret the use of nanoparticles and superconductors in the field of engineering.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Wave Optics:** **Units and its conversion-**Length, Mass, Velocity, Acceleration Momentum, Time, Temperature, Wavelength, Energy, Current, Voltage, Power, Intensity, Amplitude, Frequency, Pressure, Resistance, compressibility, resistivity, conductivity, Mobility, Angle. **Interference-** Interference in thin film of uniform thickness and its conditions (Simple Numerical), Engineering Applications – Ant-Reflection coating (ARC). **Polarization**- Polarization and its types, Malus law and Brewster's law (Simple numerical), Double refraction, Huygens's theory of double refraction, Differentiate between positive & negative crystal, Engineering applications of polarization: Liquid Crystal Display (LCD).	5
2.	**Laser and Optical Fiber:** **Laser**- Basic Principles of laser, Elements of Laser, Characteristics of laser, He-Ne laser (Gas laser), Applications of laser – Medical, Industrial and Holography- Recording. **Optical fibers-** Propagation of light - Acceptance angle, Acceptance cone, Numerical aperture, Fractional Refractive Index Change (Simple numerical). Types of optical fibers, Advantages of optical fiber communication, Applications of optical fiber in Medical, Communication, Entertainment, Data Security.	5

3.	**Quantum Physics:** de-Broglie hypothesis of matter waves, de-Broglie wavelength for a particle accelerated by Kinetic Energy (K.E) and a charged particle accelerated by Potential difference (PD) "V", (Simple Numerical), Properties of matter waves, Heisenberg's uncertainty principle for wide wave packet and narrow wave packet (Simple Numerical), Tunneling Effect, Engineering applications - Scanning Tunneling Microscope (STM), Introduction to Quantum Computing.	4
4.	**Semiconductor Physics:** Classification of solids on the basis of band theory, Fermi level for metal and semiconductor, Position of Fermi level in extrinsic semiconductors (only diagram), Solar cell: principle, working, IV-characteristics, Efficiency and fill factor, Factor to improve efficiency of solar cell, Application, advantages and disadvantages of solar cell, Hall effect: derivation for Hall voltage and Hall coefficient (Simple numerical).	5
5.	**Ultrasonic and Non-destructive Testing:** **Ultrasonic**- Properties of ultrasonic waves, Piezoelectric effect and inverse of piezoelectric effect, Generation of ultrasonic waves by inverse piezoelectric effect (using transistor), Compressibility of liquid by using ultrasonic waves (Simple Numerical). **Non- Destructive Testing (**NDT): Definition and its objectives, Difference between destructive testing and non-destructive testing, Application of NDT as an Ultrasonic flaw detection technique (Simple numerical), Advantages of NDT.	4
6.	**Nanophysics and Superconductivity:** **Nanophysics-** Introduction of nanophysics, Properties of nanoparticles (Optical, Electrical, Mechanical), Applications of nanomaterials in Electronics, Automobile, Medical. **Superconductivity-** Definition of superconductivity on the basis of temperature dependence of resistivity, Properties of Superconductors, Meissner effect, Critical magnetic field (Simple Numerical), Type I and Type II Superconductors, Engineering applications of superconductivity in Superconducting Quantum Interface Device (SQUID) with its principle, working, general application of superconductors - Power Transmission, electronics, medical, principle of Maglev train.	5
	TOTAL	**28**

Text Books:

1. M. N. Avadhanulu and P.G. Kshirsagar, "Engineering Physics", S. Chand Publications.
2. S. O. Pillai, "Solid State Physics", New age International Publications.
3. J. J. Sakurai, "Modern Quantum Mechanics", Pearson Publication.
4. V K Mehta and Rohit Mehta, "Basic Electrical Engineering", S Chand Publications.
5. Robert L. Jaffe and Washington Tayler, "The Physics of Energy", Cambridge University Press".

Reference Books:

1. H. D. Young and R. A. Freedman, "University Physics", Pearson Publication.
2. Resnick and Halliday, "Principles of Physics", John Wiley and Sons.
3. Jenkins and White, "Optics", Tata McGraw Hill.
4. Noson S. Yanofsky and Mirco A. Mannucci, "Quantum computing for computer scientists", Cambridge University Press

E-Resources:

1. NPTEL Course:
   a. NPTEL lecture based on interference of polarized light by IIT Roorkee - https://youtu.be/e-4QK_JVsdU?si=gWIBt41dDgeABO8Y
   b. NPTEL lecture based on Introduction of Polarization by IIT Roorkee- https://youtu.be/fIVlzKB4bBQ?si=meWFP5matsopCABi
   c. NPTEL lecture based on Malus Law by IIT Roorkee https://youtu.be/iFG82I3nFA0?si=JCln6fJqGNw6ix5U
   d. NPTEL lecture based on Double Refraction by IIT Roorkee https://youtu.be/Pt5wvYyguq0?si=4mowxORZQXGXNxMW
   e. NPTEL lecture based on Semiconductor Physics by IIT Roorkee - https://youtu.be/q7VIITSysMs?si=62lAMoJ2tMHKRiDH
   f. NPTEL lecture based on Introduction to superconductivity https://youtu.be/hGPA1g8fKug?si=FdYfJju6bf6u2zRe
   g. NPTEL lecture based on Meissner Effect- https://youtu.be/EkNnxBakJMs?si=qRnSvPlD2NTe4rf-
2. Feynman lecture series: https://www.feynmanlectures.caltech.edu/
3. Concepts of Modern Physics, Arthur Beiser: - https://nitsri.ac.in/Department/PHYSICS/Beiser_Modern_Physics.pdf
4. Lectures by Walter Lewin: https://www.youtube.com/channel/UCiEHVhv0SBMpP75JbzJShqw
5. Quantum Mechanics Lecture Series by Prof. H.C.Verma - https://www.youtube.com/watch?v=JFWuAQRZPjQ&list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At
6. Virtual Labs, Amrita University- https://vlab.amrita.edu/?sub=1&brch=195
7. Virtual Labs, IIT Kanpur- https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/simulation.html

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** III		
Course: Engineering Physics Lab							**Code:** 26EEBS102P		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	-	25	25

Prerequisites:

Fundamentals of Physics, basic of interference, polarization, de-Broglie hypothesis, semiconductor and ultrasonic.

Course Objectives:

1. To provide hands-on experience in fundamental optical phenomena such as interference, diffraction, polarization, and double refraction.
2. To develop experimental skills in determining optical constants like wavelength, refractive index, radius of curvature, and numerical aperture.

Course Outcomes: After completion of this course, students will able to -

CO1	Apply the principles of interference and diffraction to determine optical parameters such as wavelength, radius of curvature, and grating characteristics.
CO2	Demonstrate experimental skills in precise measurement, data analysis, error estimation, and scientific interpretation of results.

List of Experiments:

Perform any 08 experiment out of 12:

1. Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of Plano-convex lens).
2. Experiment based on polarization (To verify Law of Malus).
3. Determination of refractive index using Brewster's law.
4. Experiment based on Double Refraction (Determination of refractive indices / Identification of types of crystal).
5. Experiment based on Laser (Determination of thickness of wire / Number of lines on grating surface).
6. Determination of Planck's constant using available experimental setup.
7. To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency).
8. To determine Hall coefficient and charge carrier density.
9. Determination of velocity of ultrasonic waves and compressibility of given liquid by using Ultrasonic Interferometer.
10. An experiment based on optical fiber. (To determine the numerical aperture acceptance angel acceptance cone of optical fiber of laser diode.
11. Experiment based on semiconductor (To determine the temperature dependence characteristics of semiconductor).
12. To determine the unknown wavelength by using plane diffraction grating.

Reference Books:

1. C. L. Arora *Practical Physics* S. Chand Publishing
2. Harnam Singh & Dr. P. S. Hemne *Practical Physics* S. Chand Publishing

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B.Tech.									**Semester:** I	
Course: Basic Electrical Engineering									**Code:** 26EEES101	
Teaching Scheme				**Evaluation Scheme**						
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**MTE**	**ETE**	**TW**	**OR**	**PR**	**Total**
3	-	-	3	40	-	60	-	-	-	100

Prerequisites: Basic knowledge of Physics, fundamental electrical principles

Course Objectives:

1. To develop an understanding of fundamental electrical quantities, laws, and their applications in DC circuits.
2. To introduce the principles of magnetism, magnetic circuits, and electromagnetic induction.
3. To familiarize students with A.C. fundamentals and the analysis of single-phase A.C. circuits.
4. To provide knowledge of three-phase electrical systems and the analysis of star- and delta connected circuits.
5. To introduce the construction, operation, and performance of various electrical installation and emphasize the importance of electrical safety practices.

Course Outcomes: At the end of the course, Student will be able to **-**

CO1	Apply fundamental laws to analyze DC Circuits.
CO2	Analyze magnetic circuits by applying the principles of magnetism and electromagnetic induction.
CO3	Apply the concepts of A.C. fundamentals to determine circuit parameters.
CO4	Analyze single-phase and three-phase AC circuits.
CO5	Explain the working and applications of LT switchgear components.
CO6	Interpret electricity tariff structures and calculate energy bills.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**D.C Circuits:** Basic concepts of voltage, current, power, energy and relationship between them, definition of resistance, resistivity, and conductivity, effect of temperature on resistance of different materials, temperature coefficient of resistance, series and parallel circuits, Star-Delta transformation, Ohm's law, types of sources, current division and voltage division rule, Kirchhoff's laws.	07
2.	**Magnetic Circuit:** Concept of Magnetic flux, Flux density, MMF, reluctance, magnetic field intensity, permeability and their relationship, leakage and fringing of flux, magnetization curve, hysteresis loop, series and parallel magnetic circuits. Faraday's laws of electromagnetic induction, Fleming's left and right -hand rule.	07
3.	**A.C. Fundamentals:** Generation of alternating voltages, mathematical and graphical representation of sinusoidal voltage and current, concept of cycle, period, frequency, instantaneous, peak, average, and RMS values, peak factor, form factor, phase difference, lagging, leading and in phase quantities and phasor representation, rectangular and polar representation of phasors. Study of A.C	07

	circuits of pure resistance, inductance and capacitance and corresponding voltage and current phasor diagrams, voltage, current and power waveforms.	
4.	**A.C. Single Phase Circuits:** Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance and admittance, waveform and voltage current phasor diagrams. Concept of active, reactive, apparent power and power factor. **Three Phase Circuits:** Generation of three phase voltages, phase sequence, Balanced & Unbalanced three phase circuits, Star and Delta connections. Relationship of Phase and line values of voltage and current for Star and Delta circuits, Star and Delta balanced load, concept of active, reactive, apparent power and power factor in three phase circuit.	07
5	**Introduction to Electrical Installations:** Common systems in homes and industries, Importance of proper electrical safety and protection **LT (Low Tension) Switchgear Components** Basic function and use of -Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Molded Case Circuit Breaker (MCCB).	07
6	**Earthing (Grounding)-Need for earthing and Electrical Safety:** Necessity of earthing, types of earthing (plate and pipe type), electrical safety precautions. Energy Tariff (Electricity Bill)- Understanding electricity bill format and calculation.	07
	TOTAL	**42**

Text Books:

1. V. N. Mittle and A. Mittal, 2nd Edition, Basic Electrical Engineering, McGraw Hill Education (India) Pvt. Ltd.
2. D. C. Kulshreshtha, Basic Electrical Engineering, Tata McGraw-Hill (India) Pvt. Ltd.

Reference Books:

1. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, \Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. T. Thyagarajan, K. P. Sendur Chelvi, and T. R. Rangaswami, Engineering Basics: Electrical Engineering, Wiley Eastern Ltd.
3. R. Anand Natarajan and P. Ramesh, Basic Electrical Engineering, Tata McGrawHill Publishing Company Ltd.
4. U. A. Bakshi and V. U. Bakshi, Basic Electrical Engineering, Technical Publications, Pune.

E-references:

1. Fundamentals of Electrical Engineering, by Prof. Debapriya Das, IIT Kharagpur, https://nptel.ac.in/courses/108105112
2. Basic Electrical Technology, IISc Bangalore, Prof. L. Umanand, https://nptel.ac.in/courses/108108076

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)									**Semester:** I
Course: Basic Electrical Engineering Lab									**Code:** 26EEES101P
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	50	25	-	75

Prerequisites:

Basic Electronics, Number system and algebra.

Course Objectives:

1. To provide practical exposure to basic electrical measurements, units, and conversion techniques.
2. To develop skills in measuring insulation resistance and analyzing the steady-state behaviour of single-phase RL and RC circuits.
3. To encourage hands-on learning through DIY models demonstrating fundamental laws of electrical engineering, energy conversion, and mutual induction.

Course Outcomes: After completion of this course, students will able to -

CO1	Perform basic electrical measurements, unit conversions, and insulation resistance testing of equipment/cables using appropriate instruments.
CO2	Identify and demonstrate the working of electrical protection devices (fuses, MCB, MCCB) and earthing systems, and interpret LT electricity bills with energy conservation measures.

List of Experiments:

Group A: Minimum SIX experiments from the following list

1. Demonstration of measurement of various units and their conversions.
2. Measurement of insulation resistance of electrical equipment/cable using Megger.
5. Measurement of the steady-state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms on a storage oscilloscope.
6. Verification of the relation between phase and line quantities in three-phase balanced star and delta connections of load.
7. Demonstration of different types of electrical protection equipment such as fuses, MCB, MCCB, and earthing systems.
8. Analysis of LT electricity bills and energy conservation (Case study).

Group B: DIY Models – Any TWO, from the following list or any other suitable model

1. Demonstration of fundamental laws of Electrical Engineering using breadboard – (a) Ohm's Law (b) Faraday's law of Electromagnetic Induction (c) Kirchhoff's laws (KCL and KVL).
2. Generation of power with magnets and copper wire.
3. Conversion of mechanical energy to electrical energy and vice versa.
4. Model of mutual induction in the transformer.

Group C: A mandatory visit to any transformer/electrical machines manufacturing industry.

