Scheme and Syllabus

of

B. TECH.

ELECTRICAL ENGINEERING

Minor/Hons. in Electric Vehicles/Cyber Security/Robotics

(Academic Session: 2024-2025 onwards)

By

Skill Department of Green Technology

Skill Faculty of Engineering & Technology

SVSU

Shri Vishwakarma Skill University

Dudhola, Palwal-121102, Haryana

Transit office: Plot 147, Sector 44, Gurugram-122001, Haryana

Website: www.svsu.ac.in

Contact No: +91-124-2746800

SEMESTER-I																	
Course Code	Course Name	Credits				Hrs				Marks							
										Theory(T)			Practical(P)			Total	
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)	
24UPHY03 24UPHY04	Applied Physics	3	1	1	5	45	15	30	90	15	35	50	35	15	50	100	
24UELE01 24UELE02	Basic Electrical and Electronics Engineering	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100	
24UENG05 24UENG06	Professional Communication	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100	
24UMTH03	Engineering Mathematics-I	3	1	0	4	45	15	0	60	30	70	100	0	0	0	100	
24UMEE01	Engineering Skills Practices-I	0	0	3	3	0	0	90	90	0	0	0	70	30	100	100	
24UEVS01	Environment Studies (Audit Course)	2	0	0	0	30	0	0	30	30	70	100	0	0	0	100	
	Total	14	2	6	20	210	30	180	420	105	245	350	175	75	250	600	

SEMESTER-II																	
Course Code	Course Name	Credits				Hrs				Marks							
										Theory(T)			Practical(P)			Total	
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)	
24UCHM03 24UCHM04	Applied Chemistry	3	1	1	5	45	15	30	90	15	35	50	35	15	50	100	
24UMEE02	Basics of Mechanical Science	3	0	0	3	45	0	0	45	30	70	100	0	0	0	100	
24UCSE98 24UCSE99	Fundamentals of Programming using C	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100	
24UMTH04	Engineering Mathematics-II	3	1	0	4	45	15	0	60	30	70	100	0	0	0	100	
24UMEE03	Engineering Graphics and Design	0	0	3	3	0	0	90	90	0	0	0	70	30	100	100	
24UMEE04	Engineering Skills Practices-II	0	0	3	3	0	0	90	90	0	0	0	70	30	100	100	
24UYHS01	Yoga and Health Skills - II (Audit Course)	2	0	0	0	30	0	0	30	30	70	100	0	0	0	100	
	Total	14	2	8	22	210	30	240	480	120	280	400	210	90	300	700	

Note: The scheme and syllabus of First Year is common to programs B.Tech (Electrical Engineering) and B.Tech (Mechanical and Smart Manufacturing)

Chairperson SDGT. S.F.E.T SVSU

Dean Engineering Shri Vishwakarma Skill University

SEMESTER-III																	
Course Code	Course Name	Credits				Hrs				Marks							
										Theory(T)			Practical(P)			Total	
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)	
	MOOC Course*	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
24UPHY05	Electromagnetic Field Theory	3	0	0	3	45	0	0	45	30	70	100	0	0	0	100	
24UELE03 24UELE04	Network Analysis and Synthesis	3	0	2	5	45	0	60	105	15	35	50	35	15	50	100	
24UELE05 24UELE06	Electrical Machines-I	3	0	2	5	45	0	60	105	15	35	50	35	15	50	100	
24UELE07	Modelling and Simulation Lab (MATLAB)	0	0	3	3	0	0	90	90	0	0	0	70	30	100	100	
	Open Elective-I	3	0	0	3	45	0	0	45	30	70	100	0	0	0	100	
	Minor Specialization Course-I**	Credit Structure and Evaluation scheme as per the Hons./Minor specialization in Electric Vehicles/ Cyber Security / Robotics															
	Total (Excluding Minor Specialization)	12	0	7	21	180	0	210	345	90	210	300	140	60	200	500	

SEMESTER-IV																	
Course Code	Course Name	Credits				Hrs				Marks							
										Theory (T)			Practical (P)			Total	
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)	
24UECE01 24UECE02	Analog and Digital Electronics	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100	
24UELE08 24UELE09	Electrical Machines-II	3	0	2	5	45	0	60	105	15	35	50	35	15	50	100	
24UECE03 24UECE04	Signals and Systems	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100	
24UELE10 24UELE11	Automatic Control System	3	0	2	5	45	0	60	105	15	35	50	35	15	50	100	
	MOOC Course	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
	Minor Specialization Course-II **	Credit Structure and Evaluation scheme as per the Hons./Minor specialization in Electric Vehicles/ Cyber Security / Robotics															
	Total (Excluding Minor Specialization)	10	0	8	20	150	0	240	390	60	140	200	140	60	200	400	

Dean Engineering
Shri Vishwakarma Skill

Note:

1. *MOOC Course
   a. MOOC course may be selected from SWAYAM/NPTEL with flexibility to the student as per availability of the course during the duration of B.Tech. program.
   b. The selected course should not be the part of the course offered in the program scheme.
   c. Credits will be transferred on successfully completion of the MOOC course with certification from SWAYAM/NPTEL.
   d. A minimum duration of MOOC course shall not be less than 8 weeks.
2. After completion of IV semester, 4- 6 weeks Summer Internship is mandatory in the domain areas of B.Tech. (Electrical Engineering) and the assessment shall be made in V semester.
3. **Credit structure may vary as per the offered Hons./Minor Specialization Courses (Based on the availability of the resources in the university).

The list of Open Electives course is given below:

Open Elective-I	• Database Management Systems (Course Code: 24UCSE08) • Data Structures • Artificial Intelligence and Machine Learning • Python Programming • Soft Computing Techniques • Data Analytics

It is certified that this Scheme and Syllabus, developed and checked by us, is complete in all respects.

Dr. Preeti
Curriculum Developer & Program Coordinator
B.Tech. (Electrical Engineering)
Skill Assistant Professor (Electrical Engineering)

Chairperson
Prof. Suresh Kumar
Professor (Mechanical)
Chairperson, Skill Department of Green Technology
Skill Faculty of Engineering and Technology

Dean Engineering
Prof. Ashish Shrivastava
Professor (Electrical)
Dean
Shri Vishwakarma Skill University
Skill Faculty of Engineering and Technology

SYLLABUS

FIRST YEAR (SEMESTER-I)

B.Tech (Electrical Engineering)

and

B.Tech (Mechanical and Smart Manufacturing)

(Academic Session: 2024-2025 onwards)

Course Title	Applied Physics	Course Code	24UPHY03 24UPHY04			
Specialization	Basic Sciences	Structure (LTPC)	3	1	1	5
Offered for	UG	Status	Core √		Elective	
Faculty	SFASH	Type	New √		Modification	
Pre-requisite	Nil	To take effect from	2024-2025			
Submission date	16-11-2024	Date of approval by BoS	16-11-2024			

Course Objective:	The objective of the course is to strengthen the fundamentals of physics and then build an interface of theoretical concepts with their industrial/engineering applications
Course Outcome:	By the end of this course, the student will be able to: **CO1.** Understand the role interference, diffraction and polarization **CO2.** Develop the basic understanding of laser and fibres with their applications in various fields. **CO3.** Understand and apply the basic phenomenon of quantum mechanics **CO4.** Explain the basics of electrostatics, magneto statics and electromagnetic laws **CO5.** Apply the acquired knowledge in understanding and designing the nanotechnology.
Contents of the course	**Unit I: Wave optics** Interference of light by amplitude division; Interference due to thin films: Newton's rings, Michelson interferometer. Farunhoffer diffraction from a single slit, double slit, and N-slit, Diffraction gratings, Rayleigh criterion for limit of resolution; Resolving power of grating and telescope. Polarization in light, Double refraction, Nicol prism, Quarter and half wave plates, Production and analysis of plane, Circularly and elliptically polarized light, specific rotation, Polarimeter **Unit II: Lasers and Fiber Optics** Properties of laser beams, Different types of lasers: solid-state laser (ruby), gas laser (He-Ne), semiconductor laser; applications of lasers in science, and engineering. Need for fiber Optic Communication, Total Internal Reflection (TIR), Acceptance angle and numerical aperture, Step index and graded index fibers, Applications of optical fibers. **Unit III: Quantum Physics:** Inadequacy of classical physics, need for quantum physics, Historical overview, Plank's hypothesis, Quantization of energy, Origin of quantum theory, Photoelectric effect, de Broglie hypothesis – matter waves, Wave-particle duality, Wave-packets, Phase velocity and Group velocity, Experimental evidence of de Broglie's hypothesis: Davisson–Germer experiment, Heisenberg uncertainty principle.

