Zeal Education Society's

ZEAL COLLEGE OF ENGINEERING & RESEARCH, PUNE – 41

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Curriculum Structure and Syllabus of

F.Y. B. Tech. – Robotics and Automation Engineering

(With effect from - Academic Year 2026 - 27)

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 ROBOTICS AND AUTOMATION

VISION:

To be recognized as a multidisciplinary department and build skilled professionals by imparting quality technical education and inculcating problem solving and lifelong learning skills through project-based approach in collaboration with industries in the field of Robotics & Automation.

MISSION:

M1: To impart quality technical education in Robotics and Automation Engineering.
M2: To inculcate sustainable skills in automation technologies, research and learning attitudes, and social responsibilities.
M3: To be committed to fulfill the needs of society in the Robotics & Automation industries.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Robotics & Automation Engineering graduates excel in solving industrial challenges, innovating for society, and leveraging core engineering principles for industry advancement.
PEO2: Graduates will apply technical expertise, leadership, and entrepreneurship, to establish ethical organizations to address societal needs and pursue higher studies.
PEO3: Graduates will work effectively as individuals and as team members with high ethical values and motivation for life-long learning for the benefit of society.

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 to 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 Word: 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 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: Design and Development of robotic systems that are cost-effective, environment friendly to solve engineering and societal problems using advanced tools and techniques.

PSO2: Model, program and build error-free, safe, and productive automation systems for various manufacturing processes.

PSO3: Apply domain knowledge of robotics and automation to provide solutions in interdisciplinary areas to meet current industrial challenges.

DEPARTMENT OF ROBOTICS AND AUTOMATION

LIST OF ABBREVIATIONS

Abbreviation	Description
BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Programme Core Course
PEC	Programme 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
TH	Theory
Tut	Tutorial
TW	Term Work
OR	Oral
PR	Practical

DEPARTMENT OF ROBOTICS AND AUTOMATION

First Year B. Tech. – Robotics and Automation: 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						
26RABS101	BSC	Engineering Mathematics I	3	-	-	3	3	-	3	40	60	-	-	-	100
26RABS102	BSC	Engineering Physics	2	-	-	2	2	-	2	40	60	-	-	-	100
26RABS102P	BSC	Engineering Physics Lab	-	2	-	2	-	1	1	-	-	-	-	25	25
26RAES101	ESC	Technical Drawings with Engineering Graphics	2	-	-	2	2	-	2	40	60	-	-	-	100
26RAES101P	ESC	Technical Drawings with Engineering Graphics Lab	-	2	-	2	-	1	1	-	-	-	-	50	50
26RAES102	ESC	Fundamentals of Electronics Engineering	3	-	-	3	3	-	3	40	60	-	-	-	100
26RAES102P	ESC	Fundamentals of Electronics Engineering Lab	-	2	-	2	-	1	1	-	-	-	-	50	50
26RAVS101	VSEC	IT Proficiency	1	2	-	3	1	1	2	-	-	50		-	50
26RACC101	CC	Professional Development - I	1	2	-	3	1	1	2	-	-	50	-	-	50
26RACC102	CC	Liberal Learning – I*	-	2	-	2	-	1	1	-	-	25	-	-	25
26RAIK101	HSSM - IKS	Indian Knowledge System & Financial Literacy	2	-	-	2	2	-	2	-	-	50	-	-	50
Total			**14**	**12**	**-**	**26**	**14**	**06**	**20**	**160**	**240**	**175**	**-**	**125**	**700**

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

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	26RACC102A	Guitar	6.	26RACC102F	Basketball
2.	26RACC102B	Singing	7.	26RACC102G	Cricket
3.	26RACC102C	Cinematography	8.	26RACC102H	Rifle and Pistol Shooting
4.	26RACC102D	Dance	9.	26RACC102I	Volleyball
5.	26RACC102E	Synthesizer	10.	26RACC102J	Football

BoS Chairman

ZES's Zeal College of Engineering & Research, Dept of Robotics & Automation Engineering, Pune-41

Director

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

DEPARTMENT OF ROBOTICS AND AUTOMATION

First Year B. Tech. – Robotics and Automation: 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						
26RABS203	BSC	Engineering Mathematics II	3	-	-	3	3	-	3	40	60	-	-	-	100
26RABS204	BSC	Engineering Chemistry	2	-	-	2	2	-	2	40	60	-	-	-	100
26RABS204P	BSC	Engineering Chemistry Lab	-	2	-	2	-	1	1	-	-	-	-	25	25
26RAES203	ESC	Fundamentals of Electrical Engineering	3	-	-	3	3	-	3	40	60	-	-	-	100
26RAES203P	ESC	Fundamentals of Electrical Engineering Lab	-	2	-	2	-	1	1	-	-	-	-	25	25
26RAES204	ESC	Engineering Mechanics	3	-	-	3	3	-	3	40	60	-	-	-	100
26RAPC201	PCC	Introduction to Robotics & Automation	3	-	-	3	3	-	3	40	60	-	-	-	100
26RAVS202	VSEC	Computer Aided Engineering Drawing	-	2	-	2	-	1	1	-	-	-	50	-	50
26RAVS203	VSEC	Skill-Building with Arduino	-	2	-	2	-	1	1	-	-	25	-	-	25
26RACC203	CC	Professional Development – II	1	2	-	3	1	1	2	-	-	25	-	-	25
26RACC204	CC	Liberal Learning – II*	-	2	-	2	-	1	1	-	-	25	-	-	25
26RAVS204	VSEC	Programming in C for Robotics	-	2	-	2	-	1	1	-	-	-	25	-	25
Total			**15**	**14**	**-**	**29**	**15**	**07**	**22**	**200**	**300**	**75**	**75**	**50**	**700**

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

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	26RACC204A	Guitar	6.	26RACC204F	Basketball
2.	26RACC204B	Singing	7.	26RACC204G	Cricket
3.	26RACC204C	Cinematography	8.	26RACC204H	Rifle and Pistol Shooting
4.	26RACC204D	Dance	9.	26RACC204I	Volleyball
5.	26RACC204E	Synthesizer	10.	26RACC204J	Football

BoS Chairman

ZES's Zeal College of Engineering & Research, Dept of Robotics & Automation Engineering, Pune-41

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

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5	26RAES101P	Technical Drawings with Engineering Graphics Lab	18
6	26RAES102	Fundamentals of Electronics Engineering	20
7	26RAES102P	Fundamentals of Electronics Engineering Lab	23
8	26RAVS101	IT Proficiency	25
9	26RACC101	Professional Development - I	28
10	26RACC102	Liberal Learning – I	30
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First Year B. Tech. Robotics and Automation: Semester – II			
12	26RABS203	Engineering Mathematics II	44
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15	26RAES203	Fundamentals of Electrical Engineering	51
16	26RAES203P	Fundamentals of Electrical Engineering Lab	54
17	26RAES204	Engineering Mechanics	56
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SYLLABUS

SEMESTER - I

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Engineering Mathematics I							**Code:**26RABS101		
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, 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 be 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.	7
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.	7
3.	**Differential Calculus:** Rolle's theorem, Mean value theorems, Taylor's series and Maclaurin's series, Expansion of functions using standard expansions, Indeterminate forms.	7
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	7
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.	7
6.	**Fourier Series:** Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis.	7
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. A NPTEL Course on "Engineering Mathematics-I" IIT Khargpur - https://www.youtube.com/watch?v=4QFsiXfgbzM&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5
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 - https://www.youtube.com/watch?v=0bHky1ocA1Y
5. Partial Differentiation Example And Solution | Multivariable Calculus - https://www.youtube.com/watch?v=eTp5wq-cSXY&list=PLU6SqdYcYsfLuIJdHwY92aGBg5-uRHBOb&index=1

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Engineering Physics								**Code:** 26RABS102	
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
02	-	-	02	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: After completion of this course, students 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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Engineering Physics Lab								**Code:** 26RABS102P	
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 understand the fundamental principles of optics, lasers, semiconductors, and modern physics.
2. To develop experimental skills for measuring physical constants and material properties.
3. To analyze experimental observations and interpret results using appropriate theoretical concepts.