Reference Books:

1. U. A. Bakshi & V. U. Bakshi, Basic Electrical Engineering, Technical Publications
2. R. K. Rajput, Basic Electrical Engineering, Laxmi Publications
3. Laboratory Manual / Workbook, Basic Electrical Engineering Laboratory Manual

DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)						**Semester:** I			
Course: Electrical Energy Generation System						**Code:** 26EEES102			
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	40	60	-	-	-	100

Prerequisites:

Basics of electrical engineering, energy, power, conventional and renewable energy resources.

Course Objectives:

1. To familiarize students with energy scenarios, energy sources, and their utilization.
2. To make students understand the working of conventional and non-conventional power plants.
3. To aware students about power generation economics in India.

Course Outcomes:

On completion of the course, the learner will be able to -

CO1	Discuss the current power generation landscape of India including conventional and renewable energy sources.
CO2	Describe the layout, site selection criteria, advantages, and disadvantages of coal-based thermal and hydroelectric power plants.
CO3	Explore the working principle, site selection criteria, and advantages and disadvantages of nuclear, diesel, and gas turbine power plants.
CO4	Explain power generation using tidal and solar photovoltaic systems along with their application.
CO5	Discuss the basic principles of wind energy and ocean thermal energy conversion systems.
CO6	Acquire basic knowledge of power generation economics.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Generation of Electric Power:** Importance of electrical power in daily life, Different forms of energy: primary and secondary energy sources, Review of conventional and non-conventional energy sources, Advantages and disadvantages of conventional energy resources, Power crisis in India, need for renewable energy resources, Criteria for selecting sites for power stations, Present scenario of power generation in India.	04
2.	**Thermal Power Plant:** Site selection along with factors, Construction, working, layout, advantages and disadvantages, environmental impacts of thermal power plant, Thermal power plants in India. **Hydro-electric Power Plant:** Site selection, Construction, working, layout, advantages and disadvantages, Classification of hydroelectric power plants, List of hydroelectric power stations with their capacities in India.	05

3.	**Nuclear Power Plant:** Nuclear reaction-fusion, fission process, and chain reaction, Selection of site, Construction, working, layout, advantages, and disadvantages, Safety measures for nuclear power plants, nuclear waste and its disposal, Nuclear power stations in India. **Diesel Power Plant:** Selection of site, Construction, working, layout, advantages and disadvantages, Applications of Diesel power plant, Comparison between Thermal, hydroelectric, Nuclear, and Diesel power plant.	05
4.	**Solar Power Plant:** Generation of electricity by photovoltaic effect, Construction, working of PV cell, module, array (Series and parallel connections), Components and block diagram of general SPV system, Types of SPV system, Applications of solar photovoltaic systems, solar power generation in Maharashtra and India. **Introduction to Tidal energy**: Components of tidal power plants and their working, Site requirements, Advantages and disadvantages, Tidal power plant in India.	05
5.	**Wind Power Plant:** Basic principles of wind energy conversion, Components and working of wind energy conversion systems, Site selection, Types of windmills, Construction and working of horizontal axis and vertical axis wind turbine generator with schematic diagram, Calculation of power generated by wind turbine (Simple Numerical), wind power plants in Maharashtra and India. **Geothermal Energy Conversion:** Geothermal energy, Types of geothermal energy resources, applications, advantages and disadvantages of geothermal energy.	05
6.	**Economics of Power Generation:** Cost of electrical energy, related terms: interest and depreciation, connected load, Maximum demand, Average demand, Load factor, Diversity factor, Demand, and utilization factor (simple numerical), Base load and peak load plant, Load curve, Load duration curve, spinning reserve, Factors affecting cost of generation, Selection of power plant for power generation.	04
	TOTAL	**28**

Text Books:

1. P. K. Nag, "Power Plant Engineering," Tata McGraw Hill.
2. R. K. Rajput, "A textbook on Power System Engineering," Laxmi Publications (P) Ltd.
3. Chakrabarti, Soni, Gupta, Bhatnagar, "A textbook on Power System Engineering," Dhanpat Rai Publication.
4. R.K. Rajput, "Non-Conventional Energy Sources and Utilization," S. Chand Publications.
5. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technology, and Application," PHI Publications.
6. Deshpande M. V., "Power Plant Engineering," Tata McGraw Hill.

Reference Books:

1. Dr. S. P. Sukhatme, "Solar Energy," Tata McGraw Hill Publication.
2. Mukund Patel, "Wind and Solar Power Plants," CRC Press.
3. D. P. Kothari, K. C. Singal, RakeshRanjan, "Renewable Energy Sources and Emerging Technologies,"PHI Learning Private Limited, New Delhi.

E-Resources:

1. A NPTEL course on "Power System Generation, Transmission and Distribution (Encapsulated from earlier Video)," IIT Delhi Prof. D.P. Kothari. https://nptel.ac.in/courses/108102047
2. A NPTEL course on "Energy Resources & Technology," IIT Kharagpur Prof. S. Banerjee. https://nptel.ac.in/courses/108105058

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** I		
Course: Electrical Workshop-I							**Code:** 26EEES103		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	50	-	-	50

Prerequisites:

Basic Electrical and Electronics concepts.

Course Objectives:

1. To provide basic Electrical and Electronics Engineering concepts.
2. To make the students able to understand, design and prepare electrical and electronics circuits using basic concepts.

Course Outcomes: After completion of this course, students will able to -

CO1	To choose the electrical and electronics components/equipment for various application.
CO2	To select various sensors and measuring instruments for different applications.

List of Experiments:

A. Minimum Eight experiments from the following list

1. Introduction of Tools, Electrical Materials and Electrical Drawing Symbols
2. Introduction to basic Electrical Components (R, L, C) with its number and colour coding.
3. Introduction to Different types of Measuring Instruments and its demonstration.
4. One Lamp Controlled by One Switch and Distribution Board Connection
5. Staircase Wiring, Hospital Wiring and Godown Wiring
6. Master Switch Control Wiring and Intermediate Switch Wiring
7. Design of House Wiring
8. Introduction to Different sensor devices and its demonstration.
9. To Study different protection devices and Importance of Earthing.
10. To Study Circuit and Working of Home Inverter, UPS.

B. To demonstrate the understanding by performing minor project.

Reference Books:

1. S. L. Uppal & G. C. Garg, Electrical Wiring, Estimating and Costing, Khanna Publishers
2. J. B. Gupta, Electrical Installation, Estimating and Costing, S. K. Kataria & Sons
3. K. B. Raina & S. K. Bhattacharya, Electrical Design, Estimating and Costing, New Age International *Publishers*
4. Surjit Singh, Electrical Estimating and Costing, Dhanpat Rai & Co.

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: IT Proficiency								**Code:** 26EEVS101	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
01	02	-	02	-	-	25	-	-	25

Prerequisites:

Basic Computer Skills

Course Objectives:

1. To develop proficiency in essential office software and tools, including MS Word, MS Excel, MS PowerPoint, and LaTeX, to create, analyze, and present professional documents and data effectively, while understanding ethical internet use and leveraging AI tools.

Course Outcomes: After completion of this course, students will be able to -

CO1	Create and format professional documents using MS Word.
CO2	Organize and analyze data using Excel's features.
CO3	Apply advanced Excel functions, pivot tables, charts, and macros to analyze and secure data.
CO4	Create effective presentations using MS PowerPoint features.
CO5	Create Professional Documents Using LaTeX.
CO6	Apply ethical practices in using internet resources and AI tools.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Basics of Computer and MS Word:** Awareness of computer Basics **MS-Word:** Text Basics, Text Formatting and saving file, Working with objects, Header &footers, Working with bullets and numbered lists, Tables, Styles and Content, Merging documents, Sharing and maintaining document, Proofing the document, Printing.	07
2.	**MS-Excel:** Introduction to Excel, Formatting excel work book, Perform calculations with functions, Sort and Filter data with Excel, Create effective 2D and 3D charts to Present data visually.	08
3.	**Advance MS-Excel**: Analyze data using pivot tables and pivot charts, Protecting and sharing the work book, Use Macros to automate tasks, Proofing and Printing, More useful functions in excel, Goal seek and scenario features, V-lookup and H-lookup functions, Advanced sort and filter in excel.	07
4.	**MS-PowerPoint**: Setting up PowerPoint environment, Creating slides and applying themes, Working with bullets and numbering, Working with objects, Hyperlinks and action buttons, Working with movies and sounds, Using SmartArt and Tables, Animation and slide transition, Using slide master, Slide show option, Proofing and Printing.	07
5.	**Introduction to Latex:** Installation of the software LaTeX , Understanding Latex compilation, Basic	07

	Syntax, Writing equations, Matrix, Tables. **Page Layout** – Titles, Abstract Chapters, Sections, References, Equation references, citation. List making environments, Table of contents, Generating new commands, Figure handling, Numbering, List of figures, List of tables, Generating index. **Packages** - Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing. Classes: article, book, report, beamer, slides. IEEtran. **Applications -** Writing Resume, Writing articles/ research papers, project report.	
6.	**Internet Ethics & AI tools:** Working with Internet and-mail, Using the Internet, Internet Ethics and Safety, Social Media, **AI Tools**: Jasper, GitHub Copilot, Synthesia, Writesonic.	06
	TOTAL	**42**

List of Experiments:

1. Create a collaborative document project where multiple users contribute to a document using MS Word's track changes and commenting features.
2. To analyze and visualize data effectively using Excel's functions and charts, aiming to create insightful and dynamic data visualizations.
3. Develop a financial modeling project using Excel, incorporating advanced functions like goal seek, scenario analysis, and pivot tables. Build automation using macros for repetitive tasks.
4. Create an interactive multimedia presentation on a complex topic of interest. Incorporate animations, transitions, embedded videos, and interactive elements like hyperlinks and action buttons.
5. Design and implement a digital marketing campaign for a fictitious product or service. Create email newsletters, social media posts, and analyze campaign performance metrics.
6. Prepare research article using Latex.

Text Books:

1. Banerjee Snigdha, "MS Word 2000", New Age International.
2. Quentin Docter, Q., et al., "CompTIA IT Fundamentals Study Guide: Exam FC0-U61", Wiley, USA.
3. Lambert, J., Frye, C., et al., "Microsoft Office 2019 Step by Step", Microsoft Press, USA.

Reference Books:

1. Walkenbach John, "Excel 2013 Bible", Wiley Publishing House.
2. Wempen Faithe, "Microsoft PowerPoint 2010 Bible", Wiley Publishing House.
3. Miller, M., "Internet Basics Absolute Beginner's Guide", Que Publishing, USA.
4. Miller, M., "Computer Basics Absolute Beginner's Guide", Que Publishing, USA.

E-Resources:

1. Microsoft Office Support provides tutorials and guides for MS Office applications. https://support.microsoft.com/en-us/training
2. Digital Skilling by NPTEL - https://elearn.nptel.ac.in/shop/nptel/digital-skilling/?v=c86ee0d9d7ed

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Professional Development – I								**Code:** 26EECC101	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
01	02	-	02	-	-	50	-	-	50

Course Objectives:

1. To introduce students on professional development skills and its importance in building personal and professional life.
2. To inculcate soft skills like goal setting, time management, emotional intelligence, leadership etc required in today's professional environment.
3. To make students aware of employability skills like workplace communication, correspondence at work, team work and workplace etiquette to imbibe better employability maturity.

Course Outcomes: After completion of this course, students will be able to -

CO1	Know their own values, significance of discipline, self-grooming applied effectively in career, personal life, at workplace, society and professional world.
CO2	Understand the importance of necessity of various soft skills required in today's professional workplace environment for better growth and leadership perspective.
CO3	Aware of significance of emotional intelligence at workplace and tapping leadership opportunities at engineering and technological organizations.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Values:** Types of Values, Internal and External Stakeholders, SWOT analysis **Self-discipline:** Self-discipline impact in your life and society, Techniques to build self-discipline, Self-review and actions. **Self-Grooming**: Meaning and significance of self-grooming at personal, organizations, social and professional Level.	14
2.	**Soft Skills basics (Personal orientation)**: Soft Skills and hard skills, soft skills cultivation techniques. Attitude: positive self-talk, self-esteem, adaptability Goal Setting: SMART goals, guidelines for goal setting types of goals, goals at workplace, cascading goals Time Management: Prioritization, time stressors, time stealers time management matrix productivity pyramid	14
3.	**Soft Skills Advanced (Professional and Social orientation)** Emotional Intelligence: enhancing your emotional awareness, change and stress, crisis management Leadership: Leadership and assertiveness, problem solving and brain storming, leader attributes, types of leaders, leader features in a professional environment Social Consciousness.: Social awareness and civic responsibility, social intelligence, social inclusion, social entrepreneurship sustainable development	14

	and conversation of resources.	
	TOTAL	**42**

Text Books:

1. M. K. Sinha, "Success Through Self-Discipline: Your Personal Guide to Achieving Your Goals"
2. Sabina Pillai, Agna Fernandez," Soft Skills and Employability Skills" Cambridge Press
3. Sanjay Kumar & Pushpa Latta, commination skills "Oxford higher education
4. Minakshi Raman & Sangita Sharma, "Technical Communication, Principal & Practices", Oxfords Press.

Reference Books:

1. Stephen R. Covey, "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change", Simon & Schuster, 1989.
2. Jack Canfield, "The Success Principles", HarperCollins, 2005.
3. Norman Vincent Peale, "The Power of Positive Thinking", Prentice Hall, 1952.

E-Resources:

1. Coursera: "The Science of Well-Being" by Yale University, - https://www.coursera.org/learn/the-science-of-well-being
2. Udemy: "Self-Care: Take Care of Yourself to Better Take Care of Others" by Jessica Rogers https://www.udemy.com/course/caring-self/?couponCode=UPGRADE02223

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LIBERAL LEARNING COURSES - I

(Select any one course from the given Liberal Learning Courses)

DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Guitar)								**Code:** 26EECC102A	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Guitar musical instrument.