Prech 26/11/24

	Unit IV: Electromagnetic Theory: Faraday's law, Lenz's law, Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields, energy stored in a magnetic field, displacement current and magnetic field arising from time-dependent electric field, Maxwell's equation in vacuum and non-conducting medium. **Unit V: Nanoscience and technology** Nanomaterials, types of nanomaterials, properties of nanomaterials, Density of states (0 dimensional, 1-dimensional, 2-dimensional, 3-dimensional), Top-down and bottom up approaches, Characterization of nanomaterials (Scanning Electron microscopes and Transmission electron microscopes).
Textbook	1. David Griffiths, Introduction to Electrodynamics 2. Nouredine Zettili, Quantum Mechanics: Concepts and Applications 3. A. Ghatak, Optics, 7th Edition, McGraw Hill Education (India) Pvt Ltd. 4. O. Svelto, Principles of Lasers, 5th Edition, Springer. 5. Shotwell, K. Thyagarajan, Introduction to Fiber Optics, 1st Edition, Pearson Education India 6. Avadhanulu M. N. and P G Kshirsagar, A Text Book of Engineering Physics, 7th Edition, S. Chand 7. H K Malik and A K Singh, Engineering Physics, 2nd Edition, McGraw Hill Education (India) Pvt Ltd.
Course Objectives	The objective of the course is to strengthen the fundamentals of physics and then build an interface of theoretical concepts with their industrial/engineering applications.
Course Outcomes	**After completing this subject, student should be able to:** CO1. Understand the motion of electrons in the magnetic field and resonance phenomenon. CO2. Apply the knowledge learned in calculating the charge and mass of an electron. CO3. Understand basic concepts of quantum mechanics through experiments. CO4. Apply the tunneling concept for building new-age technology. CO5. Solve Schrodinger equation using C and Python programming languages.
Laboratory Content	**List of Experiments** 1. To find out the refractive index and Cauchy constant of a prizm. 2. The magnetic field from the Helmholtz coil. a. Variation of the magnetic field due to a circular current-carrying coil on an axial point. b. Verification of Superposition principle using Helmholtz coil. 3. Experiments on electromagnetic induction and electromagnetic braking a. Study of the electromotive force (EMF) induced as a function of the velocity of the magnet. b. Study of the charge delivered due to induction. c. Study of electromagnetic (EM) damping. 4. Cathode ray experiment a. Study of Lorentz force in a vacuum tube b. Measurement of specific charge (e/m) in a vacuum tube

Preeti
26/11/24

	5. Experimental Verification of the Heisenberg Uncertainty Principle 6. Determine the wavelength of He-Ne Laser using a double slit experiment. 7. Photoelectric effect a. Determine Planck's constant and Work function b. Verify the inverse square law of. 8. Measurement of Lorentz force in a vacuum tube. 9. Electron Spin Resonance (ESR) Spectrometer Experiment. a. Determine magnetic field as a function of frequency. b. Determine Lande's g-factor for free electrons. 10. Determine the wavelength of sodium light using a diffraction grating. 11. Determine the wavelength of He-Ne Laser using a diffraction grating. 12. To determine the energy gap of a semiconductor diode. 13. Solar Cell: To study the V-I Characteristics of solar cell. 14. Optical fibre: To determine the bending losses of Optical fibers. **Note- Experiment may be added as per the requirements of curriculum and availability of Facilities.** **Note: Minimum 8 Experiments to be performed**
	1. David Griffiths, Introduction to Electrodynamics 2. H.C. Verma, Quantum Physics References: 1. B.Sc. Practical Physics, Geeta Sanon 2. B.Sc. Practical Physics, C. L. Arora 3. Halliday and Resnick, Physics 4. W. Saslow, Electricity, magnetism and light

26/11/24

Chairperson
SDGT, SBS
SVSU

<table>
<tr><td>Course Title</td><td>Basic Electrical and Electronics Engineering</td><td>Course Code</td><td colspan="4">24UELE01
24UELE02</td></tr>
<tr><td>Specialization</td><td>Engineering Science</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">The objective of this course is to provide students with a fundamental understanding of electrical and electronics principles, circuits, machines, semiconductor devices and their applications, energy generation and distribution, as well as troubleshooting and safety practices.</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">After completion of the course, the student will be able to:
CO1: Apply fundamental electrical concepts to analyze and solve DC circuit problems.
CO2: Apply fundamental electrical concepts to analyze and solve AC circuit problems.
CO3: Comprehend the principles and working of electrical machines and transformers.
CO4: Understand the characteristics and applications of semiconductor devices and logic gates.
CO5: Analyze and interpret electrical energy generation, distribution systems and diagnose & rectify electrical faults while ensuring safety for employment.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">UNIT I: DC Circuit Analysis
Fundamentals of Electric Circuits: Charge, Current, Resistance, Voltage, Ohm's Law, Kirchhoff's Laws, Ideal DC voltage and current sources, Electric Power and sign convention, open circuit voltage, short circuit current, voltage division rule, current division rule, Practical DC voltage and current sources, Source Transformation

UNIT II: AC Circuit Analysis
AC Networks: Energy storage elements-Inductance and Capacitor, Generation of sinusoidal emf, phasor representation of alternating quantities, Average and RMS values, Peak Factor, Form Factor, AC circuit analysis through: Purely resistive, inductive & capacitive circuit, RL, RC and RLC circuit, Active Power, Reactive Power, Apparent Power, Power Factor, Impedance, Admittance, Resonance in series and parallel RLC circuit, Star and Delta connection in three phase system, voltage and current relations in star and delta connections

UNIT III: Electrical Machines and Transformers
Transformer: Principle of Operation, Concept of Ideal Transformer, EMF Equation, Voltage transformation ratio and current ratio, Classification: Core Type and Shell Type
DC Machines: Principle and Construction of DC Generator, EMF equation of DC generator, Types of DC generators: Separately and Self-Excited, DC Motors: Types and Applications
Three phase Induction Motor: Principle of operation, slip, applications</td></tr>
</table>