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

CO1	Apply principles of interference, diffraction, polarization, and laser optics.
CO2	Determine physical constants and material properties experimentally.
CO3	Analyze characteristics of semiconductor, solar cell, and optical fiber systems.
CO4	Interpret experimental results using calculations, graphs, and theoretical concepts.

List of Experiments:

Perform any 08 experiment from the following:

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.

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.
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   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 -

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Technical Drawings with Engineering Graphics							**Code:** 26RAES101		
Teaching Scheme (Hrs./Week)				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
02	-	-	02	40	60	-	-	-	100

Prerequisites:

1. Strong understanding of geometry, trigonometry, and basic algebra for precise measurements
2. Basic knowledge of electrical and electronics.
3. Spatial visualization in technical drawings.

Course Objectives:

1. Define and explain the fundamental principles of engineering drawing and design.
2. Apply appropriate techniques to create and interpret engineering drawings, including sheet layout, line types, and dimensioning.
3. Analyze and construct various geometric constructions and engineering curves such as conic sections, helixes, and rolling curves.
4. Master orthographic and isometric projection methods for representing complex objects and assemblies.
5. Demonstrate the ability to develop lateral surfaces for objects like cones, pyramids, and prisms, and understand their industrial applications.
6. Interpret and create electrical and electronic diagrams and symbols used in circuit representation and wiring diagrams.

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

CO1	Apply fundamental principles of engineering drawing and design to create accurate and standardized technical drawings.
CO2	Create detailed orthographic projections of complex objects and assemblies using both First and Third angle projection methods, ensuring clarity and accuracy.
CO3	Create precise isometric projections from given orthographic views, highlighting spatial relationships and proportions effectively.
CO4	Develop accurate lateral surface developments for cut sections of cones, pyramids, and prisms, illustrating practical industrial applications with attention to detail.
CO5	Interpret electrical symbols and standards to accurately represent basic electrical circuits and systems in schematic diagrams.
CO6	Interpret graphical representations of electronic components (resistors, capacitors, diodes, transistors, etc.) and create schematic diagrams of basic electronic circuits.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Fundamentals of Engineering Drawing:** Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions. Principle of projections, Introduction to First and Third angle Projection methods, Projection of point, line and plane.	5

2.	**Orthographic Projection and Sectional Views:** Orthographic projection of plane and solids, Full Section and Half Section view of a cutting plane.	5
3.	**Isometric Projection:** Introduction to isometric projection, oblique projection and perspective projection. Draw the isometric projection from the given orthographic views	5
4.	**Development of Lateral Surfaces and Missing Views:** Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc. Interpretation of given views.	5
5.	**Electrical Symbols and Circuit Diagrams:** Introduction to electrical symbols and standards, basic electrical circuits and their graphical representation and schematics of simple electrical systems. Introduction to wiring diagrams.	4
6.	**Electronic Components and Circuit Diagrams:** Introduction to symbols and graphical representation of electronic components (resistors, capacitors, diodes, transistors, etc.) and schematic diagram of basic electronic circuits.	4
TOTAL		**28**

Text Books:

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House.
2. Frederick E. Giesecke, Alva Mitchell, et al., "Technical Drawing with Engineering Graphics", Pearson Education.
3. Allan R. Hambley, "Electrical Engineering: Principles and Applications", Pearson.
4. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education.
5. SP 46:2003, Engineering Drawing Practice for Schools and Colleges.

Reference Books:

1. Bhattacharya S. K., "Electrical Engineering Drawing," New Age International Publishers, 2nd ed, 1998, reprint 2005.
2. Chris Schroder, "Printed Circuit Board Design using AutoCAD," Newnes, 1997.
3. Donald G. Fink and H. Wayne Beaty, "Standard Handbook for Electrical Engineers," McGraw Hill Education

E-Resources:

1. **Coursera**: Courses on technical drawing, engineering graphics, and CAD software (AutoCAD, SolidWorks). https://www.coursera.org/collections/learn-cad-drawings-prototypes
2. **MIT Open CourseWare**: Access to lecture notes, assignments, and resources from MIT's engineering courses, which cover topics related to technical drawing and engineering design. https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Technical Drawings with Engineering Graphics Lab								**Code:** 26RAES101P	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	-	50	50

Prerequisites:

1. Strong understanding of geometry, trigonometry, and basic algebra for precise measurements
2. Basic knowledge of electrical and electronics.
3. Spatial visualization in technical drawings.

Course Objectives:

1. To understand engineering drawing standards, projections, dimensioning, and graphical representation techniques.
2. To develop skills in preparing orthographic, sectional, isometric, and development drawings of engineering components.
3. To familiarize students with standard electrical and electronic symbols and basic circuit diagrams.
4. To develop basic skills in designing and interpreting simple electrical and motor-control circuits.

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

CO1	Apply standard engineering drawing conventions for lines, lettering, dimensioning, and projections.
CO2	Construct orthographic, sectional, isometric, and solid-development drawings.
CO3	Identify and represent standard electrical and electronic component symbols.
CO4	Interpret and design basic LED, relay, and motor-control circuits.
CO5	Apply standard engineering drawing conventions for lines, lettering, dimensioning, and projections.

Course Contents:

List of Experiments:

AnyEight form the following

1. Engineering drawing standards like types of lines, lettering and dimensioning.
2. Projection of lines. (Two Problems)
3. Projection of Planes. (Two Problems)
4. Orthographic Projection of given objects including sectional view. (Two Problems)
5. Isometric projection for the given set of two-dimensional views. (Two Problems)
6. Projection of Solids and Development of Lateral Surfaces of solids. (One problem each)
7. Draw and label the symbols for a resistor, capacitor, diode, transistor, and motor
8. Interpret a simple battery-powered LED circuit diagram and explain the connections
9. Design a basic circuit for motor control using switches and relays.
10. Identify and draw standard symbols for common electronic components (resistors, capacitors, diodes, transistors).

Text Books:

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House.
2. Frederick E. Giesecke, Alva Mitchell, et al., "Technical Drawing with Engineering Graphics", Pearson Education.
3. Allan R. Hambley, "Electrical Engineering: Principles and Applications", Pearson.
4. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education.
5. SP 46:2003, Engineering Drawing Practice for Schools and Colleges.

Reference Books:

1. Bhattacharya S. K., "Electrical Engineering Drawing," New Age International Publishers, 2nd ed, 1998, reprint 2005.
2. Chris Schroder, "Printed Circuit Board Design using AutoCAD," Newnes, 1997.
3. Donald G. Fink and H. Wayne Beaty, "Standard Handbook for Electrical Engineers," McGraw Hill Education.

E-Resources:

1. **Coursera**: Courses on technical drawing, engineering graphics, and CAD software (AutoCAD, SolidWorks). https://www.coursera.org/collections/learn-cad-drawings-prototypes
2. **MIT Open CourseWare**: Access to lecture notes, assignments, and resources from MIT's engineering courses, which cover topics related to technical drawing and engineering design. https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Fundamentals of Electronics Engineering								**Code:** 26RAES102	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

1. Basic understanding of electric circuits and components.
2. Knowledge of basic physics concepts such as electricity, magnetism, and semiconductor behavior.
3. Understanding of basic digital electronics principles like logic gates and number systems.