Course Objectives:

1. To build a strong foundation in Indian classical dance through mastering basic techniques, rhythms, expressions, and repertoire, culminating in a performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of Guitar instrument.
CO2	Demonstrate the performance of Guitar Instrument.
CO3	Apply different types Chords.
CO4	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to the Guitar	2
2.	Understanding standard tuning	2
3.	Introduction to tablature and note reading	2
4.	Introduction to basic music theory concepts	2
5.	Understanding scale, intervals, and chords	2
6.	Learning more open chords: D major, D minor, C major, G major	2
7.	Understanding power chords and their shapes	2
8.	Understanding barre chord shapes: F major, B minor	2
9.	Finding Chords by Ear	2
10.	Chord Progressions	2
11.	Advanced Chord Types	2
12.	Transposing Chord	2
13.	Review and Practice	2
14.	Introduction to Scales	2
	TOTAL	**28**

Text Books:

1. David Hodge, "Guitar Theory", DK Publishing.

Reference Books:

1. Russ Shipton, "The Complete Guitar Player", Published by Wise.
2. Vincent Ong, Alfred Khp," Classical Guitar Advanced Studies Repertoires", Dynamic Publication.

E-Resources:

1. https://www.youtube.com/watch?v=BBz-Jyr23M4

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Singing)								**Code:** 26EECC102B	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music in singing.

Course Objectives:

1. To offer students' knowledge of the basic concepts of Singing in a very easy to understand manner with their practical applicability.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of Singing.
CO2	Demonstrate the performance of Singing.
CO3	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Voice Culture in Indian Semi Classical Singing.	2
2.	Basics of Singing o Introduction to semi classical singing.	2
3.	Basics of Indian Semi Classical Music.	2
4.	Learning Basic Ragas.	2
5.	Music Theory Basics.	2
6.	Vocal Warm-ups.	2
7.	Introduction to Ear Training.	2
8.	Breathe Control.	2
9.	Resonance and Tone Production.	2
10.	Diction and Articulation.	2
11.	Dynamics and Expression.	2
12.	Introduction to Repertoire.	2
13.	Practice Techniques.	2
14.	Interpretation and Expression.	2
	TOTAL	**28**

Text Books:

1. **Dr. Theodore Dimon, "Anatomy of the Voice, This Is a Voice".**

Reference Books:

1. Richard Miller, "The Structure of Singing", Schirmer Books, London.
2. Jennifer Hamady, "The Art of Singing", Published by Hal Leonard.

E-Resources:

1. https://www.youtube.com/watch?v=4hNq9qykOyE
2. https://www.youtube.com/watch?v=b14gkmECz-Y

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Cinematography)								**Code:** 26EECC102C	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

A basic understanding of film theory, Camera operation, Lighting techniques and visual storytelling is essential for cinematography.

Course Objectives:

1. To make students effectively use their camera's components, study fundamental photography techniques and apply basic to advanced editing skills.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of camera equipment.
CO2	Demonstrate the performance of camera equipment
CO3	Ability to translate creative concepts into visually engaging and coherent film or video projects.
CO4	Mastery in crafting compelling visual narratives through camera angles, lighting, and composition

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Photography	2
2.	Understanding camera components (lens, shutter, sensor)	2
3.	Exposure Triangle	2
4.	Introduction to the rule of thirds, leading lines, and framing	2
5.	Understanding autofocus vs. manual focus	2
6.	Introduction to natural and artificial lighting	2
7.	White Balance and Color Theory	2
8.	Motion and Long Exposure	2
9.	Basics of portrait photography	2
10.	Basics of landscape photography	2
11.	Overview of post-processing software (e.g., Adobe Light room, Photoshop)	2
12.	Introduction to advanced editing tools	2
13.	Organizing and Storing Photos	2
14.	Final Project Presentation and Review	2
	TOTAL	**28**

Text Books:

1. Tania Hoser, "Introduction to Cinematography", Taylor & Francis.

Reference Books:

1. Anat Pick, "Screening Nature", Berghahn Books.
2. Blain Brown, "Cinematography: Theory and Practice", Taylor & Francis.

E-Resources:

1. https://youtu.be/V7z7BAZdt2M?si=to4yQ46zEKRbxKOm
2. https://youtu.be/WXdAX0No2hM?si=GZu_mJsmyJ7NGnAU

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Dance)								**Code:** 26EECC102D	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Good stamina, flexibility and familiarity with simple rhythmic patterns and beats.

Course Objectives:

1. To build a strong foundation in Indian classical dance through mastering basic techniques, rhythms, expressions, and repertoire, culminating in a performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Understand the fundamental postures, hand gestures and basic steps of Indian classical dance.
CO2	Understand and perform dance sequences to various rhythmic cycles (Tala) with confidence.
CO3	Convey emotions and stories through facial expressions (Abhinaya) and body language.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Overview of Indian Classical Dance	2
2.	Fundamental Postures and Hand Gestures (Hasta Mudras)	2
3.	Introduction to Basic Steps (Adavus or Tatkars)	2
4.	Rhythmic Patterns and Clapping (Tala)	2
5.	Advanced Basic Steps	2
6.	Strength and Conditioning	2
7.	Introduction to Basic Expressions (Abhinaya)	2
8.	Integrating Steps and Expressions	2
9.	Intermediate Rhythmic Patterns	2
10.	Improvisation and Creative Movement	2
11.	Introduction to Advanced Movements	2
12.	Review and Feedback	2
13.	Learning a Simple Dance Piece - Part 1	2
14.	Learning a Simple Dance Piece - Part 2	2
	TOTAL	**28**

Text Books:

1. Padma Subrahmanyam, "Indian Classical Dance: A Beginner's Manual", Abhinav Publications.

Reference Books:

1. Dr. Aditi Sriram, "Indian Classical Dance: A Guide", Vikas Publishing House.

E-Resources:

1. https://youtu.be/5apCTHzvkWI?si=p11CR_4XxPocTbjO
2. https://youtu.be/OIKOHzePJCA?si=7pnPZKuvfT5EIWhf

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Synthesizer/Keyboard)								**Code:** 26EECC102E	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Keyboard musical instrument.

Course Objectives:

1. To offer students' knowledge of the basic concepts of playing Keyboard in a very easy to understand manner with their practical applicability.

Course Outcomes:

CO1	Illustrate the fundamental aspects of Keyboard instrument.
CO2	Demonstrate the performance of Keyboard Instrument.
CO3	Apply different types of Chords.
CO4	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to the Keyboard	2
2.	Understanding Notes and Keys	2
3.	Basic Music Theory	2
4.	Introduction to the C major scale	2
5.	Learning to play simple melodies in C major	2
6.	Introduction to Chords	2
7.	Combining Melodies and Chords	2
8.	Review and practice melodies and chords	2
9.	Introduction to Minor Scales	2
10.	Introduction to additional chords (D major, E minor)	2
11.	Understanding chord progressions (e.g., I-IV-V)	2
12.	Review scales, chords, and progressions	2
13.	Introduction to Arpeggios	2
14.	Dynamics and Expression	2
	TOTAL	**28**

Text Books:

1. Chuan C. Chang, "Fundamentals of Piano Practice", Create space Independent Publishing Platform.

Reference Books:

1. Michael Rodman, "Keyboard for the Absolute Beginners", Alfred Publishing.
2. Davis Dorrough, "Piano Scales".

E-Resources:

1. https://youtu.be/2mPS-2guHVo?si=8X_4KKezIdrMejLH
2. https://youtu.be/tEtukfFv3Wk?si=2iJ8wdD0dfjWauPb

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** I		
Course: Liberal Learning – I (Basketball)							**Code:** 26EECC102F		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop foundational basketball skills, including dribbling, passing, shooting, and defense, while understanding game rules and strategies through practical gameplay and scrimmage.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate basic basketball skills such as dribbling, passing, shooting, and defensive fundamentals effectively.
CO2	Apply offensive and defensive strategies, including transition play, during gameplay and scrimmages.
CO3	Understand and implement basketball game rules and referee gestures accurately in practical situations.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**History & Introduction to Basketball:** History & introduction to the game, equipment, safety. Understand the basic rules.	2
2.	**Terminology & Dimensions:** Terms used in basketball and measurements of the court.	2
3.	**Warmup & Cooldown:** Basics of warmup & cooldown for preventing stiffness and injury and speedy recovery.	2
4.	**Player Stance & Ball Holding:** Learn the ready position and correct way to hold the basketball. Demonstrate proper stance and secure ball control.	2
5.	**Passing & Receiving (Chest):** Practice accurate chest passing and receiving techniques. Perform chest pass with proper technique and accuracy.	2
6.	**Passing & Receiving (Bounce):** Learn bounce passing and receiving while stationary. Execute bounce passes confidently.	2
7.	**Assessment – I**	2
8.	**Dribbling (Stationary):** Practice basic dribbling using both hands. Control the basketball while stationary.	2
9.	**Dribbling (Movement-Walk/Jog/Run):** Develop dribbling while walking and changing direction maintain ball control while moving.	2
10.	**Shooting (Technique & Set Shot):** Learn the basic shooting technique. Perform a set shot with correct body mechanics.	2
11.	**Shooting (Lay-Up):** Practice right- and left-hand lay-up technique. Execute basic lay-up shots effectively.	2
12.	**Rebounding:** Learn positioning and timing for offensive and defensive rebounds. Demonstrate correct rebounding technique.	2
13.	**Individual Defense:** Practice defensive stance and movement. Apply basic individual defensive skills.	2
14.	**Assessment – II**	2
	TOTAL	**28**

Text Books:
1. K.K. Sharma, "Basketball: Skills and Drills", Sports Publications.
Reference Books:
1. Dr. P.K. Kher, "Basketball Coaching: A Complete Guide", Khel Prakashan. 2. S. Reddy, "The Ultimate Guide to Basketball Training", Blue Rose Publisher.
E-Resources:
1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Cricket)								**Code:** 26EECC102G	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To Enhance cricket skills from basics to advanced techniques, focusing on tactics, fitness, and specialized fielding and wicket keeping through targeted practice and match simulations.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master fundamental and advanced cricket techniques, including batting, bowling, and specialized fielding and wicket keeping.
CO2	Demonstrate an understanding of game scenarios and tactical strategies, applying them effectively during match simulations and pressure situations.
CO3	Improve physical fitness, strength, and conditioning, with targeted skill enhancement and mid-season assessments to track progress.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Introduction to Cricket, History & Evolution:** Understand the Origin, Formats, and Growth of Cricket	2
2.	**Laws of Cricket & Spirit of the Game:** Learn MCC Laws and Fair Play	2
3.	**Cricket Ground, Pitch & Equipment:** Identify Dimensions and Equipment	2
4.	**Warm-Up, Stretching & Physical Fitness:** Develop basic fitness routines	2
5.	**Grip, Stance & Ready Position:** Learn Correct Batting Fundamentals	2
6.	**Front Foot/ Back Foot Batting Techniques:** Practice defensive and attacking strokes/ execute pull, cut, and back-foot defence	2
7.	**Assessment - I**	2
8.	**Bowling Grip & Run-Up:** Learn bowling basics	2
9.	**Pace Bowling Fundamentals:** Develop seam and swing basics	2
10.	**Spin Bowling Fundamentals:** Learn finger and wrist spin techniques	2
11.	**Fielding Basics:** Catching, throwing, and ground fielding	2
12.	**Wicket keeping Fundamentals:** Basic stance, catching, and footwork	2
13.	**Mini Match Practice:** Apply learned skills	2
14.	**Assessment - II**	2
	TOTAL	**28**

Text Books:

1. Sanjay Manjrekar, "Cricket Fundamentals", Orient BlackSwan
2. Ravi Shastri, "Winning Cricket: Skills and Strategies", Notion Press

Reference Books:

1. Sachin Tendulkar, "Playing It My Way", Hachette India
2. Rahul Dravid, "Cricket: The Game of Life", Penguin India

E-Resources:

1. Sports and Performance Nutrition, IIT Madras, https://onlinecourses.nptel.ac.in/noc24_hs82/

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Rifle and Pistol Shooting)								**Code:** 26EECC102H	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop fundamental skills in rifle and pistol shooting through technical knowledge, practical drills, and mental preparation for competitive performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master fundamental and advanced shooting techniques for both rifle and pistol, including aiming, breathing, and triggering.
CO2	Develop strong mental focus and relaxation techniques essential for high-performance shooting and competition readiness.
CO3	Gain hands-on experience in live shooting drills and positional shooting, preparing them for competitive shooting scenarios.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Introduction to Shooting Sports and Course Orientation:** History of shooting, information about guns.	2
2.	**Safety Rules, Range Etiquette and ISSF rules:** Rules that should be followed on range and during competitive matches.	2
3.	**Events (Rifle & Pistol):** Information about all different events.	2
4.	**Parts and Functions of gun:** Knowledge about all the parts and how it works	2
5.	**Shooting Equipment and Accessories:** Information about equipment's and it work	2
6.	**Range Commands and Safe Handling:** Regulations followed during rifle and pistol shooting competition. Maintaining discipline, following safety instructions, handling rifle responsibly.	2
7.	**Assessment - I -(Theory and Practical):** Evaluation based on history of game, safety rules and ISSF rules.	2
8.	**Shooting Stance:** Upright posture where the shooters balance the body while supporting the rifle steadily	2
9.	**Grip Techniques:** Proper grip and its techniques	2
10.	**Sight Alignment:** How to align sight with target	2
11.	**Sight Picture:** Sight picture definition and its visualization	2
12.	**Breathing Control:** Breathing techniques	2
13.	**Trigger Control:** Proper triggering and its steps	2
14.	**Follow-Through:** Importance of follow through and its process	2
	TOTAL	**28**

Reference Books:

1. David Watson, "ABCs of Rifle Shooting", Gun Digest (Imprint of KP Books), 2014

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Volleyball)								**Code:** 26EECC102I	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop foundational volleyball skills, including serving, passing, setting, spiking, and blocking, while mastering game rules and strategies through practical gameplay and scrimmage.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate proficiency in basic volleyball skills such as serving, passing, setting, spiking, and blocking.
CO2	Apply offensive and defensive strategies effectively, including serve receive and transition play, during gameplay.
CO3	Understand and implement volleyball rules and referee gestures, applying them accurately during practical gameplay and scrimmages.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Introduction to Volleyball, History:** Introduction to volleyball, origin and development of the game, inventor (William G. Morgan), evolution of volleyball at national and international levels, governing bodies (FIVB, VFI), importance and benefits of volleyball, basic objectives of the game.	2
2.	**Terminology:** Basic volleyball terminology: rally, serve, receive, pass, set, spike, dig, block, libero, rotation, substitution, attack line, service zone, front row, back row, side-out, fault, ace, rally point system, timeout and other common terms.	2
3.	**Rules, Court Dimensions:** Volleyball court dimensions (18 m × 9 m), attack line, service zone, free zone, net height (Men: 2.43 m, Women: 2.24 m), ball specifications, team composition, scoring system, rotation rules, basic violations and referee signals.	2
4.	**Fundamental Stance and Movement:** Ready position, defensive and offensive stance, body balance, footwork techniques, forward, backward, lateral and crossover movement, movement efficiency, maintaining proper posture during play.	2
5.	**Ball Familiarization and Hand-Eye Coordination:** Ball handling exercises, ball bouncing, self-tossing, partner toss, catching drills, wall passing, coordination drills, reaction exercises and confidence-building with the volleyball.	2
6.	**Passing Skill (Dig Pass):** Underhand pass (forearm pass): body position, platform formation, foot placement, contact point, follow-through, partner passing drills, movement before contact, common mistakes and corrective exercises.	2
7.	**Assessment - I**	2
8.	**Passing Skill (Volleypass):**Hand position, finger contact, body alignment, extension of arms and legs, partner setting drills, wall setting, accuracy exercises, common errors and corrections.	2
9.	**Underhand Service:** Grip, stance, ball toss, arm swing, point of contact, follow-through, target serving, serving consistency drills and correction of common faults.	2
10.	**Overhand Service:** Proper toss, striking technique, body mechanics, weight transfer,	2

	accuracy, power generation, target practice, introduction to float serve, error correction.	
11.	**Revision and Integrated Skill:** Revision of all previously learned skills, combining passing, setting and serving in continuous drills, partner and group activities, communication, teamwork and basic game situations**.**	2
12.	**Hitting Mechanics:** Introduction to attacking technique: approach steps, arm swing, jump mechanics, body coordination, and timing, landing technique, hitting drills without net and with controlled tosses.	2
13.	**Introduction to Spiking:** Basic spiking technique: 3-step/4-step approach, take-off, arm action, ball contact, follow-through, landing safely, simple attacking drills and introduction to offensive play.	2
14.	**Assessment - II**	2
	TOTAL	**28**
Text Books:		
1. Jitendra Kumar, "The Complete Guide to Volleyball", Blue Rose Publisher		
Reference Books:		
1. N. Ramachandran, "Volleyball: Steps to Success", Sports Publication		
E-Resources:		
1. https://coachtube.com/course/volleyball/volleyball-for-beginners/7004		

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Liberal Learning – I (Football)								**Code:** 26EECC102J	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To enhance players' technical skills, tactical understanding, physical fitness, teamwork, and sportsmanship, fostering a comprehensive understanding and appreciation of the game.

Course Outcomes: After completion of this course, students will be able to -

CO1	To identify and describe the fundamental skills and strategies involved in football, including ball control, dribbling techniques, basic offensive and defensive tactics.
CO2	To apply advanced dribbling and passing techniques during practice sessions.
CO3	To design and execute a cohesive game plan that integrates set pieces, team chemistry, and communication, evaluating its effectiveness through simulation matches.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Introduction to Football: History & Development: Understand the history, origin, and global development of football, including its evolution into the world's most popular sport.**	2
2.	**Laws of the Game:** Understand and apply the fundamental Laws of the Game, including rules, fouls, player positions, and match procedures.	2
3.	**Football Field, Equipment & Safety:** Identify the dimensions of a football field, use essential equipment correctly, and follow key safety practices to ensure safe participation in football.	2
4.	**Warm-up, Cool-down & Injury Prevention: Demonstrate proper warm-up and cool-down techniques and apply injury prevention practices to enhance performance and reduce the risk of injuries.**	2
5.	**Physical Fitness for Football: Develop the physical fitness components—strength, speed, endurance, agility, flexibility, and coordination—required for effective football performance.**	2
6.	**Ball Familiarization:** Develop confidence and control by performing basic ball familiarization exercises using both feet to improve touch, coordination, and ball control.	2
7.	**Assessment - I**	2
8.	**Long Passing & Lofted Pass:** Execute accurate long and lofted passes with proper technique, power, and precision to effectively switch play and create attacking opportunities.	2
9.	**Receiving and First Touch:** Demonstrate effective receiving and first-touch techniques to control the ball quickly and prepare for the next action in play.	2
10.	**Dribbling Fundamentals:** Demonstrate fundamental dribbling techniques to maintain close ball control while moving with speed, balance, and confidence.	2
11.	**Turning & Shielding the Ball:** Demonstrate effective turning and shielding techniques to protect the ball, maintain possession, and evade opponents under pressure.	2

12.	**Heading Techniques:** Demonstrate correct heading techniques using proper timing, body position, and contact to effectively control, clear, and direct the ball.	2
13.	**Small-Sided Game (5v5): Apply football skills, decision-making, teamwork, and tactical principles effectively in a 5v5 small-sided game environment.**	2
14.	**Assessment-II**	2
	TOTAL	**28**
Text Books:		
1. Srinivasan J. B, "Football Coaching: A Comprehensive Guide", Sports Publishing.		
Reference Books:		
1. Rob Ellis, "The Complete Guide to Coaching Soccer", Meyer & Meyer Sport.		
E-Resources:		
1. Udemy – Soccer Courses - https://www.udemy.com/topic/soccer/		

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** I	
Course: Indian Knowledge System and Financial Literacy								**Code:** 26EEIK101	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	-	-	50	-	-	50

Prerequisites:

Basic knowledge of algebra and mathematical operations.

Course Objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of Indian Knowledge System.
2. To make students proficient in fundamental financial concepts essential for managing personal finances effectively.
3. To equip students with practical budgeting skills to empower them to achieve financial independence.

Course Outcomes: After completion of this course, students will be able to -

CO1	Understand IKS fundamentals, Indian numeral system, and key contributions in mathematics and measurement.
CO2	Recognize metal working techniques, Vastushastra principles, historical engineering and architecture practices.
CO3	Understand financial concepts, money types, bank accounts, and essential financial terms for practical application.
CO4	Manage budgets, credit, loans, and develop financial plans for career and education goals.
CO5	Understand various investments, risk management, insurance types, and develop retirement planning strategies.
CO6	Comprehend tax forms, compliance, fraud protection, and financial considerations for investments and business.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Foundations of Indian Knowledge System:** Definition and scope of IKS, Historical development and significance. **Number System and Units for Measurement**: Salient features of the Indian numeral system, The discovery of zero and its importance, Decimal Systems, Measurement of time, distance and weight. **Mathematics**: Unique aspects of Indian mathematics, Great mathematicians and their significant contributions in the area of arithmetic, algebra, geometry, trigonometry, binary mathematics.	5
2.	**Application of Indian Knowledge System:** Metals and Metal Working: Mining and ore extraction, Extraction of iron from Biotite by indigenous techniques, Lost wax casting of idols and artefacts, Architecture and Structures: Vastushastra, Unitary buildings and Town planning, Temple architecture. Physical structures in India, Irrigation and water management	5
3.	**Finance:** Importance of Financial Literacy for Engineers, Understanding Money, Types of Money- Cash, Cheque, UPI Payment, Digital Currency, etc Types of bank accounts - saving, salary, current, loan, etc., Basic financial Terms- Income, Expenditure, Balance, saving, loan, interest rates, compound interest rate, credit,	4

	Investment taxes.	
4.	**Financial Planning:** Personal budgeting, Understanding debit and credit card, credit score, Types of credit card, credit card payment cycle, Barrowing, Loans / Debts, Types of loans, Terms of barrowing, Loan, Interest rate, Principal, EMI, EMI Calculation, Repayment of loan/debt strategy, Financial Planning for Career Development, Higher studies,	5
5.	**Investment and Wealth Management:** Basics of Investing, Effect of compounding, Types of Investment (fixed deposit, recurring deposits, Insurance policies, Bonds, Mutual Funds, Stocks, real estate, etc.) Risk and Return, Concept of SIP, STP and SWP, Stock Market, Stock Exchanges, reading of stock market indices, Life insurance, healthcare insurance, vehicle insurance, Importance of early retirement planning, Investment strategy, Pension Plan, Portfolio management,	5
6.	**Finance Compliance:** Types of Taxes, Types of Income Tax return form and Filling, Taxes and reforms, Impact of taxation policy on Investment, Scams and Frauds, Protection of personal information, Financial consideration for starting business, Real estate and purchase	4
	TOTAL	**28**

Text Books:

1. B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pawana R. N., "Introduction to Indian Knowledge System – Concepts and Applications", PHI Learning Pvt. Ltd., New Delhi.
2. Dr. Babu V., Mr. Mohammed Umair, "Financial Literacy", Himalaya Publishing House, First Edition.

Reference Books:

1. K. Bag, "History of Technology in India", Vol. I, Indian National Science Academy, New Delhi.
2. Dr. S. Gurusamy, "Indian Financial System", Tata McGraww-Hill Education Pvt. Ltd 2nd Edition.
3. D.N. Bose, S.N. Sen and B. V. Subbarayappa, "A Concise History of Science in India", Indian National Science Academy, New Delhi.

1. **E-Resources:**

1. SWAYAM - "Indian Knowledge System(IKS): Concepts and Applications in Engineering", Indian Institute of Management Bangalore (IIMB), Chanakya University, Bangalore. https://onlinecourses.swayam2.ac.in/imb23_mg53/preview
2. SWAYAM - "Introduction to Banking and Financial Markets", Indian Institute of Management Bangalore (IIMB), - https://onlinecourses.swayam2.ac.in/imb23_mg14/preview
3. Online free course on "Financial Literacy" by Khan Academy. https://www.khanacademy.org/college-careers-more/financialliteracy/xa6995ea67a8e9fdd:welcome-to-financial-literacy

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SYLLABUS

SEMESTER - II

DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** II		
Course: Engineering Mathematics II							**Code:** 26EEBS203		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Basic concept of Differentiation, Integration and Vector.

Course Objectives: The objectives of this course are

1. To introduce student some methods to find the solution of first order & first degree ordinary differential equations with its applications.
2. To make students familiar with vector differentiation.
3. To acquaint the student with mathematical tools needed in evaluating improper integrals, multiple integrals and their usage.

Course Outcomes: After completion of this course, students will able to -

CO1	Solve first order ordinary differential equation.
CO2	Apply differential equation in engineering applications.
CO3	Find the velocity vector, gradient, divergence, curl.
CO4	Evaluate improper integrals.
CO5	Set up and solve multiple integrals for regions in the plane.
CO6	Use of multiple integrals to find area bounded by curves & volume bounded by surfaces.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**First Order Ordinary Differential Equation:** Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form and Bernoulli's equation.	07
2.	**Applications of Differential Equations:** Applications of differential equations to orthogonal trajectories, Newton's law of cooling, Kirchhoff's law of electrical circuits, Rectilinear motion, Simple harmonic motion, One dimensional conduction of heat.	07
3.	**Vector Differential Calculus:** Velocity vector, acceleration vector, tangential and normal component of acceleration, Vector differential operator, gradient, directional derivatives, angle between surfaces, Divergence and curl, solenoidal and irrotational field	07
4.	**Integral Calculus:** Reduction formulae, Beta and Gamma functions, Differentiation under integral sign and Error functions.	07
5.	**Multiple Integrals:** Double integration in cartesian & polar coordinates, Change of order of integration, Triple integral in cartesian & polar coordinates.	07

6.	**Applications of Multiple Integral:** Applications to find Area, Volume, Mass, Centre of gravity and Moment of inertia.	07
	TOTAL	**42**

Text Books:

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill.
2. B. S. Grewal , "Higher Engineering Mathematics" , Khanna Publication
3. H. K. Dass, "Higher Engineering Mathematics", S. Chand Publication
4. C. Ray Wylie & L. Barrett, "Advanced Engineering Mathematics" , McGraw Hill Publications.

Reference Books:

1. Erwin Kreyszig , "Advanced Engineering Mathematics" , Wiley Eastern Ltd.
2. M. D. Greenberg , "Advanced Engineering Mathematics" , Pearson Education
3. Peter V. O'Neil , "Advanced Engineering Mathematics" , Thomson Learning
4. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics (Vol. I & Vol. II)", Vidyarthi Griha Prakashan, Pune.
5. Ron Larson and David C. Falvo, "Elementary Linear Algebra" , Houghton Mifflin Harcourt
   Publishing Company

E-Resources:

1. A NPTEL Course on "Engineering Mathematics-II" IIT Khargpur
2. Applications of Differential Equations | Orthogonal Trajectories - https://www.youtube.com/watch?v=Ziu0y2kWTCM&list=PLT3bOBUU3L9juyFTI3lpeXXhIetVB00cr
3. "Applications of Differential Equations| Newton's law of Cooling – " https://www.youtube.com/watch?v=gJSvcf9_Duc
4. Dr. Gajendra Purohit, "Gradient of a Scalar Field & Directional Derivative | Normal Vector" https://www.youtube.com/watch?v=9CHfHuFBTw8&list=PLU6SqdYcYsfJz9FAzbgocIjlkw4NXAar-&index=2
5. Dr. Gajendra Purohit, "Double Integral & Area By Double Integration | Multiple Integral" https://www.youtube.com/watch?v=db7d_a0wiUg&list=PLU6SqdYcYsfLoKyzF_dwxAQf8lIi6VC54
6. Double Integration - Change of Order of Integration | Cartesian & Polar https://www.youtube.com/watch?v=fXMyLYwBB3s&list=PLU6SqdYcYsfLoKyzF_dwxAQf8lIi6VC54&index=4

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)									**Semester:** II
Course: Engineering Chemistry									**Code:** 26EEBS204
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	40	60	-	-	-	100

Prerequisites:

Basic knowledge of volumetric analysis, structure property relationship, classification and properties of polymers, electromagnetic radiation, electrochemical series.