	UNIT IV: Semiconductors and its Applications Semiconductor materials: Intrinsic and Extrinsic, n-type and p-type semiconductor, p-n junction, p-n junction diode, forward bias and reverse bias, V-I characteristics of diode, Zener Diode **UNIT V: Electrical Energy Generation, Distribution and Safety** Power generation and power plants, Transmission and distribution systems, Electrical substations and switchgear, Power factor correction, Energy meters and energy management Troubleshooting techniques for electrical systems, Safety procedures and precautions in electrical work, Protection devices (Fuse, MCB) and grounding systems, Electrical codes and regulations, Introduction to electrical maintenance and repair.
Textbook	1. Principles and Applications of Electrical Engineering by Giorgio Rizzoni, McGraw Hill Education, 6th Edition (2015) 2. Electric Circuits by James W. Nilsson and Susan A. Riedel, Pearson, 11th Edition (2018) 3. Electric Machinery Fundamentals by Stephen J. Chapman, 5th Edition (2011), McGraw Hill Education 4. Semiconductor Physics and Devices by Donald A. Neamen, McGraw Hill Education, 4th Edition (2012) 5. Electrical Power Systems: Design and Analysis by Mohamed E. El-Hawary, Wiley-IEEE Press, 2nd Edition (1995) 6. Electrical Safety Handbook by John Cadick and Mary Capelli-Schellpfeffer, McGraw Hill Education, 4th Edition (2012) 7. Electrical and Electronic Technology by E. Hughes, Pearson, 10th Edition (2010) 8. Fundamentals of Electrical and Electronics Engineering by S. Ghosh, PHI Publications, 2nd Edition (2007) 9. Textbook of Basic Electrical and Electronics Engineering by J.B. Gupta, S.K. Kataria Publications, 2020 Edition 10. Basic Electrical Engineering by D.C. Kulshreshtha, McGraw Hill Education, 1st Edition (2009)
References	1. Electrical Engineering Fundamentals by V.D. Toro, Prentice Hall India, 2nd Edition (1994) 2. Basic Electrical Engineering by D.P. Kothari and I. J. Nagrath, Tata McGraw Hill, Revised Edition (2010) 3. Electrical & Electronic Technology by Hughes Edward, Pearson Education, 10th Edition (2007) 4. Fundamentals of Electrical Circuits by C.K. Alexander and Mathew N.O. Sadiku, Tata McGraw Hill, 4th Edition (2008) 5. Electrical Machinery by P.S. Bhimbhra, Khanna Publishers, 7th Edition (2014) 6. Integrated Electronics by Millman & Halkias, Tata McGraw Hill, 2nd Edition (2010) 7. Digital Logic and Computer Design by M. Morris Mano, Pearson, 4th Edition (2016)

Laboratory Content	**List of Experiments** 1. Introduction of tools, electrical materials and abbreviations 2. To verify Ohm's Law using a DC circuit. 3. To study and verify Kirchhoff's Laws using a DC circuit. 4. To measure resistances using various methods: color coding and multimeter. 5. To verify series and parallel combinations of resistors. 6. To study running and reversing and working principle of Single-Phase Induction Motor 7. To determine the turn ratio of the transformer 8. To study voltage-current characteristics of a diode in forward and reverse bias condition. 9. To measure input resistance, output resistance and current gain of a PNP/NPN transistor in common collector configuration. 10. To troubleshoot electrical circuits: identification and rectification of faults 11. To wire up a circuit in conduit system two lamps and a socket out let each controlled independently. 12. To wire up a circuit in conduit system one lamp controlled by two switches (stair case wiring) from different places. **Note: Minimum 8 Experiments to be performed**

<table>
<tr><td>Course Title</td><td>Professional Communication</td><td>Course Code</td><td colspan="4">24UENG05
24UENG06</td></tr>
<tr><td>Specialization</td><td>Humanities</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFASH</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">To develop effective writing and comprehension skills for diverse professional needs to make the learners employable</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">At the end of the course, the student will be able to:
CO1: Make discrete and effective use of vocabulary in diverse professional communication situations.
CO2: Understand the basics of writing in English and use the same in writing and comprehension.
CO3: Identify and correct errors in writing and enhance their overall writing accuracy
CO4: Write grammatically correct drafts and identify grammatical errors.
CO5: Demonstrate proficiency in comprehension and writing well-structured and cohesive essays</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Vocabulary Building
The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

Unit II: Basic Writing Skills
Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Unit III: Identifying Common Errors in Writing
Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

Unit IV: Nature and Style of sensible Writing
Describing, Defining, Classifying, Providing examples or evidence, Writing, introduction and conclusion

Unit V: Writing Practices
Comprehension, Précis Writing and Essay Writing</td></tr>
<tr><td>Textbook</td><td colspan="6">1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press</td></tr>
</table>

References	1. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006. 2. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
Laboratory Content Outcome	At the end of the course, the student will be able to: CO1: Use basics of communication in diverse professional situations through hands on practice. CO2: Comprehend and practice standard English speech. CO3: Identify and correct errors in writing and enhance their overall writing accuracy.
Laboratory Content	Oral Communication (This involves interactive practice sessions in Language Lab) 1. Listening Comprehension 2. Pronunciation, Intonation, Stress and Rhythm 3. Common Everyday Situations: Conversations and Dialogues 4. Communication at Workplace 5. Interviews 6. Formal Presentations

Course Title	Engineering Mathematics-I	Course Code	24UMTH03			
Specialization	Basic Sciences	Structure (LTPC)	3	1	0	4
Offered for	UG	Status	Core √		Elective	
Faculty	SFASH	Type	New √		Modification	
Pre-requisite	Nil	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student. To impart basic knowledge on complex numbers, series, basics of calculus, linear algebra and matrices.					
Course Outcome:	At the end of the course, the student will be able to: CO1. Apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions. Explain the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems. CO2. Discuss the tool of power series and Fourier series for learning advanced Engineering Mathematics. CO3. Explain the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing with engineering problems. CO4. Students should be able to apply linear algebra techniques to solve engineering problems. CO5. Illustrate the mathematical tools needed in evaluating matrices and linear equations.					
Contents of the course	**Unit I: Calculus** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima. **Unit II: Sequences and Series** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem. **UNIT III: Complex Variables** Real and complex numbers, basic properties and geometry. Cauchy-Riemann equations, Analytic functions, Harmonic functions, Derivatives of analytic functions, Contour integrals, Taylor's, Maclaurin's, Laurent's series. Zeros and poles, Cauchy Residue Theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. **Unit IV: Linear Algebra** Vector spaces, Subspaces, basis and dimension, linear transformations, representation of transformations by Matrices, linear functionals, transpose of linear transformations, canonical forms. Linear functionals and adjoints, Bilinear					

	forms, symmetric bilinear forms, skew symmetric bilinear forms. **Unit V: Matrices** Linear Systems of Equations; Linear Independence; Determinants; Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.
Textbook	1. Reena Garg, Engineering Mathematics - I, Khanna Book Publishing Company, 2020. 2. B.S Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
Reference Books	1. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008. 2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. 3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 4. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th edition, McGraw Hill, 1990.
Instruction for Paper Setter	1. There should be 11 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Title	Engineering Skill Practices-I	Course Code	24UMEE01			
Specialization	Engineering Science	Structure (LTPC)	0	0	3	3
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Nil	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	• The objective of this course is to give an exposure on the basic practices followed in the domain of mechanical engineering focusing on welding, measurements, metrology and manufacturing processes. • The exercises will train the students to acquire skills which are very essential for the engineers through hands-on sessions.					
Course Outcomes	At the end of the course, the student will be able to: CO1: Acquire basic knowledge about difference among various welding techniques, perform gas welding and cutting CO2: Develop skills in electric arc and resistance welding CO3: Understand basic manufacturing processes and metrology CO4: Understand concepts of electrical installation and importance of personal protection equipments CO5: Differentiate between earthing, bonding and grounding schemes					
Contents of the course	**Experiments will be framed to train the students in following common engineering practices:** **Unit I: Introduction and Gas Welding** Introduction and classification of welding processes, welding terms (terminology), welding positions, joints and filler metals. Gas welding and Gas cutting: Principle, Oxyacetylene welding equipment, Flame cutting. **Specimen preparation and making of lap joint, butt joint. T-joint with Oxyacetylene gas welding.** **Unit II: Electric Arc and Resistance Welding** Electric arc welding: Principle, equipments, types-MIG, TIG, submerged arc and others, Welding electrodes, classification and selection of electrodes, welding arc and its characteristics, arc stability, arc blow. Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash. Welding Defects, their causes and remedies. Brazing and soldering. **Making of lap, Butt, T-joints etc. with electric arc welding, Study of MIG and TIG welding equipment and making a weld joint by this process, study of resistance welding processes and prepare a spot-welded joint.**					