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

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.	6
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 Characteristics, Specification and Zener as voltage regulator, Light Emitting Diode (LED) and photo diode.	7

3.	**Transistor Circuits:** Transistors: Construction, types, operation, Characteristics and region of operation, CB, CE, CC configurations, BJT as a switch and CE amplifier. FET: Introduction, Construction, Operation, V-I characteristics. 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- Inverting and Non inverting amplifier. IC 555 timer as an oscillator, voltage regulation, IC voltage regulator (Three Pin)	7
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.	8
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, De-Morgan'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.

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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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Fundamentals of Electronics Engineering Lab								**Code:** 26RAES102P	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	-	50	50

Prerequisites:

1. Basic understanding of electric circuits and components.
2. Knowledge of basic physics concepts such as electricity, magnetism, and semiconductor behavior.
3. Understanding of basic digital electronics principles like logic gates and number systems.

Course Objectives:

1. To understand the characteristics and applications of active and passive electronic components.
2. To develop practical skills in using electronic measuring instruments such as CRO, function generator, and digital multimeter.
3. To develop skills in building, testing, and analyzing basic semiconductor and rectifier circuits.
4. To understand the operation and characteristics of single-stage BJT amplifier circuits.

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

CO1	Identify and analyze active and passive electronic components using standard specifications and datasheets.
CO2	Measure voltage, resistance, frequency, and phase shift using electronic test instruments.
CO3	Construct and analyze diode, Zener diode, and rectifier circuits and their V-I characteristics.
CO4	Analyze the operation and characteristics of a single-stage BJT common-emitter amplifier.
CO5	Identify and analyze active and passive electronic components using standard specifications and datasheets.

List of Experiments:

Perform any 8 Experiments:

Perform any Seven (07) experiments from Exp. No 1 to 9 and 10th is compulsory:

1. Study of Active and Passive components: Resistors (Fixed & Variable), Calculation of resistor value using color code, Capacitors (Fixed & Variable), Inductors, Devices such Diode, BJT, MOSFETs, various IC packages, Switches & Relays.
2. Measurements using various measuring equipment:
   i) Set up CRO and function generator for measurement of voltage, frequency.
   ii) Obtain the phase shift between to signals using CRO with the help of Lissagous pattern.
   iii) Measure voltage, resistance using digital multimeter. Also use multimeter to check diode, BJT.
3. Build and test circuits using Semiconductor devices and Plot V-I characteristics:
   i) P-N Junction Diode (Study the datasheet of typical PN junction diode 1N 400X).
   ii) Zener Diode (Study the datasheet of typical Zener diode 1N 4148).
4. Build and test Rectifier circuits:
   i) Implement half wave, full wave and bridge rectifier using diodes.
   ii) Observe the effect of capacitor filter on rectifier output.
5. Study of Single stage BJT Common Emitter amplifier circuits.

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List of Experiments:

i. Identify pins of a BJT (Such as BC547) and Study its datasheet specifications.
ii. To measure voltage and observe waveforms at input and output terminals of single stage BJT Common Emitter amplifier circuits.
iii. Calculate Voltage Gain of the amplifier.

6. Study of Op-amp based amplifier circuits: Build inverting and non-inverting amplifier using op-amp (Study the datasheet of typical Op-Amp 741)
7. Study of IC 555 Timer Circuits.
   i. Identify pins of IC 555 Timer Circuits.
   ii. Observe output waveforms and measure frequency of output of IC 555 Timer used in Astable Mode.
8. Study of convergence of number system:
   i. Covert the any number system into its Binary equivalent.
   ii. Covert the any number system into its Octal equivalent.
   iii. Covert the any number system into its decimal equivalent.
   iv. Covert the any number system into its Hexa decimal equivalent.
9. Verify truth table of Basic Gates.
10. Case Study of any one electronics appliances with block diagram, specification etc. (Compulsory).

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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)						**Semester:** I			
Course: IT Proficiency						**Code:** 26RAVS101			
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
01	02	-	02	-	-	50	-	-	50

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.	7
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.	8
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.	7
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.	7

5.	**Introduction to Latex:** Installation of the software LaTeX , Understanding Latex compilation, Basic 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.	7
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.	6
	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.

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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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)						**Semester:** I			
Course: Professional Development – I						**Code:** 26RACC101			
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 and conversation of resources	14
	TOTAL	**42**

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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

Liberal Learning - I

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Liberal Learning – I (Guitar)								**Code:** 26RACC102A	
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Liberal Learning – I (Singing)							**Code:** 26RACC102B		
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Liberal Learning – I (Cinematography)							**Code:** 26RACC102C		
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Liberal Learning – I (Dance)							**Code:** 26RACC102D		
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Synthesizer (Keyboard)								**Code:** 26RACC102E	
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Liberal Learning – I (Basketball)								**Code:** 26RACC102F	
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.	Introduction to Basketball	2
2.	Basic Skills – Dribbling	2
3.	Basic Skills- Passing	2
4.	Basic Skills- Shooting	2
5.	Defensive Fundamentals	2
6.	Rebounding Basics	2
7.	Ball Handling & Control	2
8.	Shooting Mechanics	2
9.	Offensive Strategies	2
10.	Defensive Strategies	2
11.	Transition Play	2
12.	Gameplay & Scrimmage	2
13.	Game Rules, Referee Gestures	2
14.	Practical	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Liberal Learning – I (Cricket)							**Code:** 26RACC102G		
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 and Fundamentals.	2
2.	Basic Techniques.	2
3.	Introduction to Game Scenarios.	2
4.	Physical Fitness and Match Simulations.	2
5.	Advanced Batting Techniques	2
6.	Advanced Bowling Techniques	2
7.	Specialized Fielding and Wicket keeping	2
8.	Tactical Understanding	2
9.	Refining Batting Techniques	2
10.	Refining Bowling Techniques	2
11.	Fielding Under Pressure	2
12.	Strength and Conditioning	2
13.	Targeted Skill Improvement	2
14.	Mid-Season Assessment	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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Liberal Learning – I (Rifle and Pistol Shooting)								**Code:** 26RACC102H	
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 about shooting game	2
2.	Basic technical knowledge	2
3.	Technique Refinement (Aiming, breathing and triggering)	2
4.	Learning about live shooting and technics	2
5.	Practicing standard Positional rifle Shooting	2
6.	Mental Preparation and Focus	2
7.	Practice and learning session of live shooting (Rifle)	2
8.	Learning about pistol shooting (Pistol)	2
9.	Introduction of pistol positions and dry practice	2
10.	Practical Shooting Drills (basic)	2
11.	Learning about live shooting and technics (Standing position)	2
12.	Learning of Concentration, breathing and relaxing exercise for shooting	2
13.	Introduction of competition level and practice	2
14.	Final test and oral (Rifle and Pistol Match)	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** I	
Course: Liberal Learning – I (Volleyball)								**Code:** 26RACC102I	
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	2
2.	Basic Skills - Serving	2
3.	Basic Skills- Passing	2
4.	Basic Skills- Setting	2
5.	Spiking Basics	2
6.	Blocking Basics	2
7.	Digging Basics	2
8.	Serve Receive	2
9.	Offensive Strategies	2
10.	Defensive Strategies	2
11.	Transition Play	2
12.	Gameplay & Scrimmage	2
13.	Game Rules , Refree Gestures	2
14.	Practical	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** I		
Course: Liberal Learning – I (Football)							**Code:** 26RACC102J		
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 and Basic Skills.	2
2.	Ball Control and Movement.	2
3.	Advanced Dribbling and Passing.	2
4.	Shooting and Finishing.	2
5.	Offensive Tactics.	2
6.	Defensive Tactics.	2
7.	Set Pieces (Offensive and Defensive).	2
8.	Team Chemistry and Communication.	2
9.	Midfield Dominance.	2
10.	Forward Play and Creativity.	2
11.	Defense Organization.	2
12.	Goalkeeper Training.	2
13.	Speed and Agility.	2
14.	Simulation Matches.	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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)						**Semester:** I			
Course: Indian Knowledge System and Financial Literacy						**Code:** 26RAIK101			
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, Investment, Taxes	4
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. A. 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.