Course Objectives:

1. To familiarize the students with the basic phenomenon/concepts of chemistry and its applications in various fields of Engineering.
2. To impart knowledge of technologies involved in water analysis to improve water quality.
3. To learn significance science of corrosion and preventive methods used for minimizing corrosion.
4. To understand structure, properties and applications of speciality polymers and nanomaterials.

Course Outcomes: After completion of this course, student will be able to-

CO1	Analyze water softening parameters.
CO2	Utilize different analytical methods for analysis of various chemical compounds.
CO3	Understand the mechanism of destruction of metals (corrosion) and effective preventive measures.
CO4	Explore the knowledge of advanced engineering materials for various engineering applications.
CO5	Analyze fuel and suggest use of alternative fuels.
CO6	Familiarize with classification, properties and applications of nanomaterials.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Water Technology:** Introduction, Chemical Analysis of Water- Hardness; Temporary and Permanent, Alkalinity (Hydroxide, Carbonate and Bicarbonate), Softening Methods: Zeolite and Demineralization Process, Water Purification: Reverse Osmosis. Simple Numerical on Hardness Determination and Alkalinity Calculation.	5
2.	**Instrumental Methods of Analysis:** Types of analysis: Quantitative and Qualitative analysis Introduction, Instrumentation and Applications of following methods: Colorimetry, pHmetry (Titration of Strong acid versus Strong base), Conductometry (Titration of Strong acid versus Strong base)	5
3.	**Corrosion Science:** Introduction, Types of Corrosion-Dry and Wet corrosion, Wet Corrosion Mechanism: Hydrogen Evolution and Oxygen Absorption, Factors affecting rate of corrosion. Methods of prevention of corrosion: Cathodic Protection (Sacrificial Anode), Anodic Protection (Anodizing), Methods to apply Metallic Coatings-Hot dipping, Electroplating.	4

4.	**Engineering Polymers:** Polymers: Introduction, Definition of Polymer, Monomer and Functionality of monomers Speciality Polymers: Introduction, Preparation, Properties and Applications of the following polymers: 1. Engineering Thermoplastic: Polycarbonate 2. Conducting Polymer: Polyacetylene Polymer Composites: Introduction, Constituents of composite, Advantages over conventional materials, Applications, Fiber Reinforced Plastic (FRP)-Glass reinforced and Carbon reinforced.	5
5.	**Fuels and Combustion:** Introduction, Calorific value - Definition, Gross and Net calorific value, Determination of Calorific value: Principle, Construction and Working of Bomb Calorimeter (Simple Numerical), Solid fuel: Coal: Analysis of Coal-Proximate (Simple Numerical). Alternate fuels: Biodiesel and Power alcohol. Hydrogen as future fuel: Production, Advantages, Storage and Applications in Hydrogen fuel cell.	5
6.	**Nanomaterials:** Introduction, Classification of Nanomaterials Based on Dimensions, Nanoscale materials: Structure, Properties and Applications of Graphene and Quantum dots (semiconductor nanoparticles), Importance of Nanotechnology in engineering applications.	4
	TOTAL	**28**

Text Books:

1. O.G. Palanna," Engineering Chemistry", Tata McGraw Hill Education Pvt. Ltd.
2. Dara S. S., Umare S. A., "Textbook of Engineering Chemistry", 12th Ed, S. Chand and Company Ltd.
3. Jain and Jain, "Engineering Chemistry", 16th Ed, Dhanpat Rai and Co. (Pvt.) Ltd., Delhi..

Reference Books:

1. G. R. Chatwal& S. K. Anand, "Instrumental Methods of Chemical Analysis", , Himalaya Publishing House.
2. Dr. Sunita Rattan; A Textbook of Engineering Chemistry; 3rd Ed, S. K. Kataria& Sons, New Delhi
3. V. R. Gowarikar, N. V. Viswanathan, JayadevSreedhar, "Polymer Science", Wiley Eastern Limited.
4. Billmeyer F. W., "Textbook of polymer science", John Wiley and Sons.

E-Resources:

MOOC / NPTEL/YouTube Links:

1. NPTEL Course on Corrosion, IISc Banglore : http://nptel.ac.in/courses/113108051/
2. NPTEL Course on Polymer, IIT Kharagpur: http://nptel.ac.in/courses/104105039/,

http://nptel.ac.in/courses/104103071/40

3. NPTEL Course on Water Technology, IIT Kanpur: http://nptel.ac.in/courses/105104102/
4. NPTEL Course on UV-Visible Spectroscopy: http://nptel.ac.in/courses/102103044/4
5. NPTEL Course on Energy Sources: http://nptel.ac.in/courses/103105110/4
6. NPTEL Course on "Engineering Chemistry-I, https://nptel.ac.in/courses/122/106/122106028/
7. NPTEL Course on "Fundamentals of Spectroscopy", NCL,IISER Pune https://nptel.ac.in/courses/104/106/104106122/

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** II		
Course: Engineering Chemistry Lab							**Code:** 26EEBS204P		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	-	25	25

Prerequisites:

Basic knowledge of volumetric analysis, structure property relationship, classification and properties of polymers, electromagnetic radiation, electrochemical series.

Course Objectives: The objectives of this course are

1. To develop practical skills in quantitative chemical analysis of water samples for hardness and alkalinity.
2. To familiarize students with instrumental techniques such as pH metry, conductometry, and spectrophotometry.
3. To enable students to verify Beer's law and determine unknown concentrations using absorption spectroscopy.
4. To provide hands-on experience in the preparation of polymeric resins and determination of molecular weight of polymers.

Course Outcomes: After completion of this course, students will able to -

CO1	Apply instrumental techniques such as pH metry, conductometry, and spectrophotometry to determine acid strength, verify Beer's law, and find unknown concentrations.
CO2	Demonstrate understanding of corrosion behaviour and nanoparticle synthesis through observation and analysis of demonstration experiments.

List of Experiments: (Minimum 08 Experiments are compulsory)

A. Lab Experiments (Any Seven)

1. Determination of hardness of water by EDTA method.
2. Determination of alkalinity of water.
3. Determination of strength of strong acid using pH meter.
4. Determination of maximum wavelength of absorption of $CuSO_4$/$FeSO_4$/$KMnO_4$, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of strong acid with strong base using Conductometer.
6. Preparation of phenol-formaldehyde/urea-formaldehyde resin.
7. Proximate analysis of coal.
8. Coating of copper or zinc on iron plate using electroplating.
9. Determination of the molecular weight of a polymer by using Ostwald's Viscometer.

B. Demonstration (virtual) (Any One)

10. Demonstration of effect of environmental conditions on metal by weight loss method.
11. Synthesis of oxide nanoparticles.

Reference Books:

1. B. Sivasankar, "Engineering Chemistry", Tata Mcgraw-Hill Education Publishing company Limited.
2. G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta "Fundamentals of Nanotechnology", CRC press.

E-Resources:

Virtual Labs:

1. PICT Pune: http://chemistryvl.pict.edu/#/
2. NITK Surathkal: Hardness of water: https://ee1-nitk.vlabs.ac.in/exp/determination-of-hardness/simulation.html#
3. NITK Surathkal: Alkalinity of water: https://ee1-nitk.vlabs.ac.in/exp/determination-of- alkalinity/ simulation.html
4. IIT Hyderabad: Colorimeter, verification of Beer's law, https://mas-iiith.vlabs.ac.in/exp/beer-law/ simulation.html
5. IIT Kanpur: Preparation of phenol-formaldehyde resin, http://ebootathon com/labs/beta/chemistry/ EngineeringChemistryLab/exp1/simulation.html
6. Amrita University: Determination of viscosity average molecular weight polymer, https://pcv-au.vlabs.ac.in/physicalchemistry/Determination_of_ViscosityAverageMolecularWeightofPolymer/

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)							**Semester:** II		
Course: Basic Electronics Engineering							**Code:** 26EEES203		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
3	-	-	3	40	60	-	-	-	100

Prerequisites:

Basic Concepts of Physics.

Course Objectives:

1. To understand the Fundamentals of Passive Electronic Components and Semiconductor Materials.
2. To master the Principles and Applications of Diodes and Special Purpose Diodes.
3. To familiarize with Transistor Operation, Configurations, and Applications.

Course Outcomes:

CO1	Demonstrate Proficiency in Analyzing and Designing Electronic Circuits Utilizing Passive Components.
CO2	Explain P-N junction diode And VI Characteristics.
CO3	Apply Knowledge of Transistor Characteristics and Configurations in Circuit Design.
CO4	Utilize Operational Amplifiers in Electronic Circuit Design and Analysis.
CO5	Recognize the Principles of Electronic Measurements and Instrumentation.
CO6	Explain Basic Digital Number System Conversion.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Electronics Components** Introduction to Electronics: Evolution of Electronics, Impact of Electronics in industry and society. Introduction to Passive Components: Classification, Specifications and Color coding techniques of Resistors, Capacitors, Inductors. Introduction to Active Components: Construction, Types and Applications.	7
2.	**Semiconductor materials** Semiconductors: P-type and N-type, Current in semiconductors: Diffusion and Drift Current. P-N Junction Diode: Construction, working in forward and reverse bias, V-I characteristics, Diode applications: Diode as a switch, Diode as Rectifier: HWR, FWR, BR, Specifications of Rectifier diodes. Special purpose diodes: Zener diode: V-I Charateristics	7
3.	**Transistor Circuits** Transistors: Construction, types, operation, Characteristics and region of operation, CB, CE, CC configurations, BJT as a switch and CE amplifier. Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Types of MOSFET, n- Channel E-MOSFET : Construction, Operation, V-I characteristics.	7
4.	**Linear Integrated Circuits:** Introduction to Op-amp, Functional block diagram of operational amplifier, idea land practical parameters, Concept of negative& positive feedback, Applications-	7

	Inverting and Non inverting amplifier. IC 555 timer as an oscillator, voltage regulation , IC voltage regulators(Three Pin)	
5.	**Electronic Measurements and Instrumentation** Electronics measurements: Frequency measurements and conversions in various units like Hz, KHz, MHz etc, and Voltage, current and power Measurement units, measurement units for resistance, conductance, impedance, capacitance and inductance. Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.	7
6.	**Digital Number System And Boolean Algebra** Introduction: Binary, octal , Decimal, Hexadecimal numbers, and its conversion. Signed Binary number representation: Signed Magnitude, 1's complement and 2's complement representation. Binary, Octal, Hexadecimal Arithmetic: 2's complement arithmetic. Boolean algebra and logic Gates: Boolean algebra, Basic theorems and properties of Boolean algebra. Logic Gates, DeMorgan's theorem.	7
	TOTAL	**42**

Text Books:

1. Thomas. L. Floyd, "Electronics Devices", 9th Edition, Pearson.
2. R.P. Jain, "Modern Digital Electronics", 4th Edition, Tata McGraw Hill.
3. H.S. Kalsi, "Electronic Instrumentation", 3rd Edition, Tata McGraw Hill.
4. D. Patrnabis , "Sensors and Transducers", 2nd Edition, PHI.

Reference Books:

1. Donald A. Neamen,"Semiconductor Physics and Devices", McGraw-Hill Higher Education, 2011.
2. Paul Horowitz and Winfield Hill, "The Art of Electronics", Cambridge University Press.
3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall, 2000 Education.
4. Brian R. Jones "Principles of Electronic Instrumentation", Prentice Hall.
5. Ramon Pallas-Areny and John G. Webster, "Sensors and Signal Conditioning", Wiley.

E-Resources:

1. MIT Open CourseWare – Electronics
   https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/
2. NPTEL - Electronics & Communication Engineering
   https://archive.nptel.ac.in/courses/117/105/117105144/
3. All About Circuits https://www.allaboutcircuits.com/
4. Electronics Hub https://www.electronicshub.org/

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Introduction to Electrical Engineering Materials								**Code:** 26EEES205	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Concept of electricity, fundamentals of electromagnetism, and basic knowledge of chemistry (bond structure).

Course Objectives:

1. To discuss the properties of materials used in the manufacturing of various Electrical equipment.
2. To familiarize students with the applications of material science in electrical engineering.