	Unit III: Basic manufacturing processes and Metrology Fitting – Drilling & tapping – Material joining processes **Specimen preparation and Fitting: Square joint, V joint, half round joint, dovetail joint** **Metrology** Introduction to Metrology, Need for Inspection, Accuracy and Precision, Objectives of Metrology and Measurements, General Measurement Concepts, Calibration of Measuring Instruments, Errors in Measurements, Methods of Measurement **Unit IV: Electrical Installations** Personal Protection Equipment: Long-sleeved blue coat, safety shoes, helmet with integral visor, general safety rules, safety rules of working with electrical equipment, Hand tools, Types of wires and cables: Labeling of wires, residential wiring cables, electrical conduit: Electrical metal conduits, non-metal conduits, cable trays, raceways, Experiments related to Switch and a lamp, Switch and a socket, switch and two lamps, switch and two sockets, two lamps controlled using a two-way switch, wiring an impulse relay, wiring a mechanical timer, wiring a programmable timer, wiring a distribution panel **Unit V: Earthing, Grounding Schemes and Protective Equipments** Earthing: How earthing is done, types of earthing, advantages, Bonding, Grounding, Comparison between grounding, earthing and bonding, Fuse: Working, Selection and Characteristics Experiments related to demonstration of earthing and grounding of electrical systems
Textbook	1. Engineering Metrology and Measurements By N.V. Raghavendra and L. Krishnamurthy (Oxford University Press) 2. S. K. Choudhry and Hajra, "Elements of Workshop Technology (Vol. I Manufacturing Processes)", Media Promoters and Publishers Pvt. Ltd., 2008. 3. B.S. Raghuwanshi, "A Course in Workshop Technology (Vol. I, Manufacturing Processes)'', Dhanpat Rai and Sons, New Delhi, 2015.
References	1. Chapman. W. A. J., Workshop Technology, Part 1 & 2, Taylor & Francis. 2. R. K. Jain, "Workshop Technology Vol I & II'', Khanna Publishers, New Delhi, First Edition, 2021. 3. P. N. Rao, "Manufacturing Technology Volume –I '', Tata McGraw Hill, Delhi, Fifth Edition, 2019.

Course Title	Environmental Science	Course Code	24UEVS01			
Specialization	Audit Course	Structure (LTPC)	2	0	0	0
Offered for	UG	Status	Core √	Elective		
Faculty	SFASH	Type	New √	Modification		
Credits	0	Marks	Internal	30		
Hours	30		External	70		
Pre-requisite	Nil	To take effect from	2024-2025			
Submissiondate	13-07-2024	Date of approval by BoS	23-07-2024			
Course Objective	To develop foundation on principles of environmental studies and concept of structure and function of different compartments of the environment.					
Course Outcome	**On completion of this course, students will be able to:** **CO1**: Understand the fundamentals of environmental studies. **CO2:** Comprehend ecosystems and their dynamics. **CO3:** Implement corrective measures for the abatement of pollution. **CO4**: Understand the waste management techniques. **CO5:** Grasp environmental policies, legislation, and issues.					
Contents of the course	**Unit 1: Indian Knowledge System- Indigenous Practices, Air & Environment** Environment: Nature, Scope and Importance, Need for Public Awareness. Renewable and Non-Renewable Resources, Atmosphere: Introduction, layers of the atmosphere, Traditional agricultural practices - Organic farming, Crop rotation, Intercropping), Water management techniques - Stepwells, Tankas, Baolis, Forest management and conservation methods - Sacred groves, Agroforestry **Unit 2: Ecosystems** Concept, Structure and Function of an Ecosystem, Energy Flow in the Ecosystem, Bio-geochemical Cycles, Types of Ecosystem: Forest Ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic Ecosystems. **Unit 3: Environmental Pollution** Environmental Pollution: Definition, Causes, Effects and Control Measures, Different Types of Pollutions, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Environmental issues: Climate change, global warming, acid rain, ozone layer depletion **Unit 4: Waste Management, Environmental policies and legislation** Solid waste management Municipal solid waste management techniques: Bio Composting, Vermicomposting, Incineration, Landfill sites, Liquid waste management: Waste water and Standards for its discharge given by CPCB, Waste water treatment: Effluent Treatment Plant and Sewage treatment plant (STP), Wildlife Protection Act 1972, Forest Conservation Act 1980, Water (Prevention and control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986					
Field Work	• Visit to a local area to document environmental assets river/forest/grassland/hill/mountain • Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural • Participation in plantation drive and nature camps. • Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.					

Text Books	1. Singh, J.S., Singh, S.P. & Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications. 2. Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders. 3. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson).
References	1. Deevedi M. (2021). Environment and ecology in the Indian knowledge system. Vidyanidhi Prakashan. 2. Melissa K. Nelson and Daniel Shilling. (2018). Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability. Cambridge University Press. 3. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK. 4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. 5. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/ 6. Ahluwalia, V. K. (2015). *Environmental Pollution, and Health*. The Energy and Resources Institute (TERI).

SYLLABUS

FIRST YEAR (SEMESTER-II)

B.Tech. (Electrical Engineering)

and

B.Tech. (Mechanical and Smart Manufacturing)

(Academic Session: 2024-2025 onwards)

Course Title	Applied Chemistry	Course No. :	24UCHM03 (Theory) 24UCHM04 (Lab)		
Specialization	Basic Sciences	Structure (LTP)	3	1	1
Offered for	UG	Status	Core √	Elective	
Faculty	SFASH	Type	New √	Modification	
Pre-requisite	Nil	To take effect from	2024-2025		
Submission date	23-07-2024	Date of approval by BoS	23-07-2024		

Course Objective:	The concepts developed in this course will aid in quantification of several concepts in chemistry. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. An understanding of the principles of Applied Chemistry will develop scientific attitude in the budding engineers to understand the physical and chemical properties of the available materials for engineering application as well as an ability to design new effective material.
Course Outcome:	By the end of this course, the student will be able to: CO1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. CO2. Rationalize bulk properties and processes using thermodynamic considerations. CO3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. CO4. Rationalize periodic properties such as ionization potential, electronegativity,oxidation states and electronegativity. CO5. List major chemical reactions that are used in the synthesis of molecules.
Contents ofthe course	**Unit 1 Atomic and molecular structure** Schrodinger equation. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. ***Spectroscopic techniques and applications*** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Diffraction and scattering. **Unit 2: Intermolecular forces and potential energy surfaces** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

	Unit 3: Use of free energy in chemical equilibria Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and EMF. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams. **Unit 4 Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries **Unit 5 Organic Chemistry** a) **Stereochemistry:** Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds b) **Organic reactions and synthesis using conventional and green approach:** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.
Textbook	1. Engineering Chemistry-I Concept and Application by Jit Chakraborty, Asimesh Dutta Gupta, Ravikanth Kamlekar 2. University chemistry, by B. H. Mahan Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane 3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell 4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan 5. Physical Chemistry, by P. W. Atkins 6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition, http://bcs.whfreeman.com/vollhardtschore5e/default.asp 7. Dr. G. H. Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14. 8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 2014. 9. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
References	1. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala. 2. Spectroscopy (Vol-4) by K.L. Kapoor 3. Hydrogen – A fuel for Automatic Engines, Prashukumar G P, ISTE 4. Fuel cells: Principles and Applications, Viswanathan B and AuliceScibioh, University Press 5. Fuel Cells: Theory and Applications, Hart A B and Womack G J, Chapman and Hall 6. A Text Book of Engineering Chemistry, Shashi Chawla, 7. "Engineering Chemistry" by A. Mallick 8. Engineering Chemistry by R. Devi, V. R. Reddy and Rath, Cengage learning 9. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, 10. Vogel's Text Book of Practical Organic Chemistry 5th Edition