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/financial-literacy/xa6995ea67a8e9fdd:welcome-to-financial-literacy

SYLLABUS

SEMESTER - II

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Engineering Mathematics II							**Code:** 26RABS203		
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Basic concept of Differentiation, Integration and Vector.

Course Objectives:

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 be able to -

CO1	Solve first order ordinary differential equation.
CO2	Apply differential equation in engineering applications.
CO3	Determine the velocity vector, gradient, divergence, curl.
CO4	Evaluate improper integrals.
CO5	Demonstrate 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.	7
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.	7
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.	7
4.	**Integral Calculus:** Reduction formulae, Beta and Gamma functions, Differentiation under integral sign and Error functions.	7
5.	**Multiple Integrals:** Double integration in cartesian & polar coordinates, Change of order of integration, Triple integral in cartesian & polar coordinates.	7

6.	**Applications of Multiple Integral:** Applications to find Area, Volume, Mass, Centre of gravity and Moment of inertia.	7
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 - https://youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&si=3xAONJdT2ph_jcvG
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Engineering Chemistry								**Code:** 26RABS204	
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, students 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: Engineering Thermoplastic: Polycarbonate 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 & Com 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, Jayadev Sreedhar, "Polymer Science", Wiley Eastern Limited.
4. Billmeyer F. W., "Textbook of polymer science", John Wiley and Sons.
5. B. Sivasankar, "Engineering Chemistry", Tata Mcgraw-Hill Education Publishing company Limited.
6. G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta "Fundamentals of Nanotechnology", CRC press.

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/

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-itk.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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Engineering Chemistry Lab								**Code:** 26RABS204P	
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 volumetric analysis, structure property relationship, classification and properties of polymers, electromagnetic radiation, electrochemical series.

Course Objectives:

1. To understand the principles and applications of analytical chemistry, water chemistry, polymers, fuels, and electrochemistry.
2. To develop practical skills in chemical analysis using titration, pH meter, conductometer, spectrophotometer, and viscometer.
3. To develop skills in preparing and analyzing materials such as polymers, coatings, and nanoparticles.
4. To understand environmental and industrial applications of chemical processes and material analysis.

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

CO1	Determine water quality parameters such as hardness, alkalinity, and acidity using standard methods.
CO2	Analyze chemical samples using pH, conductometric, spectrophotometric, and titration techniques.
CO3	Prepare and characterize polymers, electroplated coatings, and other engineering materials.
CO4	Analyze fuels, corrosion behavior, and nanomaterials using appropriate experimental techniques.
CO5	Determine water quality parameters such as hardness, alkalinity, and acidity using standard methods.

List of Experiments:

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)

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

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 & Com 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, Jayadev Sreedhar, "Polymer Science", Wiley Eastern Limited.
4. Billmeyer F. W., "Textbook of polymer science", John Wiley and Sons.
5. B. Sivasankar, "Engineering Chemistry", Tata Mcgraw-Hill Education Publishing company Limited.
6. 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
   a. /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_ViscosityAverageMolecularWeightofPoly mer/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)						**Semester:** II			
Course: Fundamentals of Electrical Engineering						**Code:** 26RAES203			
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Basic knowledge of Physics, fundamental electrical principles, and Basics of linear algebra.

Course Objectives:

1. To familiarize students with the fundamentals of Electrical Engineering.
2. To make students aware about the functioning of electrical machines, batteries, and their applications.
3. To introduce students to the components of low-voltage electrical installations and the methodology for estimating energy bills.

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

CO1	Understand work, power, and energy relationships, unit conversions, and Lead Acid and Lithium-Ion battery charging/discharging processes.
CO2	Explain simple resistive circuits powered by DC supply using circuit theorems.
CO3	Interpret voltage, current, and phase relationship for RLC loads.
CO4	Evaluate voltage, current, and power relationships in star and delta AC circuits, including protection systems.
CO5	Analyze the operational principle of transformers and energy bill calculation for domestic consumers.
CO6	Analyze DC machines and three-phase induction motors using operating principles, characteristics, and basic equations.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Work, Power and Energy and Batteries:** **Basic Definition and Units:** Length, Mass, Time, Temperature, Area, Volume, Acceleration, Density, Velocity, Pressure, Work, Energy, Torque, Power, Voltage, Current, Resistance, Capacitance, Conductance, Charge, Inductance, Frequency, Impendence etc., Multiples and Submultiples, Types of units (MKS, CGS and SI), Unit conversions. **Work, Power and Energy:** Effect of temperature on resistance, resistance temperature coefficient (derivation and numerical), insulation resistance of single core cable (derivation and numerical), conversion of energy from one form to another in electrical, mechanical, and thermal systems. **Batteries:** Lead acid and Lithium Ion battery – (Construction, working, charging and discharging and its applications), concept of depth of charging, state of charge of battery, battery capacity, battery efficiency, ampere-hour and watt-hour of battery, maintenance of batteries, and series-parallel connection of batteries.	07
2.	**DC Circuits:** Analysis of series and parallel circuits, KVL and KCL (statement, sign convention), ideal and practical voltage and current sources, simple mesh and node analysis, source transformation (simple numerical), star-delta transformation (simple numerical), Superposition and Thevenin's theorem (Statement and numerical - only for independent sources, and resistive circuit).	07

3.	**AC Circuits (Single phase circuits):** Generation of sinusoidal voltage, representation of sinusoidal waveforms, concept of cycle, period, frequency, instantaneous, peak, average, and RMS values, Lagging, leading and in phase quantities and their phasor representation, Rectangular and polar representation of phasors, Concept of real, reactive, apparent, complex power and power factor, Analysis of single-phase AC series circuit (pure R, L, C and series R-L, R-C, and R-L-C combinations), Concept of impedance, admittance, voltage-current, power waveforms and relevant phasor diagrams for different combinations.	07
4.	**AC Circuits (Three-phase circuit) and Electrical Installations:** **AC Circuits (Three-phase circuit):** Concept of three-phase supply and phase sequence, Three-phase balanced circuits, voltage and current relations in star and delta connections, and power calculations. **Electrical Installations:** Components of LT Switchgear: Fuse, MCB, MCCB (working, advantages, disadvantages and applications), Earthing - (Definition, importance of earthing, types, advantages of earthing, difference between earthing and neutral).	07
5.	**Single Phase Transformer:** Construction, working principle and EMF equation of transformer, Ideal and practical transformer, Losses, Types of transformers (Step up and step-down transformer), Concept of voltage regulation and efficiency (simple numerical), Introduction to auto-transformer (Construction, working, advantages and applications). **Electricity Bill:** Power rating of household appliances, Definition of "unit" used for consumption of electrical energy, Two-part electricity tariff, Calculation of electricity bill for domestic consumers.	07
6.	**DC Machines**: DC generator and motor (Construction, working principle, types, and applications), emf equation of DC generator, (Simple numerical). Voltage expression of generator and motor (Simple numerical), Concept of back-emf (simple numerical), Armature and shaft torque equation (only descriptive treatment). **AC Machines**: Constructional features, working principle of three-phase induction motor, types (squirrel cage and slip ring), concept of synchronous speed, rotor speed, slip, power stages in three phase induction motor, concept of torque equation of three phase induction motor, torque-slip characteristics, industrial applications of induction motor.	07
TOTAL		**42**

Text Books:

1. B.L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology" - Volume I: Basic Electrical Engineering," S. Chand Publication.
2. V. K. Mehta, Rohit Mehta, "Basic Electrical Engineering," S. Chand and Company Private Ltd.
3. D. P. Kothari, I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering," PHI Publication.
4. Bharti Dwivedi, Anurag Tripathi, "Fundamental of Electrical Engineering," Wiley Publication.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology," Pearson Publication.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering," Oxford University Press.
3. H Cotton, "Electrical technology," CBS Publications.
4. D. C. Kulshreshtha, "Basic Electrical Engineering," McGraw Hill.