Course Outcomes: On completion of the course, the learner will be able to -

CO1	Discuss the scope of material science for electrical engineers along with properties and applications of dielectric materials.
CO2	Examine the breakdown mechanism in solid, liquid, and gaseous insulating material through laboratory testing.
CO3	Apply theoretical knowledge to effectively select conducting materials for practical applications in electrical engineering.
CO4	Illustrate materials used in electrical applications including transformers, electrical machines, cables, capacitors, and switchgear (MCB) along with their properties.
CO5	Evaluate the suitability of magnetic materials for specific electrical engineering requirements.
CO6	Identify special-purpose materials and their properties used in domestic and commercial applications.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to material science:** Scope of material science for electrical engineers, types of materials (dielectric, conducting, insulating, magnetic), general electrical properties of materials. **Dielectric materials:** Introduction, active and passive dielectrics, Fundamental term associated with dielectrics: Dielectric constant, Dipole, flux density, dipole moment, polar and non-polar molecules, electric susceptibility, polarizability, concept of polarization, relationship between polarization, susceptibility and dielectric constant, ferroelectric material (concept, materials used and application), hysteresis loop in ferroelectric material, piezo-electricity (concept, materials used and application), Pyro-Electric materials.	07
2.	**Dielectric breakdown:** Mechanism of breakdown in gases, liquids, and solid, concept of ionization, Breakdown voltage, breakdown strength, factors affecting breakdown strengths of solid, liquid, and gaseous dielectric materials. **Testing of materials**: Measurement of dielectric strength of solid insulating material 2584, Measurement of dielectric strength of liquid insulating material -IS 6798, Measurement of dielectric strength of gaseous insulating material as per IS.	07

3.	**Conducting materials:** General properties of conductor, Classification of conducting materials: low-resistivity and high resistivity materials (property and applications), Electrical conducting materials - Copper, aluminum, iron, steel, silver and, (electrical/ mechanical/ thermal properties and its applications), properties and applications of copper Alloys (brass & bronze), High resistive materials: Constantan, Nichrome, Tungsten, carbon (property and applications), Materials used for transmission lines, resistor, rheostat, heavy-duty contacts-silver copper, copper cadmium. Trade names of commonly used conductors-ACSR, aluminum alloy conductors, etc.	07
4.	**Insulating materials:** Characteristics of good insulating materials (electrical, thermal, chemical, and mechanical properties),classification based on temperature, Fibrous insulating materials: paper, pressboard (properties and applications), ceramics, mica, porcelain (properties and applications), liquid insulating materials: Transformer oil, Askarel (properties and applications), the effect of moisture on insulation properties, gaseous insulating materials: air, Sulphur hexafluoride (properties and applications), insulating materials used for transformer, DC motor and induction motor, cables, capacitors, switchgear (MCB).	07
5.	**Magnetic materials:** Introduction, Parameters of Magnetic material: magnetic flux density, magnetic field intensity, Permeability, magnetic dipole moment, magnetic Susceptibility, (simple numerical), Classification of magnetic materials: Diamagnetic, paramagnetic, ferromagnetic, hysteresis curve and loss, domain theory, factors affecting permeability and hysteresis loss, hard and soft magnetic materials, Ferrites and Ferromagnetic materials (properties and applications), magnetic materials used in transformer and rotating machines (DC motor and induction motor).	07
6.	**Special purpose materials:** Soldering: hard and soft soldering (concept, material used and properties), HRC fuses, electric contacts (material used and properties), Thermocouple (concept, materials used and its applications), Overview of the materials used for solar cells, fuel cells, battery, printed circuit board (PCB) fabrication (properties), materials used for coatings to enhanced solar thermal energy collection (properties), materials used for insulating varnishes and coolants (properties).	07
TOTAL		**42**

Text Books:

1. S. P. Seth, "A Course in Electrical Engineering Materials," Dhanpat Rai and Sons publication.
2. R. K. Rajput, "A Textbook of Electrical Engineering Materials," Laxmi Publications (P) Ltd.
3. K. B. Raina and S. K. Bhattacharya, "Electrical Engineering Materials," S. K. Kataria Sons.
4. P.K. Palanisamy, "Material Science for Electrical Engineering,"Scitech Pub. Pvt. Ltd., Chennai (India).
5. C. S. Indulkar and S. Thiruvengadam, "Electrical Engineering Materials," S. Chand and Company Ltd.
6. K.M. Gupta and Nishu Gupta, "Advanced Electrical and Electronics Materials: Processes and

Applications," Scrivener Publishing (John Wiley & Sons, Inc. Hoboken, New Jersey).
Reference Books:
1. D. M. Tagare, "Electrical Power Capacitors-Design & Manufacture," Tata McGraw Hill Publication. 2. S. P. Chalotra and B. K. Bhattacharya, "Electrical Engineering Materials," Khanna Publishers, Nath Market. 3. Kamraju and Naidu, "High Voltage Engineering," Tata McGraw Hill Publication.
E-Resources:
1. Prof. Bishakh Bhattacharya, "Nature and Properties of Materials, IIT Kanpur https:// onlinecourses.nptel. ac.in/noc20_me13/preview. 2. Dielectric materials: https://www.youtube.com/watch?v=etjZmdmrjSU

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Introduction to Electrical Engineering Materials Lab								**Code:** 26EEES205P	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Physics.

Course Objectives: The objectives of this course are

1. To provide practical knowledge of various electrical engineering materials and their properties.
2. To develop skills in testing and characterizing insulating, conducting, and magnetic materials used in electrical systems.

Course Outcomes: After completion of this course, students will able to -

CO1	Identify and classify different types of electrical engineering materials based on their properties and applications.
CO2	Perform standard tests on insulating, conducting, and magnetic materials and interpret the experimental results.

List of Experiments:

Part A) Minimum six experiments from the following list.

1. To measure the dielectric strength of solid insulating material-IS 2584. (compulsory)
2. To measure the dielectric strength of liquid insulating material 6789. (compulsory)
3. To measure the dielectric strength of gaseous insulating material as per IS using Sphere Gap-Unit. (compulsory)
4. To obtain the hysteresis loop of the ferromagnetic material.
5. To measure the resistivity of high-resistive alloys.
6. To understand the principle of thermocouples and to obtain characteristics of different thermocouples.
7. Measurement of flux density by Gauss-meter.
8. To measure insulation resistance and kVAr capacity of the power capacitor.

Part B) Activity-based lab conduction. Minimum two experiments from the following list.

1. Review of research/online literature from the latest journal papers /transactions related to different insulating, magnetic, and conducting materials, advanced material developments, and their applications. Prepare a report and give a group-wise presentation.
2. Two to three household appliances like a mixer -motor, ceiling fan- -motor, etc. can be opened up by students either individually or by a group of students and analyzed w.r.t. the materials found in it. Name each material used and to which category of materials it belongs, other applications of the same materials can be listed.
3. Engage in discussions, presentations, or activities involving IS/IEC/IEEE standards and recent patents concerning insulating, conducting, and magnetic materials.
4. Explore a case study on recent advancements in magnetic materials, high-temperature superconductors, and their practical applications.

5. Detailed case study of complete insulation system in transformer, comparison of various types of solid, and liquid materials, and study of recent advances related to major and minor insulating materials.

Industrial visit: Visit to any transformer/electrical machines manufacturing industry. (Compulsory)

Reference Books:

1. James F. Shackelford & M. K. Muralidhara, "Introduction to Material Science for Engineering," 6th Edition, Pearson Education.
2. "Insulation Technology Course Material" of IEEMA Ratner, Pearson Education.
3. Traugott Fischer, "Materials Science for Engineering Students," Elsevier Publications.
Rakosh Das Begamudre, "Energy Conversion Systems," New Age International Publishers.

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)									**Semester:** II
Course: Fundamentals of Electrical Measurements									**Code:** 26EEPC201
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Basic knowledge of Physics, fundamental electrical principles.

Course Objectives:

1. To introduce the fundamental concepts of electrical measurement systems, instrument characteristics, errors, and standards.
2. To explain the construction, working principles, and applications of various analog measuring instruments.
3. To develop the ability to select and apply appropriate methods for measurement of resistance, inductance, and capacitance.

Course Outcomes: After completion of this course, students will able to -

CO1	Explain the basic concepts of measurement systems including characteristics of instruments, types of errors, standards, and units of electrical quantities.
CO2	Describe the construction, working principle, torque equation, and applications of analog instruments such as PMMC, Moving Iron, and Electrodynamometer type instruments.
CO3	Apply suitable methods and bridges for the measurement of low, medium, and high resistances.
CO4	Analyze AC bridge methods for the measurement of inductance, capacitance, and frequency.
CO5	Determine power and energy in single-phase and three-phase circuits.
CO6	Illustrate the working principles and applications of digital instruments (DVM, Digital Multimeter, CRO) and transducers in electrical measurements.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Electrical Measurements:** Significance of measurement in electrical engineering, Classification of measuring instruments (Absolute & Secondary) Essential characteristics of measuring instruments: Accuracy, Precision, Sensitivity, Resolution, Error, Loading effect **Types of errors:** Gross, Systematic, Random Standards of measurement and calibration Units and dimensions of electrical quantities	07
2.	**Analog Measuring Instruments:** Classification of analog instruments: Indicating, Recording, Integrating Operating forces in instruments: Deflecting, Controlling and Damping torque Permanent Magnet Moving Coil (PMMC) instrument: Construction, working, torque equation, advantages & disadvantages Moving Iron (MI) instruments: Attraction and Repulsion type – construction, working, torque equation	07

	Electrodynamometer type instruments: Construction and applications Extension of range of ammeters and voltmeters using shunts and multipliers	
3.	**Measurement of Resistance:** Classification of resistances: Low, Medium and High, Measurement of medium resistance using Wheatstone bridge, Measurement of low resistance using Kelvin's Double Bridge, Measurement of high resistance using Megger, Measurement of earth resistance, Limitations and applications of different methods	07
4.	**Measurement of Inductance and Capacitance:** AC Bridges: General principle and balance condition, Measurement of self-inductance using Maxwell's inductance bridge and Maxwell's inductance-capacitance bridge, Measurement of capacitance using Schering Bridge, Measurement of frequency using Wien's Bridge, Advantages, limitations and applications of AC bridges	07
5.	**Measurement of Power and Energy:** Measurement of power in single-phase circuits using dynamometer type wattmeter, Measurement of power in three-phase circuits (Three-wattmeter and Two-wattmeter method), Construction and working of single-phase induction type energy meter, Errors in energy meters and their compensation. Smart meters and modern trends in electrical measurements.	07
6.	**Digital Instruments and Advanced Measurement Techniques:** Comparison between Analog and Digital instruments, Digital Voltmeter (DVM): Types and working principle (Ramp type), Digital Multimeter: Block diagram and applications: Transducers: Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers, LVDT, strain gauge, (construction, working, applications, advantages, and disadvantages). Oscilloscope: Introduction, various parts, front panel controls, use of CRO for measurement of voltage, current, period, and frequency. Phase angle & frequency by Lissajous pattern. Introduction to DSO.	07
	TOTAL	**42**

Text Books:

1. A. K. Sawhney, "A Course in Electrical and Electronic Measurements & Instrumentation," Dhanpat Rai & Co.
2. J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation," S. K. Kataria & Sons.
3. Doebelin EO, "Measurement Systems: Application and Design," Tata McGraw Hill.
4. Albert D. Helfrick and William D. Cooper, "Modern electronic instrumentation and measurement techniques," Pearson India Education.

Reference Books:

1. E. W. Golding & F. C. Widdies, "Electrical Measurements & Measuring Instruments", Reem Publications.
2. Dr. Rajendra Prasad, "Electronic Measurements & Instrumentation", Khanna Publishers.
3. Arun K. Ghosh, "Introduction to Measurements and Instrumentation", PHI Publication.

4. Patranabis D, "Sensors and Transducers," Prentice Hall of India.

E-Resources:

1. NPTEL Course, "Electrical Measurement and Electronic Instruments", by Dr. Avishek Chatterjee, IIT Kharagpur:
   Link: https://archive.nptel.ac.in/courses/108/105/108105153/
2. Fundamentals of Electrical Measurements Laboratory
3. Link: https://www.youtube.com/playlist?list=PL2Q_0aXptwl1foD9eKFGXo3iQfOriDmp5

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)				**Semester:** IV					
Course: Fundamentals of Electrical Measurements Lab				**Code:** 26EEPC201P					
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	25	-	25

Prerequisites:

Basic knowledge of Physics, fundamental electrical principles.

Course Objectives:

1. To develop the ability to select and apply appropriate methods for measurement of resistance, inductance, and capacitance.
2. To enable students to understand the measurement of power and energy in single-phase and three-phase circuits.
3. To provide knowledge of digital measuring instruments, CRO, and transducers used in modern electrical measurements.

Course Outcomes: After completion of this course, students will able to -

CO1	To provide hands-on experience with analog and digital measuring instruments.
CO2	To cultivate accuracy in measurement, data recording, error analysis, and interpretation of results.

List of Experiments:

Minimum Eight experiments from the following list.

1. Demonstration of working parts of various types of meters by opening the instrument & explanation of symbols & notations used on instruments.
2. Measurement of voltage, current, and resistance by using a potentiometer.
3. Calibration of Ammeter, Voltmeter, and Wattmeter using Potentiometer.
4. Measurement of resistance by ammeter voltmeter method.
5. Measurement of active & reactive power in a three-phase balanced circuit using the wattmeter method with a two-way switch.
6. Measurement of reactive power by one wattmeter with all possible connections of the current coil and pressure coil.
7. Measurement of three-phase active & reactive power by two-wattmeter method procedure.
8. Measurement of energy consumed in a single-phase circuit using an energy meter.
9. To plot the calibration curve for a single-phase energy meter
10. To study and plot the characteristics of LVDT.
11. Measurement of voltage, current, time period, and frequency using CRO.
12. Measurement of frequency of an unknown signal and phase angle between two signals obtaining Lissajous pattern using a CRO.

Reference Books:

1. J. B. Gupta, A Course in Electronic and Electrical Measurements and Instrumentation, S. K. Kataria & Sons
2. R. K. Rajput, Electrical and Electronic Measurements and Instrumentation, S. Chand Publishing
3. H. S. Kalsi, Electronic Instrumentation, McGraw Hill Education (Useful for digital instruments,

CRO, and modern measurement techniques)
4. A. D. Helfrick & W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Pearson Education

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Electrical CAD and Python Programming								**Code:** 26EEVS202	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Programing.

Course Objectives:

1. To introduce the fundamentals of Computer Aided Design (CAD) tools for creating electrical drawings and schematics.
2. To develop skills in preparing single line diagrams, wiring diagrams, and panel layouts using Electrical CAD software.
3. To understand the basics of Python programming language and its syntax.
4. To apply Python programming for solving electrical engineering problems and data handling.
5. To develop the ability to integrate CAD drawings with Python-based calculations and automation.
6. To enhance practical skills through hands-on experiments related to electrical design and programming.