	11. Inorganic Quantitative Analysis by A.I. Vogel, ELBS Publications. 12. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd.
Laboratory Content	**List of Experiments** 1. Determination of surface tension and viscosity 2. Thin layer chromatographic separation 3. Ion exchange column for removal of hardness of water 4. Determination of chloride content of water 5. Colligative properties using freezing point depression 6. Determination of the rate constant of a reaction 7. Determination of cell constant and conductance of solutions 8. Potentiometry - determination of redox potentials and emfs 9. Synthesis of a polymer/drug 10. Saponification/acid value of an oil 11. Chemical analysis of a salt 12. Lattice structures and packing of spheres 13. Models of potential energy surfaces 14. Chemical oscillations- Iodine clock reaction 15. Determination of the partition coefficient of a substance between two immiscible liquids 16. Adsorption of acetic acid by charcoal 17. Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg. 18. Prediction and analysis of 1H NMR spectra of some selected compounds. 19. Prediction and analysis of 13C NMR spectra of some selected compounds. 20. Prediction and analysis of IR spectra of some selected compounds. 21. To calculate Biochemical Oxygen Demand (BOD) of the given water sample. 22. To calculate Total Dissolved Solids (TDS) present in the given water sample. 23. To determine the inorganic nitrogen (Nitrate Nitrogen) in the given water sample. 24. To calculate the Total Kjeldahl Nitrogen in the given water sample **Note: Minimum 8 Experiments to be performed**

<table>
<tr><td>Course Title</td><td>Basics of Mechanical Science</td><td>Course Code</td><td colspan="4">24UMEE02</td></tr>
<tr><td>Specjalization</td><td>Engineering Science</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Applied Physics</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">The objective of this course is to give an exposure the basic concepts of thermodynamics, power cycles and internal combustion engines</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">By the end of this course, the student will be able to:
CO1: Understand the basic thermodynamics and mechanism of reaction
CO2: Understanding of first law of thermodynamics and the work done for the different flow processes
CO3: Understand the second law of thermodynamics and entropy
CO4: Acquire the knowledge about the air standard efficiency calculation for air standard cycle.
CO5: Understand the basic concepts of refrigeration and air conditioning</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Introduction to Basic Concepts
Thermodynamics, Concept of thermodynamic System, thermodynamic equilibrium, Boundary and Surroundings, Open, Closed and Isolated Systems. Property, state, path, process and cycle, point functions and path functions, Phase and pure substances, Equation of State, reversible, Quasi-static and irreversible processes, Energy and its forms, Energy transfer across the System boundaries. Types of work transfer, heat and work; sign conventions for heat and work interaction, Concept of temperature and heat, microscopic and macroscopic approach, Concept of continuum, Zeroth law of thermodynamics. Concept of thermal equilibrium and principles of thermometry. Ideal gas and characteristic gas equation.

Unit II: First Law of Thermodynamics
Concept of First law of thermodynamics, essence and corollaries of First law; internal energy and enthalpy, analysis of non-flow and flow processes for an ideal gas for constant volume (isochoric), constant pressure (isobaric), constant temperature (isothermal), adiabatic and polytropic processes. Changes in various properties, work done and heat exchange during these processes, free expansion and throttling process and its applications in Engineering processes; Steady Flow Energy Equation and its application to various thermodynamic systems.</td></tr>
</table>

	Unit III: Second Law of Thermodynamics Limitations of First law of thermodynamics, concept of Kelvin Plank and Clausius statements of the Second law and their equivalence and their application to Refrigerator, Heat Pump and Heat Engine. Thermodynamic temperature scale, Efficiency and philosophy of Carnot cycle and its consequences, Carnot Engine and Carnot theorem; Carnot refrigerator, Heat Pump and Heat Engines. Clausius theorem; Clausius inequality; concept of entropy, principle of increase in entropy, representation of various processes on T-S coordinates and change in entropy for different processes, concept of entropy. **Unit IV: Gas Power Cycles** Air-standard efficiency, Nomenclature of Piston-Cylinder arrangement w.r.t. swept volume; clearance volume, compression ratio and mean effective pressure; Analysis and philosophy of Air-Standard Cycles i.e. Otto Cycle, Diesel Cycle and Dual Cycle; their compression ratio, mean effective pressure, power output and Efficiency; Comparison between the three Cycles. **Unit V: Refrigeration and Air Conditioning** Introduction to refrigeration, methods of refrigeration, Refrigeration cycles: Carnot cycle of refrigeration (ideal cycle), Bell-Coleman cycle of refrigeration, their COP, Vapour compression system, Vapour Absorption System Psychrometry: Definition, Composition of air, Daltons law of partial pressure, Gas and Vapour mixture, Dry and Wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Saturated air, Specific humidity, Degree of saturation, Relative humidity, Absolute humidity
Textbook	1. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons. 2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd 3. V. Ganeshan, Internal Combustion Engines, Tata McGRaw Hill.
References	1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons. 2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

<table>
<tr><td>Course Title</td><td>Fundamentals of Programming using C</td><td>Course Code</td><td colspan="4">24UCSE98
24UCSE99</td></tr>
<tr><td>Specialization</td><td>Engineering Science</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>25-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">• To acquire problem solving skills
• To be able to develop flowcharts
• To understand structured programming concepts
• To be able to write programs in C Language</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">After completion of the course, the student will be able:
CO1: Recall and understand the basics constructs of a programming language.
CO2: Demonstrate the problem solving and critical thinking skills.
CO3: Applying the knowledge of programming skills in problem solving using C language.
CO4: Analyzing the Different programs in terms of their complexity and efficiency
CO5: Test the program for its correctness from all possible inputs.
CO6: Design the program in C language to solve any problem.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Introduction to Computers and C
Introduction to Computers: Computer Systems, Computer Languages, Complier and Interpreter, Creating and Running Programs, Software Development life cycle, Flow charts and algorithm. Number Systems: Binary, Octal, Decimal, Hexadecimal and conversion from binary to octal, decimal, hexadecimal and vice versa.
Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements, Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

Unit II: Control statements and functions
Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do- While and Examples. Continue, Break and Go to statements.
Functions: Function Basics, standard and User-defined Functions, Methods of Parameter Passing- call by value, call by reference, Recursion- Recursive Functions.

Unit III: Storage Classes and Arrays
Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers. Preprocessors: Preprocessor Commands
Arrays: Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.</td></tr>
</table>

	Unit IV: Pointers Pointers: Introduction, Basics of pointers, Pointer declarations and initialization, Pointer arithmetic, Relationship between arrays and pointers, accessing array elements using pointers, Array of Pointers, Pointers to void, null pointer, Dangling pointers Dynamic Memory Allocation- Using malloc, calloc, realloc, and free **Unit V: Strings and Structures** **Strings**: Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions. **Structures:** Definition and Initialization of Structures, Accessing Structures. Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions
Textbook	1. Yashavant P. Kanetkar, " Let Us C" BPB Publications, 17th Edition 2020.
References	1. Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006. 2. Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006. 3. B.A. Forouzan and R.F. Gilberg, "A Structured Programming Approach in C", Cengage Learning, 2007
Laboratory Content	**Course Objectives:** The objective of the course is to give exposure to the student about the implementation of different algorithm in C language. **Course Outcome:** At the end of the course, the student will be able to CO1. Understand the fundamentals of programming in C Language CO2. Write, compile and debug programs in C CO3. Formulate given problems and give solutions by programming it in C. CO4. To be able to effectively choose programming components to solve computing problems in real-world. **List of Experiments** 1. Write a C program to demonstrate the use of different data types (int, float, char, double) and print their sizes using the size of operator. 2. Write a C program to find the largest of three numbers using if-else statements. 3. Write a C program to print the first 10 Fibonacci numbers using a for loop. 4. Write a C program to create a function that calculates the factorial of a given number. 5. Write a C program to swap two numbers using a function without using a temporary variable. 6. Write a C program to find Roots of a Quadratic Equation. 7. Write a C program to generate various pattern using Pyramid of numbers. 8. Write a C program to find the Factorial, Fibonacci using Recursion. 9. Write a C program to perform sorting of numbers on 1D array using