E-Resources:

1. A NPTEL Course on "Fundamentals of Electrical Engineering", IIT Kharagpur:
   Link: https://archive.nptel.ac.in/courses/108/105/108105112/
2. A NPTEL Course on "Basic Electrical Technology,"IISc Bangalore:
   Link:https://archive.nptel.ac.in/courses/108/108/108108076/
3. Virtual lab – Amrita Vishwa Vidyapeetham:
   Link:https://vlab.amrita.edu/?sub=1&brch=75
4. Electrical Engineering Basics:
   Link:https://www.classcentral.com/classroom/youtube-electrical-engineering-basics-54532

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)				**Semester:** II					
Course: Fundamentals of Electrical Engineering Lab				**Code:** 26RAES203P					
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 Physics, fundamental electrical principles, and Basics of linear algebra.

Course Objectives:

1. To understand the fundamental principles and laws of electrical engineering through practical experiments.
2. To develop skills in measuring and analyzing electrical circuits, machines, and power systems.
3. To understand electrical protection, energy conservation, transformers, and electrical machines.
4. To develop practical knowledge through DIY models and industrial visits.

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

CO1	Apply fundamental electrical laws and theorems to analyze DC and AC circuits.
CO2	Measure and analyze electrical quantities, circuit responses, and three-phase systems.
CO3	Evaluate the performance of transformers, electrical machines, and protection equipment.
CO4	Demonstrate electrical engineering concepts through DIY models and industrial visits.

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.
3. Verification of Superposition theorem with DC supply using hardware.
4. Verification of Thevenin's theorem with DC supply using hardware.
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. Calculation of efficiency and voltage regulation of single-phase transformer by direct loading test.
9. Demonstration of cut-out sections of machines: DC machine (commutator-brush arrangement), Induction machine (squirrel cage rotor).
10. Analysis of LT electricity bills and energy conservation (Case study).

Group B: DIY Models – Any TWO, from the following list

11. 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).
12. Generation of power with magnets and copper wire.
13. Conversion of mechanical energy to electrical energy and vice versa.
14. Model of mutual induction in the transformer.
15. **Group C: A mandatory visit to any transformer/electrical machines manufacturing industry.**

DEPARTMENT OF ROBOTICS AND AUTOMATION

Text Books:

1. B.L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology" - Volume I: BasicElectrical Engineering," S. Chand Publication.
2. V. K. Mehta, Rohit Mehta, "Basic Electrical Engineering," S. Chand and Company Private Ltd.
3. D. P. Kothari, I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering," PHI Publication.
4. Bharti Dwivedi, Anurag Tripathi, "Fundamental of Electrical Engineering," Wiley Publication.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology," Pearson Publication.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering," Oxford University Press.
3. H Cotton, "Electrical technology," CBS Publications.
4. D. C. Kulshreshtha, "Basic Electrical Engineering," McGraw Hill.

E-Resources:

1. A NPTEL Course on "Fundamentals of Electrical Engineering", IIT Kharagpur:
   Link: https://archive.nptel.ac.in/courses/108/105/108105112/
2. A NPTEL Course on "Basic Electrical Technology,"IISc Bangalore:
   Link:https://archive.nptel.ac.in/courses/108/108/108108076/
3. Virtual lab – Amrita Vishwa Vidyapeetham:
   Link:https://vlab.amrita.edu/?sub=1&brch=75
4. Electrical Engineering Basics:
   Link:https://www.classcentral.com/classroom/youtube-electrical-engineering-basics-54532

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Engineering Mechanics								**Code:** 26RAES204	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

1. Fundamental grasp of physics, particularly mechanics, including concepts such as force, motion, and equilibrium.
2. Proficiency in mathematics, especially algebra, trigonometry, and calculus.
3. Understanding concepts related to forces, Stress strain etc.
4. Familiarity with engineering principles and terminology, as well as basic knowledge of materials and their properties.

Course Objectives:

1. Understand mechanics laws and apply force principles to analyze statics in two dimensions, including force systems and force couple systems.
2. Define and apply equilibrium principles, including Lami's theorem and free body diagrams, to analyze equilibrium in two dimensions.
3. Determine reactions and analyze beams and trusses using methods of joints and sections.
4. Calculate centroids, centers of mass, and moments of inertia for laminas, applying area moment of inertia concepts.
5. Describe friction characteristics, apply friction laws, and analyze frictional forces on various surfaces and objects.
6. Analyze rectilinear and curvilinear motion kinetics, apply work-energy principles, and analyze collisions using impulse-momentum principles.

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

CO1	Apply principles of mechanics to analyze forces and moments on particles and rigid bodies.
CO2	Analyze reactions and forces in statically determinate beams and trusses using engineering principles.
CO3	Calculate centroid, center of mass, and moment of inertia for various shapes.
CO4	Analyze frictional forces and solve problems related to static and dynamic friction on different surfaces and objects.
CO5	Calculate position, velocity and acceleration of particle using principles of kinematics.
CO6	Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Analysis of Force Systems:** Introduction, Units and dimensions, Laws of mechanics, Force, Characteristics, force system ,Varignon's theorem, Force couple system, Equilibrium and equilibrant, Conditions of equilibrium, Principles of equilibrium, Lami's theorem, Free body diagram, Action and reaction.	7

2.	**Analysis of Statically Determinate Beams and Truss:** Beams: Types of beams and types of supports, Reactions of simple beams and reactions of Cantilever beams, Statically determinate beams. Truss: Two force members, analysis of plane truss using method of joints and sections.	7
3.	**Centroid and Moment of Inertia:** Centroid and centre of gravity – Centroid of plane and composite figures – Centre of gravity of solid figures - Area moment of inertia of plane and composite figures – Parallel axis theorem and perpendicular axis theorem - Mass moment of inertia – Comparison of mass moment of inertia and area moment of inertia.	7
4.	**Friction:** Nature and characteristic of friction, static and dynamic friction, laws of friction, angle of friction, angle of repose, cone of friction. Introduction to Block friction on horizontal and inclined planes, wedge friction. Ladder friction and Belt friction.	7
5.	**Kinematics:** Introduction, basic concept, rectilinear motion: motion with uniform acceleration, gravitational acceleration and variable acceleration, curvilinear motion: rectangular components, motion of projectile, normal and tangential components	7
6.	**Kinetics:** Introduction, Newton's second law of motion, equation of motion, Newton's law of gravitation, application of Newton's second laws to rectilinear and curvilinear motion, , impulse momentum principle and impact.	7
TOTAL		**42**

Text Books:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers: Statics and Dynamics", 12th Edition, McGraw Hill Education, 2019.
2. Bhavikatti, S S, "Engineering Mechanics", 7th edition, New Age International (P) Limited Publishers, 2019.

Reference Books:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education, 2009.
2. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
3. Timoshenko S, Young D. H, Rao J. V, SukumarPati, "Engineering Mechanics", 5th Edition, Tata McGraw-Hill Education, 2017.
4. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010.