Course Outcomes: On completion of the course, the learner will be able to -

CO1	Create basic electrical drawings and symbols using Electrical CAD software.
CO2	Prepare single line diagrams, wiring diagrams, and panel layouts for electrical systems.
CO3	Develop Python programs using fundamental programming constructs for electrical calculations.
CO4	Apply Python for data processing, file handling, and analysis of electrical parameters.
CO5	Implement modular programs and simple automation related to electrical engineering applications.
CO6	Integrate CAD drawings with Python-based solutions for real-world electrical design problems.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Electrical CAD:** Introduction to CAD software interface, coordinate systems, basic drawing tools, layers, dimensioning, and electrical symbol libraries.	05
2.	**Electrical Drawings using CAD:** Preparation of electrical symbols, single line diagrams (SLD), wiring diagrams, control circuit diagrams, and panel layout drawings.	04
3.	**Python Programming Fundamentals:** Introduction to Python, data types, variables, operators, input/output statements, conditional statements, and looping constructs.	05
4.	**Python for Electrical Applications:** Functions, lists, arrays, modules, file handling, and simple programs for electrical calculations (Ohm's law, power, energy, etc.).	05
5.	**Advanced Python Concepts:** Use of libraries (NumPy, Matplotlib – basic level), data visualization of electrical parameters, and simple automation scripts.	05

6.	**Integration of CAD and Python:** Exporting data from CAD drawings, using Python for design calculations, report generation, and mini-project applications.	04
	TOTAL	**28**

List of Experiments: (Minimum Eight experiments from the following list.)

1. Introduction to Electrical CAD software interface and creation of basic electrical symbols.
2. Prepare a Single Line Diagram (SLD) of a simple electrical distribution system using CAD.
3. Draw wiring diagram of a residential/commercial electrical installation using CAD.
4. Create a control panel layout and bill of materials using Electrical CAD.
5. Write a Python program to calculate electrical parameters (Voltage, Current, Power, Energy) based on user inputs.
6. Develop a Python program to compute electricity bill using slab-rate tariff.
7. Implement Python programs for series-parallel resistance calculations and power factor improvement.
8. Perform file handling in Python to store and retrieve electrical measurement data.
9. Use Python to sort and analyze electrical load data based on power ratings.
10. Mini Project: Prepare an electrical drawing in CAD and perform related design calculations using Python.

Text Books:

1. Gaurav Verma & Matt Weber, AutoCAD Electrical 2024 for Electrical Control Designers, CADCIM Technologies.
2. Eric Matthes, Python Crash Course, No Starch Press, 3rd Edition.
3. Yashavant Kanetkar, Let Us Python, BPB Publications.

Reference Books:

1. Sham Tickoo, *AutoCAD Electrical 2023 for Electrical Control Designers*, CADCIM Technologies.
2. Mark Lutz, *Learning Python*, O'Reilly Media.
3. R. Naraayanan, *Computer Aided Design of Electrical Machines*, New Age International.

E-resource:

1. Complete AutoCAD 2D for Electrical drafting: https://www.youtube.com/watch?v=xzQgm7jBiRM&t=14646s
2. AutoCAD tutorial for beginners: https://www.youtube.com/playlist?list=PLrOFa8sDv6jfDpaJxwDr9lhGpyQYopH28 https://www.youtube.com/playlist?list=PLcH1MIEuSvoGUIKq_HWjAiWcrNWUWbDhm
3. AutoCAD tutorial for Electrical engineers beginners: https://www.youtube.com/playlist?list=PLrOFa8sDv6jeqPGoHVwPQVoB3BWMtvcRJ
4. AutoCAD training exercises for beginners: https://www.youtube.com/playlist?list=PLrOFa8sDv6jcau9_xGxn_Uqy7tFgQT90F
5. Complete AutoCAD 2D for Electrical drafting: https://www.youtube.com/watch?v=xzQgm7jBiRM
6. AutoCAD electrical tutorial: https://www.youtube.com/watch?v=6VXybp4g4vU&list=PLgphov1ulu64oIYfeGe9tI0drvMZpZA6e https://youtu.be/VtLXKU1PpRU?si=8YSWZIgWEJjglcqn

7. AutoCAD Electrical:
https://www.youtube.com/playlist?list=PLCpgueQDWMF4VPSH9vrmu-CCj27nkm59B
https://www.youtube.com/playlist?list=PL9R2s5XMUJUNC6LtCeqcG3N-Gs7YVZNdU
8. Schematic circuit design in AutoCAD Electrical:
https://www.youtube.com/watch?v=7hkjuejaOxw
9. Prof. Sudarshan Iyengar, "Python for Data Science", IIT Madras – NPTEL Python Official Documentation – https://docs.python.org/3/
10. NPTEL Course: "Programming, Data Structures and Algorithms using Python" – IIT Madras

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)									**Semester:** II
Course: Electrical Workshop-II									**Code:** 26EEVS203
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic concepts of Electrical Engineering & Electronics Engineering.

Course Objectives:

1. To provide hands-on experience in assembly and testing of basic electronic circuits.
2. To introduce soldering, PCB related practices and electronic component identification.
3. To enhance troubleshooting and practical problem-solving skills in electrical and electronic systems.

Course Outcomes: After completion of this course, students will able to -

CO1	Assemble and test basic electronic circuits on breadboard and PCB.
CO2	Demonstrate soldering, desoldering and fabrication techniques for electronic circuits.

List of Experiments:

A. Minimum Eight experiments from the following list.

1. Identification and testing of passive and active electronic components (R, C, L, Diode, Transistor).
2. Perform soldering and desoldering practice on general purpose PCB.
3. Assemble and test a full-wave rectifier circuit with and without filter on breadboard/PCB.
4. Assemble and test a transistor as a switch and LED driver circuit.
5. Design and assemble a simple regulated DC power supply using IC 7805.
6. Assemble and test a transistorized series voltage regulator.
7. Design and assemble a simple LED flasher circuit using transistor or 555 timer.
8. Assemble and test a Clap switch / Touch switch circuit.
9. Construct and test a light-operated switch using LDR and transistor.
10. Assemble and test a water level indicator circuit using transistors.

B. To demonstrate the understanding by performing minor project.

Reference Books:

1. Ward Cheney, David Kincaid, "Numerical Mathematics and Computing," Thomson Brooks/Cole, 6th edition, 2007.
2. Curtis F. Gerals, Patrick O. Wheatley, "Applied Numerical Analysis," 7th Edition, Pearson Publication.
3. Steven Chapra, Raymond P. Canale, "Numerical Methods for Engineers," Tata McGraw Hill Publication.
4. S.S. Sastry, "Introductory methods of Numerical Analysis," PHI Learning Private Ltd.
5. P. Thangaraj, "Computer oriented Numerical Methods," PHI Learning Private Ltd.

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Professional Development - II								**Code:** 26EECC203	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
01	02	-	02	-	-	50	-	-	50

Course Objectives:

1. To introduce students on professional development skills and its importance in building personal and professional life.
2. To bring in self-awareness and realization of Values, Self-discipline and self-grooming for betterment of life and contribution to our Society.

Course Outcomes: After completion of this course, students will be able to -

CO1	Understand the interpersonal skills importance and finding skill gaps for development.
CO2	Know how to be effective in managing our time with application of simple tools & techniques.
CO3	Know the effective components of teamwork and how to be effective in our role for team performance and goals.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Employability Skills:** Preparing for employment- transition from education to employment, selection process understanding, modern cv styles based on sector of employment, core and technical skills formulation and authentication, group discuss strategies and guidelines, Stages of interview- aptitude, technical, GD and personal interview	16
2.	**Prime skills at work place:** Employability skills, raising your employability quotient, researching own perspective at workplace communication and organization culture, communication and interpersonal relations, significance of presentation skills in corporate world, overcoming fear of public speaking, correspondence at work	16
3.	**Special skills to excel at workplace:** Work correspondence: Importance and types of work correspondence, seven Cs of communication, mechanics of effective business correspondence Teamwork: understanding team behaviors, teamwork as employability skill, significance of team spirit Workplace Etiquette: Etiquette in the modern workplace, Etiquette -global and local, gender sensitivity, Etiquette in interaction, Netiquette, non-office hours and party times business meets do and do nots, character building and careful identity creation in the organization.	16
	TOTAL	**48**

Text Books:

1. M. K. Sinha, "Success Through Self-Discipline: Your Personal Guide to Achieving Your Goals"
2. Sabina Pillai, Agna Fernandez," Soft Skills and Employability Skills" Cambridge Press

3. Sanjay Kumar & Pushpa Latta, commination skills "Oxford higher education
4. Minakshi Raman & Sangita Sharma, "Technical Communication and Principal & Practices Oxfords Press.

Reference Books:

1. Stephen R. Covey, "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change", Simon & Schuster, 1989.
2. Jack Canfield, "The Success Principles", HarperCollins, 2005.
3. Norman Vincent Peale, "The Power of Positive Thinking", Prentice Hall, 1952.

E-Resources:

1. Coursera: "The Science of Well-Being" by Yale University, - https://www.coursera.org/learn/the-science-of-well-being
2. Udemy: "Self-Care: Take Care ofYourselfto Better Take Care of Others" by Jessica Rogers https://www.udemy.com/course/caring-self/?couponCode=UPGRADE02223

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LIBERAL LEARNING COURSES - II

(Select any one course from the given Liberal Learning Courses)

DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Guitar)								**Code:** 26EECC204A	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Guitar musical instrument.

Course Objectives:

To enhance guitar skills through intermediate fingerpicking, lead techniques, and genre exploration, culminating in a polished final performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Execute intermediate fingerpicking techniques with precision and rhythm.
CO2	Apply advanced lead guitar techniques and pentatonic scales effectively.
CO3	Perform confidently across various genres including blues, rock, folk, and classical.
CO4	Deliver a polished final performance through focused practice and preparation.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Rhythm and Timing.	2
2.	Time Signatures.	2
3.	Understanding Basic Rhythms.	2
4.	Circle of Fifths.	2
5.	Introduction to Minor Scales.	2
6.	Advanced Chord Shapes.	2
7.	Introduction to Lead Techniques.	2
8.	Introduction to Pentatonic Scale.	2
9.	Practice and Review.	2
10.	Exploring Different Genres.	2
11.	Final Project Planning.	2
12.	Intensive Practice.	2
13.	Pre-Performance Preparation.	2
14.	Final Performance.	2
	TOTAL	**28**

Text Books:

1. David Hodge, "Guitar Theory", DK Publishing.

Reference Books:

1. Russ Shipton, "The Complete Guitar Player", Published by Wise.
2. Vincent Ong, Alfred Khp," Classical Guitar Advanced Studies Repertoires", Dynamic Publication.

E-Resources:

https://www.youtube.com/watch?v=BBz-Jyr23M4

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Singing)								**Code:** 26EECC204B	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music in singing.

Course Objectives:

To develop advanced singing techniques and ear training through Indian classical music, focusing on repertoire selection, effective rehearsal, and performance presentation.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master legato, staccato, and advanced vocal methods in Indian classical music.
CO2	Improve musical ear through rigorous training and diverse classical repertoire.
CO3	Apply effective rehearsal strategies to prepare and present a polished performance.
CO4	Deliver a well-executed performance of selected Indian classical pieces with artistic expression

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Vibrato and Ornamentation.	2
2.	Range Extension.	2
3.	Legato and Staccato.	2
4.	Advanced Ear Training.	2
5.	Basics of Indian Semi Classical Music.	2
6.	Improvisation Techniques.	2
7.	Selecting Repertoire for Performance.	2
8.	Rehearsal Techniques.	2
9.	Dress Rehearsal.	2
10.	Final Performance.	2
11.	Performance Review.	2
12.	Exploring New Repertoire.	2
13.	Advanced Techniques and Styles.	2
14.	Course Recap and Future Directions.	2
	TOTAL	**28**

Text Books:

1. **Dr. Theodore Dimon, "Anatomy of the Voice, This Is a Voice".**

Reference Books:

1. Richard Miller, "The Structure of Singing", Schirmer Books, London.
2. Jennifer Hamady, "The Art of Singing", Published by Hal Leonard.

E-Resources:

1. https://www.youtube.com/watch?v=4hNq9qykOyE
2. https://www.youtube.com/watch?v=b14gkmECz-Y

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Cinematography)								**Code:** 26EECC204C	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

A basic understanding of film theory, Camera operation, Lighting techniques and visual storytelling is essential for cinematography.

Course Objectives:

1. To master videography by learning camera techniques, shooting methods, and editing, culminating in a final project showcasing advanced skills in video production.

Course Outcomes: After completion of this course, students will be able to -

CO1	Operate camera components and techniques for steady, sharp video shooting.
CO2	Apply rule of thirds, framing, and stabilization methods effectively.
CO3	Use advanced editing tools and sound design for polished video projects.
CO4	Deliver a comprehensive final video project demonstrating learned skills.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Videography	2
2.	Understanding camera components (lens, sensor, viewfinder)	2
3.	Techniques for steady shooting (tripods, handheld, gimbals)	2
4.	Understanding the rule of thirds, leading lines, and framing in video	2
5.	In-depth explanation of the exposure triangle: aperture, shutter speed, and ISO	2
6.	Importance of audio in videography	2
7.	Techniques for achieving sharp focus	2
8.	Motion and Stabilization	2
9.	Storyboarding and Planning	2
10.	Filming Techniques	2
11.	Introduction to Video Editing	2
12.	Introduction to advanced editing tools (color correction, audio editing, effects)	2
13.	Sound Design and Mixing	2
14.	Final Project Presentation and Review	2
	TOTAL	**28**

Text Books:

1. Tania Hoser, "Introduction to Cinematography", Taylor & Francis.

Reference Books:

1. Anat Pick, "Screening Nature", Berghahn Books.
2. Blain Brown, "Cinematography: Theory and Practice", Taylor & Francis.

E-Resources:

1. https://youtu.be/V7z7BAZdt2M?si=to4yQ46zEKRbxKOm
2. https://youtu.be/WXdAX0No2hM?si=GZu_mJsmyJ7NGnAU

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Dance)								**Code:** 26EECC204D	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Good stamina, flexibility and familiarity with simple rhythmic patterns and beats.