	Bubble Sort. 10. Write a C program to perform sorting of numbers on 1D array using Selection Sort 11. Write a C program to perform 1D array to search an element using Linear search. 12. Write a C program to perform 1D array to search an element using Binary search 13. Write a C program to perform Matrix addition using 2D arrays. 14. Write a C program to perform Matrix multiplication using 2D arrays. 15. Write a C program to demonstrate various functions for string manipulations **Note: Minimum 8 Experiments to be performed**
Instruction for Paper Setter	1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 10 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 5 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Title	Engineering Mathematics-II	Course Code	24UMTH04			
Specialization	Basic Sciences	Structure (LTPC)	3	1	0	4
Offered for	UG	Status	Core √		Elective	
Faculty	SFASH	Type	New √		Modification	
Pre-requisite	Engineering Mathematics-I	To take effect from	2024-2025			
Submission date	12-07-2024	Date of approval by BoS	23-07-2024			
Course Objectives	The objective of this course is to familiarize the prospective engineers with techniques in multivariable calculus, differential equations and statistics.					
Course Outcomes	At the end of the course, the student will be able to: CO1: Deal with functions of several variables that are essential in most branches of engineering. CO2: Acquainted with mathematical tools needed in evaluating multiple integrals and their usage. CO3: Categories the effective mathematical tools for the solutions of ordinary differential equations that model physical processes. CO4: Categories the effective mathematical tools for the solutions of partial differential equations that model physical processes. CO5: Will be able to understand the applications of Laplace and Fourier transform					
Contents of the course	**Unit I: Multivariable Calculus (Differentiation)** Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence. **Unit II: Multivariable Calculus (Integration)** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. **Unit III: Ordinary Differential Equations** First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. **Unit IV: Partial Differential Equations** First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogeneous and non - homogeneous linear partial differential					

	equations second and higher order by complementary function and particular integral method, Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries. System of differential equations, Laplace transforms to solve differential equations, transfer functions, impulse functions, frequency response. **Unit V: Fourier And Laplace Transform** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications
Textbook	1. Reena Garg and Chandrika Prasad, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2020. 2. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th edition, McGraw Hill, 1990. 3. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, 2006 4. A. D. Poularikas, The Transforms and Applications Handbook, CRC Press, 1996. 5. E. Kreyszig. Advanced Engineering Mathematics, Wiley, 2015 6. Calculus and Analytic Geometry, G. B. Thomas and R. L. Finney, Pearson Education, 2010
References	1. L. Garcia, Probability and Random Processes for Electrical Engineering, 2nd Ed., Addison-Wesley, 1993. 2. P.Z. Peebles, Probability, Random Variables and Random Signal Principles, 4th Ed., McGraw Hill, 2000. 3. H. Stark and J.W. Woods, Probability and Random Processes with Applications to Signal Processing, Prentice Hall, 2002. 4. K. L. Chung and F. AitSahlia, Elementary Probability Theory with Stochastic Processes 5. Introduction to Mathematical Finance, 4th Ed., Springer-Verlag, 2003.
Instruction for Paper Setter	1. There should be 11 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

<table>
<tr><td>Course Title</td><td>Engineering Graphics and Design</td><td>Course Code</td><td colspan="4">24UMEE03</td></tr>
<tr><td>Specialization</td><td>Engineering Science</td><td>Structure (LTPC)</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objectives</td><td colspan="6">• Introduction to engineering design and its place in society
• Exposure to the visual aspects of engineering design
• Exposure to engineering graphics standards
• Exposure to solid modelling
• Exposure to computer-aided geometric design</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">At the end of the course, the student will be able to:
CO1. Recall the basics of engineering drawing and projection
CO2. Understand different types of projections
CO3. Differentiate between different types of projection and its applications
CO4. Understand application of isometric projection
CO5. Familiarize with the 2D and 3D projections of various figure</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Introduction of Engineering Drawing
Introduction of Engineering Drawing (01 Sheet): Scope and Importance of Engineering Drawing; Drawing instruments and their uses; Indian standards for drawing. Sheet layout, technical lettering and conventions for lines and materials. Introduction to general principles of dimensioning. Scales: plain diagonal and vernier.

Unit II: Projection and Projection of Lines
Projection (02 Sheets): Principles of Projection; Introduction to planes of projection (reference planes) and auxiliary planes. Projection of point in all the four quadrants, calculation of shortest distance.
Projection of lines (01 Sheet): Projection of lines in different quadrants according to its orientation/position with horizontal, vertical and profile plane; true and apparent lengths; traces of lines; finding out the true length and true inclinations of the line inclined to both the reference planes using rotating line method and rotating trapezoidal plane method.

Unit III: Projection of Planes and Solids
Projection of Planes (02 Sheets): Projections of plane surfaces-triangle, square, rectangle, pentagon, hexagon and circular planes in different positions when plane is parallel to one of the reference planes, inclined to one of the reference planes andperpendicular to other and inclined to both reference planes.
Projection of Solids (02 Sheets): Solids and their classification; right and oblique solids, projections of right regular- prisms, pyramids, cylinders and</td></tr>
</table>

	cones in different positions when their axis is parallel to one of the reference planes, inclined to oneor both of the reference planes. **Unit IV: Sections of Solids and Development of Solids** **Sections of Solids (02 Sheets):** Introduction to sectioning and its importance; methods of sectioning, apparent shape and true shape of sections of right regular prisms, pyramids, cylinders and cones resting on horizontal plane on their base. **Development of Surfaces (02 Sheets):** Development of lateral surface of right regular prism, pyramid, cylinder and cone resting on their base on horizontal plane with their frustum and truncation. **Unit V: Isometric and Orthographic Projection** **Isometric Projection (02 Sheets):** Introduction, isometric scale, isometric projection of simple plane figures, isometric projection of cube, square block, right regular prisms, pyramids, cylinders and cones and their combinations. **Orthographic Projection (02 Sheets):** Orthographic projections of simple solids from the given 3D/isometric view. **AUTOCAD (05 Exercises):** Management of screen menus commands, Introduction to drawing entities Co-ordinate systems: Cartesian, polar and relative coordinates, drawing limits, units of measurement and scale, Layering: organizing and maintaining the integrity of drawings, Design of prototype drawings as templates, Editing/modifying drawing entities: selection of objects, object snap modes, editing commands, Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing. **Note: Minimum 12 sheets may be prepared covering all the topics.**
Textbook	1. Rhodes R.S, Cook L.B; Basic Engineering Drawing, 1st Edition, Pitman Publishers, 2. Rana B.C and Shah M.B, Engineering Drawing and computer graphics, 2nd Edition, Pearson Education India Publishers. (2009). 3. Jolhe D.A; Engineering Drawing: With an Introduction to AutoCAD, 2nd Edition, Tata McGraw Hill (2007)
References	1. Ostrowsky. O; Engineering Drawing with CAD application 2nd Edition, Routledge Publishers 2007. 2. Aggarwal B; Engineering Drawing, 1st Edition, Tata McGraw Hill Publications,2008. 3. Gill P.S; Engineering Drawing ,5th Edition, S.K. Kataria and Sons Publications, 2011. 4. Dhawan R. K; Engineering Drawing, 7th Edition, S. Chand and Sons Publishers. 5. Bhatt N.D; Engineering Drawing,50th Edition, Charotar Publication,2011.