E-Resources:

1. NPTEL: Engineering Mechanics - Course (nptel.ac.in)
2. MIT OpenCourseWare: Engineering Dynamics | Mechanical Engineering | MIT OpenCourseWare
3. MIT OpenCourseWare: Engineering Mechanics I | Civil and Environmental Engineering | MIT OpenCourseWare

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Introduction to Robotics & Automation								**Code:** 26RAPC201	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

1. Comprehending the fundamental concepts, Basics of mechanics, Knowledge of electrical & electronics.
2. Knowledge of mathematics, particularly algebra, geometry, and trigonometry.
3. Knowledge of programming fundamentals & languages

Course Objectives:

1. To expose the students to fundamentals of Robotic systems and its application in Industrial Automation.
2. To explore the anatomy of robots, including their components such as sensors, actuators controllers.
3. To understand mechanisms and coordinate systems, and various manipulator configurations.
4. To gain knowledge on the industrial automation process and understand the application of PLCs.
5. To understand robot programming and languages for manufacturing automation and VAL language applications for motion control.
6. To explore recent advancements in robotics and automation, including emerging trends such as AI, machine learning.

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

CO1	Explain the fundamental concepts of robotics, industrial automation, components of process control, and the role of PLCs in industrial environments.
CO2	Analyze manipulator configurations, degrees of freedom (DOF), kinematic linkages, workspace, and coordinate systems for robotic manipulators.
CO3	Select and integrate appropriate sensors and drive actuators (electric, hydraulic, pneumatic) for specific robotic perception and motion applications.
CO4	Design and select suitable end-effectors and grippers, and calculate required gripper forces for automated handling and manipulation tasks.
CO5	Apply robot programming methods (teach pendant, lead-through, languages) and simulation tools to develop motion sequences for automated operations like pick-and-place.
CO6	Identify and assess emerging trends—including AI, soft robotics, IIoT, Internet of Robotic Things, and safety standards—in modern industrial automation systems.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Robotics and Automation:** Evolution from Industrial Revolution to Industrial 5.0, Introduction to Automation, basic elements of automated system, components of automation and process control.	8

	Evolution of robotics, Laws of Robotics, Robot Anatomy-Definition, Terminology of Robotics, Introduction to Fluid Mechanics and its relevance in robotics, Introduction to Industrial Process Automation, Types of Automation Systems, Introduction to PLC.	
2.	**Coordinate Systems & Kinematic Geometry:** Classification of Robots based on various technical parameters, Workspace, Work Envelope, and Operating Envelop and its importance. Kinematic Links, Pair, Chain, Degree of Freedom, Redundant DOF and Degree of Mobility. Introduction to Coordinate and Classification of Robot Coordinate System.	7
3.	**Robot Sensors & Actuators:** Sensors: Definition, Types of Sensors: Conventional & Modern Sensors, Role of sensors in robot perception, Selection criteria of Sensors for different application in Robotics. Actuators: Definition, Types (electric, hydraulic, and pneumatic), and their roles in robot movement, Applications. Integration of Sensors and Actuators in Robotics.	7
4.	**Grippers and Drive Systems:** End-Effectors: Grippers, Tools, Selection of grippers and tools , Simple numericals on Gripper Force	6
5.	**Robot Programming & Languages:** Robot controller- major components, operating mode of robot, Jogging-Types, Motion commands, end effectors and sensors commands, Robot Languages-Classifications - Teach Pendant Method, Lead-through Programming, Basic commands for Pick and Place operation. Introduction to Simulation Software's – like MATLAB / RoboAnalyzer / RoboDK / RoboStudio / Coppeliasim (VREP).	7
6.	**Recent Advancements in Robotics and Automation:** Emerging trends and technologies in robotics: Artificial Intelligence, Machine Learning, Adaptive Control, Soft Robotics, Bio-Inspired Robotics, Aerial Robotics, and their applications. Industrial Internet of Things (IIOT), Internet of Robotic Thing, Safety for Insustrial Robotics & Automation.	7
TOTAL		**42**

Text Books:

1. John J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson Edu.
2. K.S. Fu, R.C. Gonzalez, and C.S.G. Lee, "Robotics: Control, Sensing, Vision, and Intelligence", Tata Mcgraw Hill.
3. Mikell P. Groover,"Automation, Production Systems, and Computer-Integrated Manufacturing" Pearson Edu.

Reference Books:

1. Nikolaus Correll, Bradley Hayes, and Alcherio Martinoli,"Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms", MIT Press
2. Kevin M. Lynch and Frank C. Park, "Modern Robotics: Mechanics, Planning, and Control", Cambridge University Press.
3. Thomas R. Kurfess.,"Robotics and Automation Handbook", CRC Press.

DEPARTMENT OF ROBOTICS AND AUTOMATION

E-Resources:

1. NPTEL: "Introduction to Robotics" by IIT, Kanpur, https://onlinecourses.nptel.ac.in/noc24_me88/preview
2. Coursera: "Robotics Specialization" by University of Pennsylvania, https://platform.onlinelearning.upenn.edu/offering/robotics-specialization-a0Q2E00000JmMPhUAN
3. MIT Open Courseware: "Introduction to Robotics" https://ocw.mit.edu/courses/2-12- introduction-to-robotics-fall-2005/pages/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Computer Aided Engineering Drawing								**Code:** 26RAVS202	
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	02	-	01	-	-	-	50	-	50

Prerequisites:

Knowledge of geometry, solids, engineering drawing concepts, orthographic views, isometric views, knowledge of units and measurements, basic skills handling computer devices

Course Objectives:

1. To introduce students to the fundamentals of CAD software and its applications in engineering drawing.
2. To develop proficiency in using CAD software for creating, editing, and managing 2D and 3D drawings.
3. To enhance students' skills in precision drawing, dimension, and annotation using CAD tools.
4. To prepare students to undertake CAD projects and customize CAD software for specific engineering applications.

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

CO1	Understand basic CAD concepts, interface, and drawing commands.
CO2	Apply object selection methods and layer management techniques.
CO3	Apply advanced drawing commands and precision drawing techniques.
CO4	Analyze modifying tools, dimensions, and annotation requirements in CAD drawings.
CO5	Evaluate and refine 2D drawings and 3D models using advanced CAD tools.
CO6	Create a complete CAD project following drawing standards and output requirements.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to CAD and Basic Drawing Commands:** Introduction to CAD and CAD Software, Overview of CAD and its applications, Introduction to various CAD software tools. Understanding the CAD Interface, Workspace, ribbon, command line, and toolbars, Navigating the CAD interface. Units and Measurement, setting up units, Understanding measurement systems in CAD. Basic Drawing Commands, Line, Circle, Arc, Rectangle, Polygon. Editing Commands, Erase, Move, Copy, Mirror, Rotate.	4
2.	**Object Selection and Layer Management:** Object Selection Methods, Selecting objects: Select, Window, Crossing, Fence, Using selection filters and quick select. Using Layers and Properties, creating layers, assigning colors, line types, and line weights, Managing layer properties and visibility.	4
3.	**Advanced Drawing Commands and Precision Techniques:** Advanced Drawing Commands, Polyline, Spline, Ellipse, Hatch, Region. Working with Blocks and Attributes, Creating, inserting, and editing blocks, Understanding and using attributes. Precision Drawing Techniques, Polar tracking, Object snaps, Ortho mode.	4