Course Objectives:

1. To develop advanced dance techniques, expressive skills, and performance readiness in Indian classical dance, culminating in a final performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Develop advanced techniques in footwork, postures, and hand gestures, with a focus on fluidity and expression.
CO2	Embody various characters and emotions through in-depth exploration of Abhinaya (expressional dance).
CO3	Execute learned dance pieces with precision, synchronization, and advanced rhythmic variations.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Character Portrayal.	2
2.	Rehearsal and Feedback.	2
3.	Advanced Footwork and Postures.	2
4.	Advanced Hand Gestures and Movements.	2
5.	Rhythmic Variations and Combinations.	2
6.	Rehearsal of Dance Piece.	2
7.	Performance Techniques.	2
8.	Integrating Steps and Expressions.	2
9.	Full Dress Rehearsal.	2
10.	Improvisation and Creative Movement.	2
11.	Corrections and Adjustments.	2
12.	Mini Performance.	2
13.	Introduction to Abhinaya in Depth.	2
14.	Preparing a New Short Dance Item.	2
	TOTAL	**28**

Text Books:

1. Kapila Vatsyayan, "Indian Classical Dance", Publications Division Ministry of Information & Broadcasting.

Reference Books:

1. Shubhada Varadkar, "The Glimpse of Indian Classical Dance", Krimiga Books, Krimiga Content Development Pvt. Ltd.

E-Resources:

1. https://youtu.be/VP2jLLk8_jA?si=zg6_muy1w7jE5mbi
2. https://youtu.be/xZEP4XupwJA?si=YBt3RmcHxCRc2JSr

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Synthesizer/Keyboard)								**Code:** 26EECC204E	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Keyboard musical instrument.

Course Objectives:

1. To develop advanced musical skills through complex progressions, improvisation, and composition, culminating in a polished performance and mastery of selected repertoire.

Course Outcomes: After completion of this course, students will be able to -

CO1	Apply complex chord progressions and advanced scales effectively in performance.
CO2	Demonstrate proficiency in improvisation and advanced chord voicings.
CO3	Perform selected repertoire with refined technique and stage presence.
CO4	Successfully showcase learned skills through a polished recital or performance.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	Introduction to more complex progressions (e.g., ii-V-I)	2
2.	Basics of improvisation	2
3.	Learning advanced scales (e.g., blues scale, pentatonic scale)	2
4.	Learning advanced chord voicings and inversions	2
5.	Advanced Arpeggios and Runs	2
6.	Basics of composing music	2
7.	Initial practice on selected repertoire	2
8.	Focused practice on repertoire pieces	2
9.	Understanding stage presence and performance techniques	2
10.	Final adjustments and practice on repertoire	2
11.	Attending or reviewing a masterclass	2
12.	Receiving personalized feedback on playing	2
13.	Dress rehearsal for recital or performance	2
14.	Showcasing learned skills and pieces	2
	TOTAL	**28 hrs.**

Text Books:

1. Chuan C. Chang, Fundamentals of Piano Practice, Createspace Independent Publishing Platform

Reference Books:

1. Michael Rodman, "Keyboard for the Absolute Beginners", Alfred Publishing
2. Davis Dorrough, "Piano Scales".

E-Resources:

1. https://youtu.be/2mPS-2guHVo?si=8X_4KKezIdrMejLH
2. https://youtu.be/tEtukfFv3Wk?si=2iJ8wdD0dfjWauPb

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Basketball)								**Code:** 26EECC204F	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To master advanced basketball skills, strategies, and mental conditioning to excel in team play, complex scenarios, and tournament preparation.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate mastery of advanced dribbling, passing, shooting, and defensive techniques.
CO2	Apply complex defensive systems, advanced team play, and game strategies in mixed scenarios.
CO3	Develop the mental toughness, conditioning, and strategic insights needed for successful tournament performance

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Revision Of Fundamentals:** Review all Semester I skills. Recall and perform basic techniques correctly.	2
2.	**Body Technique & Footwork:** Learn pivoting, stopping and changing direction. Perform basic basketball footwork correctly.	2
3.	**Combined Skill Practice:** Combine passing, dribbling and shooting drills. Integrate fundamental basketball skills.	2
4.	**Player Stance & Ball Control:** Improve balance and ball protection. Maintain proper stance during play	2
5.	**Passing & Receiving Drills:** Practice passing with movement. Improve passing accuracy and coordination.	2
6.	**Dribble Control:** Develop speed and control while dribbling. Demonstrate improved dribbling ability.	2
7.	**Assessment – III**	2
8.	**Shooting Practice:** Practice set shots and lay-ups repeatedly. Improve shooting consistency.	2
9.	**Rebounding Practice:** Apply rebounding techniques in drills. Secure rebounds with correct positioning.	2
10.	**Individual Defence Practice:** Practice one-on-one defensive drills. Defend an opponent using proper stance.	2
11.	**Footwork Drills:** Improve pivoting and movement efficiency. Demonstrate better balance and coordination.	2
12.	**Combined Passing & Dribbling:** Perform passing after dribbling. Coordinate ball handling with passing.	2
13.	**Combined Shooting Drill:** Shoot after dribbling and passing. Apply shooting in simple game situations.	2
14.	**Assessment - IV**	2
	TOTAL	**28**

Text Books:

1. K.K. Sharma, "Basketball: Skills and Drills", Sports Publications

Reference Books:
1. Dr. P.K. Kher, "Basketball Coaching: A Complete Guide", Khel Prakashan 2. S. Reddy, "The Ultimate Guide to Basketball Training", Blue Rose Publisher
E-Resources:
1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Cricket)								**Code:** 26EECC204G	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop advanced cricket skills and strategies in batting, bowling, and fielding, with a focus on mental conditioning, tactical execution, and competitive performance through intensive practice and match simulations.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate advanced techniques in batting, bowling, and fielding, including targeted drills and intensive practice.
CO2	Apply batting and bowling strategies, and execute tactical plans during match simulations and competitive play.
CO3	Develop strong mental conditioning and teamwork skills, preparing for high-performance in competitive matches and final assessments.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Advanced Batting Footwork:** Improve movement against pace and spin	2
2.	**Stroke Production:** Cover drive, straight drive, sweep, lofted shots	2
3.	**Batting Against Spin:** Reading length and line	2
4.	**Advanced Fast Bowling:** Yorkers, bouncers, slower balls	2
5.	**Advanced Spin Bowling:** Flight, drift, turn, variations	2
6.	**Fielding Techniques:** Slip catching, close-in catching	2
7.	**Assessment - III**	2
8.	**Advanced Wicket Keeping:** Standing up to spinners, stumping's	2
9.	**Running Between Wickets:** Calling, turning, decision-making	2
10.	**Team Communication:** On-field coordination	2
11.	**Fitness For Cricket:** Agility, endurance, speed	2
12.	**Match Simulation:** Game scenarios	2
13.	**Practical & Theory Assessment:** Evaluate semester ii competencies	2
14.	**Assessment - IV**	2
	TOTAL	**28**

Text Books:

1. Sanjay Manjrekar, "Cricket Fundamentals", Orient BlackSwan
2. Ravi Shastri, "Winning Cricket: Skills and Strategies", Notion Press

Reference Books:

1. Sachin Tendulkar, "Playing It My Way", Hachette India
2. Rahul Dravid, "Cricket: The Game of Life", Penguin India

E-Resources:

1. Sports and Performance Nutrition, IIT Madras, https://onlinecourses.nptel.ac.in/noc24_hs82/preview

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)						**Semester:** II			
Course: Liberal Learning – II (Rifle and Pistol Shooting)						**Code:** 26EECC204H			
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To achieve advanced proficiency in rifle shooting through specialized training, technical refinement, and mental preparation for competitive performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master advanced rifle shooting techniques and positions to achieve higher scores.
CO2	Develop strong mental preparation and focus techniques for peak performance and overcoming technical hurdles.
CO3	Gain specialized training and match practice, preparing them for ISSF events and advanced shooting challenges.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Dry Fire Practice**	2
2.	**Live Fire Introduction:** 1st attempt of live firing	2
3.	**Shot Grouping Practice:** Grouping and its process	2
4.	**Common Shooting Errors and Corrections**	2
5.	**Target Analysis:** How to analyse fired target	2
6.	**Zeroing:** Body zero and its importance	2
7.	**Assessment - III**	2
8.	**Standing Position Practice:** To take a proper body position and balancing the body weight properly.	2
9.	**Sitting Position Practice:** Focusing on triggering and making close grouping	2
10.	**Position Transition Drills:** Knowledge about correct position and its steps	2
11.	**Accuracy Improvement Drills**	2
12.	**Speed and Precision Shooting:** To do the process in given time and releasing the shot in correct timing	2
13.	**Trigger Reset Techniques:** Triggering steps	2
14.	**Assessment - IV**	2
	TOTAL	**28**

Reference Books:

1. David Watson, "ABCs of Rifle Shooting", Gun Digest (Imprint of KP Books), 2014

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Volleyball)								**Code:** 26EECC204I	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To achieve advanced proficiency in volleyball by mastering complex techniques, strategic systems, and mental conditioning, while preparing for competitive play and tournament scenarios.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate expertise in advanced serving, spiking, setting, and blocking techniques tailored to specific positions.
CO2	Implement complex offensive and defensive systems and adapt to mixed scenarios through situational drills and gameplay.
CO3	Develop mental toughness, conditioning, and strategic insights necessary for successful tournament preparation and performance.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Timing and Approach:** Introduction to spiking approach, 2-step and 3-step approach, arm swing coordination, jump timing, take-off mechanics, balance, and practice drills**.**	2
2.	**Straight Smash:** Fundamentals of straight spike, correct hand contact, body positioning, jump and arm action, landing technique, target practice, and error correction**.**	2
3.	**Basic Blocking:** Ready position for blocking, footwork along the net, hand positioning, timing of the jump, blocking against different attacks, and safety precautions**.**	2
4.	**Single Blocking Technique:** Individual blocking skills, reading the attacker's movement, timing the block, penetration over the net, recovery after blocking, and practice drills**.**	2
5.	**Rolling and Diving:** Techniques of forward roll, side roll, and dive, safe landing methods, defensive recovery, floor movement drills, and injury prevention**.**	2
6.	**Court Positioning:** Player positions (1–6), offensive and defensive court coverage, movement according to ball direction, transition from attack to defence, and positional awareness.	2
7.	**Assessment - III**	2
8.	**Rotation System:** Volleyball rotation rules, clockwise rotation, serving order, positional faults, rotational movement, and practical game application**.**	2
9.	**Team Communication:** Communication signals, calling the ball, leadership on court, teamwork, coordination during rallies, and effective communication exercises.	2
10.	**Basic Offensive System (4-2):** Introduction to the 4–2 offensive formation, setter responsibilities, hitter positioning, attack combinations, player movement, and tactical execution**.**	2
11.	**Defensive Positioning:** Defensive formations, court coverage, reading opponents' attacks, blocking-defense coordination, and transition from defense to offense**.**	2

12.	**Mini Game (3 Vs 3):** Modified volleyball games emphasizing teamwork, communication, rotation, offensive and defensive skills, and decision-making in small-sided play**.**	2
13.	**Match Practice:** Full-game practice following official volleyball rules, application of learned skills and tactics, referee signals, scoring system, teamwork, and sportsmanship**.**	2
14.	**Assessment - IV**	2
	TOTAL	**28**
Text Books:		
1. Jitendra Kumar, "The Complete Guide to Volleyball", Blue Rose Publisher		
Reference Books:		
1. N. Ramachandran, "Volleyball: Steps to Success", Sports Publication		
E-Resources:		
1. https://coachtube.com/course/volleyball/volleyball-for-beginners/7004		

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DEPARTMENT OF ELECTRICAL ENGINEERING

Program: B. Tech. (Electrical Engineering)								**Semester:** II	
Course: Liberal Learning – II (Football)								**Code:** 26EECC204J	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To enhance players' technical skills, tactical understanding, physical fitness, teamwork, and sportsmanship, fostering a comprehensive understanding and appreciation of the game.

Course Outcomes: After completion of this course, students will be able to -

CO1	To explain key concepts of transition play, positional drills, and the importance of endurance and stamina in football.
CO2	Apply advanced tactics during simulation matches, analyze high-pressure situations.
CO3	Students will design a game week routine that covers match preparation, mental and physical readiness, and post-match analysis, evaluating its impact on team performance and skills.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	**Shooting Techniques**: Demonstrate effective shooting techniques with proper body position, accuracy, power, and placement to create goal-scoring opportunities.	2
2.	**Finishing in Front of Goal:** Develop the ability to finish scoring opportunities in front of goal using accurate technique, quick decision-making, and composure under pressure.	2
3.	**Crossing Techniques:** Demonstrate effective crossing techniques with proper accuracy, timing, and delivery to create goal-scoring opportunities for teammates.	2
4.	**Tackling Techniques:** Demonstrate safe and effective tackling techniques using proper timing, body positioning, and decision-making to regain possession.	2
5.	**Defensive Skills:** Develop effective defensive skills through proper positioning, marking, interception, and teamwork to prevent attacking opportunities.	2
6.	**Goalkeeping Basics:** Demonstrate basic goalkeeping techniques including positioning, handling, diving, and distribution to effectively protect the goal.	2
7.	**Assessment - III**	2
8.	**Throw-ins**: Demonstrate correct throw-in techniques using proper body position, foot placement, and ball delivery to restart play effectively.	2
9.	**Free Kicks & Penalty Kicks: Demonstrate proper techniques for taking free kicks and penalty kicks with accuracy, power, and decision-making to create scoring opportunities.**	2
10.	**Running with the Ball: Develop the ability to run with the ball using speed, control, and awareness to advance play and beat opponents effectively.**	2
11.	**Communication on the Field: Develop effective on-field communication skills through clear instructions, teamwork, and coordination to improve team performance.**	2
12.	**Conditioning Drills:** Improve football-specific fitness through conditioning drills that develop endurance, speed, agility, strength, and overall match readiness.	2
13.	**Practice Match:** Apply technical skills, tactical understanding, teamwork, and	2

	decision-making effectively in a practice match situation.	
14.	**Assessment - IV**	2
	TOTAL	**28**
Text Books:		
1. Srinivasan J. B, "Football Coaching: A Comprehensive Guide", Sports Publishing.		
Reference Books:		
1. Rob Ellis, "The Complete Guide to Coaching Soccer", Meyer & Meyer Sport.		
E-Resources:		
1. Udemy – Soccer Courses - https://www.udemy.com/topic/soccer/		

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