<table>
<tr><td>Course Title</td><td>Engineering Skills Practices-II</td><td>Course Code</td><td colspan="4">24UMEE04</td></tr>
<tr><td>Specialization</td><td>Engineering Science</td><td>Structure (LTPC)</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Engineering Skills Practice-I</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objectives</td><td colspan="6">• Introduction to different manufacturing methods in different fields of engineering
• Practical Exposure to some of the advanced and latest manufacturing techniquesbeing employed in the industry</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">At the end of the course, the student will be able to:
CO1: Acquire basic knowledge about Lathe machine and its operations
CO2: Prepare machine component using milling machine
CO3: Acquire knowledge about CNC machines and its operations
CO4: Use CNC part programming, sub programming on CNC turning and VMC simulator
CO5: Compare and differentiate between wiring and home automation system</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Experiments will be framed to train the students in following common engineering machining operations:

Unit I: Lathe Machine & its operations
Lathe & its accessories, Lathe specifications, Lathe cutting tools, speed, feed, depth of cut & machining time, various operations on Lathe, Attachments used on Lathe; Turret & Capstan Lathe, Toolholding devices.

• Safety Precautions and use of personal protective equipment (PPE), demonstration of tools, equipment, accessories and lathe machines. Specifications of the lathe machine available in the mechanical workshop.
• Preparing a machined component/ job (as per the drawing) involving Different types of operation like turning, taper turning, external step turning, thread cutting and knurling which are free from false tool cuts, burrs and sharp edges, conforming to general dimensional tolerance +/-0.05mm.

Unit II: Milling Machines & its operations
Milling machines (Horizontal, Vertical & Universal milling machine), specifications, accessories, standard & Special attachments milling operations; Indexing, Type of indexing; milling cutters, size, shape & material of milling cutters; numerical related to cutting speed, feed, depth of cut & machining time.
• Safety Precautions and use of personal protective equipment</td></tr>
</table>

	(PPE), demonstration of tools, equipment, accessories and milling machine. Specifications of the milling machine available in the mechanical workshop. • **Preparing a machine component like keyway, production of spur gear teeth/helical Involute gear teeth (as per the drawing) using a milling machine with a side and face cutter, which is free from burrs and sharp edges conforming to general dimensional tolerance +/-0.05mm.** **Unit III: CNC Machines** Basic components of CNC machines, Advantages and Disadvantages of CNC machines, Application of CNC machines, difference between Conventional and CNC machines, NC Machine Tooling, types of tool holding devices-spindle tooling-flexible tooling, work locating and holding devices, basic principles of working holding and location, special devices used in CNC Machines, Automatic Tool Changer in CNC. • **Safety Precautions and use of personal protective equipment (PPE), demonstration of tools, equipment, accessories and CNC Machines (Turning and VMC).** • **Specifications of the SIEMENS and FANUC control panels available in the CNC machine lab.** **Unit IV: Introduction to Part Programming** Concepts of part programming, basic terms-Bit, Byte, Character, NC Work, Block, G and M Codes. Type of part programming- Manual Part Programming, Computer Aided Part Programming, Part Programming for different operations : Methods of writing a part program, axis identification, part zero, floating zero and machine zero, part programming of drilling machine, for lathe and milling machine operations. CNC Part programming, sub programming and execution of an operation on CNC lathe and milling machine. • **CNC Part programming, sub programming and execution of an operation on CNC Turning simulator.** • **CNC Part programming, sub programming and execution of an operation on VMC simulator.** **Unit V: Smart Home Devices and Wiring** Home automation system, various home automation protocols, comparison between wiring and home automation system, maintenance: servicing and troubleshooting, standards for home automation Experiments related to configuring switch actuator and 2 gang push buttons, configuring blind actuator and 2 gang push buttons, configuring dimming actuator and 2 gang push buttons, configure argus sensor and switch actuator.
Textbook	1. Manufacturing processes (Vol. 2.) by Hazra Chowdhary (Media Promoters & Publishers Pvt. Ltd) 2. Manufacturing Processes by S. Kalpakjian (Pearsons) 3. Workshop Technology (Vol.2) by B.S Raghuwanshi (Dhanpat Rai & Co.)

	4. CNC Machines by By B. S. Pabla, M. Adithan(First Edition), New Age International (P) Ltd. 5. T. K. Kundra, P. N. Rao and N. K. Tiwari, "Numerical Control and Computer Aided Manufacturing", TMH
References	1. Manufacturing Processes by Myron L. Begeman (John Wiley & Sons) 2. Production Technology by H.M.T.(Tata McGraw-Hill Education) 3. Tilak Raj, "CNC Technology & Programming", Dhanpat Rai publishing Company (P) ltd., N Delhi. Digital Content Links: 4. https://www.haascnc.com/content/dam/haascnc/en/service/reference/programming-workbooks/shopnotes---machinist%27s-cnc-reference-guide.pdf 5. https://academy.titansofcnc.com/files/Fundamentals_of_CNC_Machining.pdf 6. https://cache.industry.siemens.com/dl/files/554/74475554/att_56792/v1/PGsl_0313_en_en-US.pdf 7. https://cache.industry.siemens.com/dl/files/233/108869233/att_825441/v1/PG_0805_en.pdf 8. https://www.acemicromatic.net/sites/default/files/2018-02/cnc3.pdf

Course Title	Yoga and Health Skills –II	Course Code	24UYHS01			
Specialization	Audit Course	Structure (LTPC)	2	0	0	0
Offered for	UG	Status	Core √		Elective	
Faculty	SFASH	Type	New √		Modification	
Pre-requisite	Nil	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	23-07-2024			
Course Objectives	Students will get information about the origin, history and development of Yoga along with different streams of yoga, literature and meditation.					
Course Outcomes	At the end of the course, the student will be able to: CO1: To make aware of the definition, history and nature of yoga. CO2: Telling information about different school of yoga. CO3: Giving information about cleansing technique and yogic diet. CO4: Explaining the importance of health. CO5: Yogic management of various diseases and the utility of meditation.					
Contents of the course	**Unit I: Introduction to Yoga** Meaning and Definition of Yoga, Aim and Objectives of Yoga, Misconceptions of Yoga; Brief knowledge about Streams of Yoga-Ashtang and Hatha Yoga. Yogic Prayer Mantra. Importance of Yoga in modern era. **Unit II: Yoga Practices** Raja Yoga (Ashtanga Yoga), Gyan Yoga, Bhakti Yoga, Karma Yoga, Hatha Yoga **Unit III: Introduction to Cleansing Technique** Meaning, Definition, Objectives and Classification. Yogic diet: Diet, Yogic Diet, Anti-diet, Balanced diet. **Unit IV: Health** Meaning, Definition, aim and objectives, Dincharya (Daily regimen): Meaning, definition and sequential elements, Application of Dincharya, Ritucharya (Seasonal Regimen): Meaning, Definition, Types with their salient features, Season wise Does and Don'ts. **Unit V: Yogic management in health problems and Meditation** Yogic management in health problems: cervical, back pain, diabetes and stress. Meditation: Meaning, types, importance, general instructions and suggestions for meditation, physical, mental and spiritual effects of meditation.					

Textbook	1. Yoga & yogic chikitsa - Singh Prof. Ramharsh ,Chaukhamba Sanskrit Pratishthan, Edition 2011 2. Swami Vivekananda: Jnana Yoga, Bhakti Yoga, Karma Yoga, Raja Yoga, Advaita Ashrama, Calcutta, 2002. 3. Prof. Ramharsh Singh -SwashthavrittaVigyan, Chaukhambha Sanskrit Prakashan, Varanasi, 1998. 4. Sriram Sharma Acharya- Jivem Sharadah Shatam, Akhand Jyoti Mathura 1998. 5. Prof. Ramharsh Singh-Yogewam Yogic Chitksha, Chaukhambha Sanskrit Prakashan, Varanasi, 1998. 6. SwasthaVrittaVigyanewam Yogic Chiktsha- Dr. RakeshGiri, Sikhsha Bharti, Uttrakhand.
References	1. Swami Kuvalyananda : Asana, Kaivalyadhama, Lonavla, 1993 2. Swami Satyananda Saraswati: Asana, Pranayama, Bandha, Mudra, Bihar School of Yoga, Munger, 2006 3. Basavaraddi, I.V. & others: YOGASANA: A Comprehensive description about Yogasana, MDNIY, New Delhi, 2011. 4. Basavaraddi, I.V. & others: Yogic Sukshma Evam Sthula Vyayama, MDNIY, New Delhi, 2011.