4.	**Modifying Tools and Dimensioning:** Introduction to Modifying Tools, Stretch, Scale, Trim, Extend, Inquiry Commands, Distance, Area, ID, List. Dimensioning Basics, Linear dimensions, aligned dimensions, Radius and Diameter dimensions, Annotation Tools, Text, Multiline Text, Leaders, Adding and managing annotations.	4
5.	**Advanced Editing and 3D Modeling:** Advanced Editing Commands, Offset, Fillet, Chamfer, Array. Advanced Modification Tools, Advanced use of Stretch, Scale, Rotate, Mirror. Introduction to 3D Modeling, Basics of Wireframe, Surface, and Solid modeling, Creating and Editing 3D Objects, Extrude, Revolve, Sweep. Applying materials and textures, Rendering and Visualization, Introduction to rendering techniques, Visualization and presentation of 3D models.	6
6.	**Project Work, Customization, and Standards:** Project Work, designing a simple mechanical or architectural component, Adding dimensions, annotations, and detailing. Customization in CAD, Workspace customization, Creating and using shortcut keys and tool palettes. Plotting and Printing, Preparing drawings for output, Plotting and printing techniques. Review and Assessment, Review of the CAD project, Assessment and feedback.	6
TOTAL		**28**

List of Experiments:

Minimum 6 exercises should be completed

1. Drawing Simple Shapes: Create basic geometric shapes such as squares, circles, and triangles using line, circle, and polyline tools.
2. Generate given simple orthographic view in CAD software, using basic draw and modify command.
3. Technical Drawing Practice (at least 2 components): Present students with a technical drawing containing various mechanical parts. Instruct them to redraw the components using advanced drawing commands like arcs, splines, and ellipses.
4. Isometric Drawing (at least 2 components): Generate an isometric drawing of a simple object, using CAD's isometric snap grid and tools.
5. Editing Objects (at least two drawings): Provide students with a drawing containing various objects and ask them to practice editing commands such as move, copy, rotate, and scale to modify the objects according to given specifications.

OR

6. Parametric Drawing: Introduce students to parametric drawing by asking them to create a simple parametric object, such as a door or window, with adjustable dimensions using CAD parametric constraints.
7. CAD Project Development: Assign a project where students have to draw the drawing of component using CAD software.

OR

8. AutoCAD Customization: Encourage students to explore AutoCAD customization options by creating custom line types, hatch patterns, and dimension styles.

DEPARTMENT OF ROBOTICS AND AUTOMATION

Text Books:
1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication. 2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International.
Reference Books:
1. AUTOCAD® 2019, BEGINNING AND INTERMEDIATE, Munir M. Hamad, Autodesk Approved Instructor, Mercury Learning And Information LLC. ISBN: 978-1-683921-76-9
E-Resources:
1. AutoCAD Quick Start Guide – https://www.autodesk.com/learn/ondemand/curated/autocad-quick-start-guide

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)						**Semester:** II			
Course: Skill-Building with Arduino						**Code:** 26RAVS203			
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic Electronics Engineering, Electronics Circuit Design.

Course Objectives:

1. To introduce various signals, sensors, input/output devices, and communication methods used in embedded systems.
2. To develop basic Arduino programming skills using Embedded C and Arduino IDE.
3. To interface and program digital input/output devices using Arduino.
4. To measure analog sensor data and perform sensor calibration using Arduino.
5. To implement serial data transmission and reception using Arduino and Bluetooth.
6. To develop a basic Arduino-based home automation and IoT prototype.

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

CO1	Understand input/output devices, sensors, signals, and communication methods.
CO2	Apply Arduino programming concepts and control structures to develop basic programs.
CO3	Apply digital input/output programming for interfacing keypads, LEDs, and LCDs.
CO4	Analyze analog sensor data and calibrate sensors using Arduino.
CO5	Evaluate serial communication techniques for data transmission and reception.
CO6	Create an Arduino-based project and IoT prototype.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Input and Out Devices:** Digital Signal and its Example, Analog Signal and its Example, Types of communication Methods, Digital Sensors List, Analog Sensors List, Output Devices List, Serial Communication Devices List.	4
2.	**Arduino Programming Basics:** Introduction to C programing, What Is Embedded C, Why we Choose Embedded C, Arduino programming Structure, Control Structure in Arduino, Types Of Arduino and its Features, How to choose Arduino IC's, Software Required For Arduino, Arduino IDE Installation.	4
3.	**Arduino Digital Input/output Handling:** List of Digital Input/output devices, how to program for Digital Input devices, Example: Get input from Keypad, how to Program for Digital Output devices, Example: LED controlling, Arduino LCD Interfacing - LCD Display Pinout, Display the Static Data, Display the Dynamic Data.	4

4.	**Arduino Analog Input and Calibration:** List of Analog Sensors, How to Program for Analog Devices, Example: Measuring Room Temperature, What is Calibration?, Calibrate the Temperature sensor	4
5.	**Arduino Serial Communication:** List of Serial Communication Devices, How to program for Serial Transmission, Example: Send Data to Mobile via Bluetooth, How to program for Serial Receiving, Example: Receive Date from Mobile via Bluetooth.	6
6.	**Home Automation Using Arduino:** What is Home Automation?, Devices Used in home automation, Program Testing, Simple IOT structure Using Arduino What is IOT, Devices Used in IOT, Program Testing	6
TOTAL		**28**

List of Experiments

Any EIGHT from following and project is compulsory

1. Introduction about Arduino Uno kit.
2. Introduction about IDE Software.
3. Controlling the Light Emitting Diode (LED) with a push button.
4. Interfacing the RGB LED with the Arduino Uno.
5. Controlling the LED blink rate with the potentiometer interfacing with Arduino Uno.
6. Detection of the light using photo resistor.
7. Interfacing of temperature sensor LM35 with Arduino Uno.
8. Interfacing Servo Motor with the Arduino Uno.
9. Interfacing of the Active Buzzer with Arduino Uno.
10. Interfacing of the Relay with Arduino uno.
11. Building Intrusion Detection System with Arduino and Ultrasonic Sensor.
12. Directional Control of the DC motor using Arduino Uno.

Note: The term work marks will be based on experiments and project.

Project:

Here are some guidelines to consider when planning and executing IoT projects:

1) Define Clear Objectives
2) Select Appropriate Technology
3) Design for Scalability
4) Ensure Data Security
5) Consider Interoperability
6) Focus on User Experience
7) Optimize Power Efficiency
8) Comply with Regulations
9) Test and Validate
10) Plan for Maintenance and Updates
11) Document and Share Knowledge
12) Engage Stakeholders

DEPARTMENT OF ROBOTICS AND AUTOMATION

Text Books:
1. J. M. Hughes, "Arduino: A Technical Reference", Reilly Media. 2. Jack Purdue, "Beginning C for Arduino", Springer Nature.
Reference Books:
1. William P. Osborne, "Learn to Program in Arduino C", Arduino open Source Community. 2. Warwick-A-Smith , "Arduino Uno Hardware Manual: A Reference and User Guide for the Arduino Uno Hardware and Firmware" , wepublishing.net 3. Neerparaj Raj, "Arduino Project Engineers A Multi-Purpose Book for All Branches" , BPB 4. Norman Dunbar, "Arduino Software Internals: A Complete Guide to How Your Arduino Language and Hardware Work Together" , Apress Publication
E-Resources:
1. Essential Resources for Beginners Learning Electronics With Arduino: https://interestingengineering.com/innovation/13-essential-resources-for-beginners-learning-electronics-with-arduino 2. Arduino Tutorial: https://www.javatpoint.com/arduino 3. Arduino Project Hub: https://projecthub.arduino.cc/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Professional Development II								**Code:** 26RACC203	
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
01	02	-	02	-	-	25	-	-	25

Course Objectives:

1. To introduce students on employability skills and its importance in building career and professional life.
2. To inculcate prime and significant soft skills like presentation skills, communication skills etc required in today's professional environment.
   To make students aware of employability skills like 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	Aware of change management from academic environment to corporate and industrial environment for an effective start in career, personal life, at workplace, society and professional world.
CO2	Understand the importance of necessity of prime soft skills like employability skills, presentation skills and communication skills required in today's professional workplace environment.
CO3	To be aware of significance of Special skills to excel at workplace and tapping team leader opportunities at engineering and technological organizations with finest work etiquette demonstration as a ladder for better growth and leadership perspective.

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.	**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

Liberal Learning - II

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Liberal Learning – II (Guitar)								**Code:** 26RACC204A	
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 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:

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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Liberal Learning – II (Singing)								**Code:** 26RACC204B	
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 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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Cinematography)							**Code:** 26RACC204C		
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Dance)							**Code:** 26RACC204D		
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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Synthesizer (Keyboard)								**Code:** 26RACC204E	
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**		**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**

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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Basketball)							**Code:** 26RACC204F		
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.	Advanced Dribbling Techniques	2
2.	Advanced Passing Techniques	2
3.	Advanced Shooting Techniques	2
4.	Advanced Defense Techniques	2
5.	Position Specific Training	2
6.	Conditioning & Strength Training	2
7.	Mental Toughness & Focus	2
8.	Advance Team Play	2
9.	Complex Defensive System	2
10.	Mixed Scenarios & Situational Drills	2
11.	Tournament Preparation	2
12.	Advance Game Play & Strategy	2
13.	Mastery & Final Assessment	2
14.	Final Scrimmage	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)								**Semester:** II	
Course: Liberal Learning – II (Cricket)								**Code:** 26RACC204G	
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.	Batting Strategies.	2
2.	Bowling Strategies.	2
3.	Fielding Strategies.	2
4.	Match Simulations and Tactical Execution.	2
5.	Targeted Skill Improvement.	2
6.	Mental Conditioning.	2
7.	Intensive Match Simulations.	2
8.	Advanced Batting Drills.	2
9.	Advanced Bowling Drills.	2
10.	Fielding and Wicket keeping in Game Conditions.	2
11.	Game Analysis and Strategy Sessions.	2
12.	Final Skill Polishing.	2
13.	Teamwork and Communication.	2
14.	Competitive Matches and Final Assessments.	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Rifle and Pistol Shooting)							**Code:** 26RACC204H		
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.	Understand and learning about advance rifle position	2
2.	Advance technical knowledge	2
3.	Advance Technique Refinement	2
4.	Learning about advance shooting and technics for achieving score	2
5.	Specialized Training	2
6.	Mental Preparation and Focus	2
7.	Peak Performance and analyses	2
8.	Advanced Skills Development	2
9.	Tactical Applications and working about single shoot	2
10.	Advanced Challenges and Readiness	2
11.	Review and Consolidation	2
12.	Focus on technical and mental hurdles	2
13.	Person to person attention	2
14.	Match practice and preparation as per ISSF event	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Volleyball)							**Code:** 26RACC204I		
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.	Advanced Serving Techniques	2
2.	Advanced Spiking Techniques	2
3.	Advanced Setting Techniques	2
4.	Advanced Blocking Techniques	2
5.	Position – Specific Training	2
6.	Conditioning & Strength Training	2
7.	Mental Toughness & Focus	2
8.	Game Analysis & Feedback	2
9.	Complex Offensive System	2
10.	Complex Defensive System	2
11.	Mixed Scenarios & Situational Drills	2
12.	Advanced Gameplay & Strategies	2
13.	Review & Reinforcement	2
14.	Tournament Preparation	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

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Liberal Learning – II (Football)							**Code:** 26RACC204J		
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.	Transition Play.	2
2.	Positional Drills.	2
3.	Endurance and Stamina.	2
4.	Video Analysis and Feedback.	2
5.	Advanced Tactics and Strategy.	2
6.	High-Pressure Situations.	2
7.	Leadership and Team Roles.	2
8.	Refining Skills and Tactics.	2
9.	Match Preparation.	2
10.	Mental and Physical Preparation.	2
11.	Game Week Routine.	2
12.	Post Goalkeeper Training.	2
13.	Post-Match Analysis and Recovery.	2
14.	Simulation Matches.	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/

DEPARTMENT OF ROBOTICS AND AUTOMATION

Program: B. Tech. (Robotics and Automation)							**Semester:** II		
Course: Programming in C for Robotics							**Code:** 26RAVS204		
Teaching Scheme (Hrs./Week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	-	-	25	25

Prerequisites:

No prior programming experience required, basic electronics and logic gates

Course Objectives:

1. To introduce the fundamentals of C/C++ programming
2. To develop algorithmic and logical thinking
3. To apply C/C++ for solving robotics-related problems
4. To build a foundation for microcontroller programming and embedded systems

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

CO1	Understand the history, structure, and development environment setup for C/C++ programming with Logic Building
CO2	Declare variables and apply appropriate data types in C/C++; perform input/output operations using
CO3	Write structured programs using operators, conditional statements, and loops; define and invoke user-defined functions for modularity.
CO4	Organize data using arrays, manipulate strings, define structures, and use pointers for memory referencing in robotic applications.
CO5	Implement file operations to read, write, and store sensor-related data in external files for robotic data logging.
CO6	Simulate basic robotic behaviors such as line follows and obstacle detection using decision-making logic and sensor data processing.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to C/C++ with logic building in Robotics**: History, IDE setup (TurboC++, Code::Blocks), structure of C/C++ program	5
2.	**Variables, Data Types, and I/O in Sensor Control**: Integer, float, char, string, input/output using scanf & printf	5
3.	**Operators and Control Flow in Robotic Decisions:** Arithmetic, logical, relational operators; if, switch, nested conditions **Loops and Functions**: for, while, do-while, recursion, function declaration and call	5
4.	**Arrays, Strings, Structures & Pointers for Robotic Data Handling**: Single & multidimensional arrays, character arrays, string functions **Structures and Pointers**: User-defined types, pointer basics, pointer with arrays & functions	5

5.	**File Handling for Robotic Data Logging**: Opening, reading, writing, closing files – used in logging sensor data	4
6.	**Practical Applications in Robotics**: Simulate line following logic, basic obstacle detection, command processing	4
TOTAL		**28**

List of Experiments:

Any EIGHT from the following

1. Display "Hello, Robotics!" with Student Name Input
2. Arithmetic Operations on Sensor Data
3. Sensor Threshold Logic Using if-else
4. PWM Pulse Simulation using for Loop
5. Average Sensor Reading Using Function & Array
6. Switch-Case to Simulate Robot Modes (Idle, Active, Error)
7. Command Parsing: String Manipulation for "START", "STOP"
8. Structure to Hold Robot Sensor Data with Status
9. Pointer with Array: Sensor Data Access by Reference
10. File Handling: Log Sensor Readings into a Text File
11. Simulate LED Blinking using Loops and Delay Logic
12. Case Study: Simulate Line-Following Robot Logic

Text Books:

1. E. Balagurusamy, "Programming in ANSI C", McGraw-Hill.
2. Yashavant Kanetkar, "Let Us C", BPB Publications.
3. Bjarne Stroustrup, "Programming — Principles and Practice Using C++", Addison-Wesley.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall.
2. Robert Lafore, "Object-Oriented Programming in C++", SAMS.
3. S. R. Schach, "Introduction to Object-Oriented Programming with C++", McGraw-Hill.

E-Resources:

1. NPTEL – Programming in C
   https://nptel.ac.in/courses/106104128
2. NPTEL – Problem Solving Through Programming in C
   https://nptel.ac.in/courses/106105171
3. NPTEL – Problem Solving Through Programming in C
   https://nptel.ac.in/courses/106105171
4. OnlineGDB C Compiler
   https://www.onlinegdb.com
5. Programming for Robotics (ETH Zurich)
   https://rsl.ethz.ch/education-students/lectures.html

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THE END

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