SYLLABUS

SECOND YEAR (SEMESTER-III)

B.Tech (Electrical Engineering)

(Academic Session: 2024-2025 onwards)

Course Title	Electromagnetic Field Theory	Course Code	24UPHY05			
Specialization	Basic Sciences	Structure (LTPC)	3	0	0	3
Offered for	UG	Status	Core √		Elective	
Faculty	SEASH	Type	New √		Modification	
Pre-requisite	Applied Physics	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			

Course Objective:	To introduce the concepts of different coordinate systems, Maxwell's equations, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current, propagation of electromagnetic waves and their applications in practical problems
Course Outcome:	After completing the course, the students should be able: CO1: To differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory. CO2: To describe static electric fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials. CO3: To use integral and point form of Maxwell's and other associated laws for solving the problems of electromagnetic field theory. CO4: To describe time varying fields, propagation of electromagnetic waves in different media, pyonting theorem, their sources & effects and to apply the theory of electromagnetic waves in practical problems. CO5: To apply concepts of Wave reflection and refraction, Smith Chart in practical Field.
Contents ofthe course	**Unit I: Introduction** Sources and Effects of Electro-magnetic field, Review of scalar and vector field, Dot and Cross products, coordinates-cylindrical, spherical etc. Vector representation of surface, physical interpretation of gradient, divergence and curl, different coordinated systems, Divergence Theory – Stoke's Theorem **Unit II: Electrostatics** Coulomb's Law, Electric field intensity, Field due to point and continuous charges – Gauss's law and application, Electric flux density, Maxwell's Equation, Electric potential, Electric field and equipotential plots, Electric field due to point-charges, line charges and surface charges, Electric field in free space, conductors, dielectric --Dielectric polarization - Dielectric strength, Electric field in multiple dielectrics- Effect of dielectric medium, Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density in electrostatic fields

	Unit III: Magnetostatics Introduction, Biot-Savart's Law, Ampere's Circuit Law-Maxwell's Equation, Magnetic Flux Density, Forces due to magnetic fields, magnetic torque, moment, magnetic dipole, inductance, reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations **Unit IV: Electromagnetic Wave Propagation** Continuity equations, Displacement current, Maxwell's equation, Boundary conditions, Plane wave equation and its solution in conducting and non-conducting media, Phasor notation, Phase velocity, Group velocity, Depth of penetration, Conductors and dielectrics, Impedance of conducting medium. Polarization, Reflection and refraction of plane waves at plane boundaries, Poynting vectors, and Poynting theorem **Unit V: Waves and Applications** Transmission line equations, Characteristic impendence, Distortion-less lines, Input impendence of a loss less line, Open and Short circuited lines, Standing wave and reflection losses, Impedance matching, Application of smith chart.
Textbook	1. Elements of Electromagnetics, Sadiku Matthew 2. Principles of Electromagnetics, Mathew N. O. Sadiku, Oxford University Press Inc., Latest Editions 3. Electromagnetism – Theory and Applications, Ashutosh Pramanik, PHI 4. Engineering Electromagnetics, W.H. Hayt, J A Buck, McGraw Hill Education
References	1. Theory and Problems of Electromagnetics by Joseph. A.Edminister, Tata McGraw Hill Edition Second edition 2. Electromagnetics with Applications, Kraus and Fleish, McGraw Hill International Editions, Fifth Edition, 1999

Course Title	Network Analysis and Synthesis	Course Code	24UELE03 24UELE04			
Specialization	Professional Core	Structure (LTPC)	3	0	2	5
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Basic Electrical and Electronics Engineering	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	To make the students understand concepts of graph theory, two port networks, and network synthesis.					
Course Outcome:	After the successful completion of the course the students will be able to: CO1: Implement Network Analysis methods through the use of Graph Theory CO2: Analyze the circuit using Kirchhoff's law and network simplification theorems CO3: Infer and evaluate transient response and steady state response CO4: Evaluate two port networks. CO5: Synthesize network using Foster and Cauer Forms.					
Contents of the course	**Unit-I: Graph Theory** Comparisons between conventional and graph theory approach, Graph of a Network, definitions, tree, co tree, link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis. **Unit-II: Network Solution Methods** Node and Mesh Analysis, Concept of linearity, and homogeneity principle, Dependent & Independent sources based numerical problems (Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem), Reciprocity theorem, Millman's theorem, compensation theorem, Tellegen's theorem, **Unit-III: Transient Circuit Analysis** Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods **Unit-IV: Network Functions and Two port Networks** Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions. Characterization of LTI two port networks ZY, ABCD, A'B'C'D', g and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & Π					

	Representation **Unit-V: Network Synthesis and Filters** Network Synthesis : Positive real function; definition, properties, and limitations; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms, similarities and dissimilarities between Foster's and Cauer's forms Filters: Image parameters and characteristics impedance, passive and active filter fundamentals, low pass, high-pass, (constant K type) filters, and introduction to active filters.
Textbook	1. Network Analysis and Synthesis by Franklin F. Kuo, Wiley India Education, 2nd Edition (2006) 2. Circuits and Networks by A. Sudhakar and S. P. Shyammohan, Tata McGraw-Hill, New Delhi, 4th Edition (2010) 3. Network Analysis by M. E. Van Valkenburg, Prentice Hall of India, 3rd Edition (2006) 4. Circuit Theory by A. Chakrabarti, Dhanpat Rai & Co., 7th Edition (2018) 5. Network Analysis and Synthesis by C.L. Wadhwa, New Age International Publishers, 5th Edition (2007) 6. Networks and Systems by D. Roy Choudhary, Wiley Eastern Ltd., 1st Edition (1988) 7. An Introduction to Circuit Analysis: A System Approach by Donald E. Scott, McGraw-Hill, 1st dition (1987) Hill.
References	1. Engineering Circuit Analysis by A. William Hayt, McGraw-Hill Education, 8th Edition (2012) 2. Network Analysis and Synthesis by A. Anand Kumar, PHI Publication, 2nd Edition (2019) 3. Network Analysis by N.C. Jagan and C. Lakshminarayana, B.S. Publications, 2nd Edition (2008) 4. Electric Circuits and Networks by K.S. Suresh Kumar, Pearson Education, 1st Edition (2009) 5. Linear Circuits: Analysis and Synthesis by A. Ramakalyan, Oxford University Press, 1st Edition (2005)
Laboratory Content	**List of Experiments** 1. To verify Maximum Power Transfer Theorem. 2. To verify Superposition Theorem. 3. To verify Thevenin's and Norton's Theorem. 4. To verify Reciprocity Theorem 5. To calculate and verify "Z" parameters of a two port network. 6. To calculate and verify "Y" parameters of a two port network. 7. To calculate and verify "ABCD" parameters of a two port network. 8. To calculate and verify "H" parameters of a two port network. 9. To plot the frequency responses of high pass filter (HPF) and determine the halfpower frequency. 10. To plot the frequency responses of band-pass filters (BPF) and determine the bandwidth. 11. To synthesize a network of a given network function and verify its response. **Note: Minimum 8 Experiments to be performed**

<table>
<tr><td>Course Title</td><td>Electrical Machines-I</td><td>Course Code</td><td colspan="4">24UELE05
24UELE06</td></tr>
<tr><td>Specialization</td><td>Professional Core</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>2</td><td>5</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Basic Electrical and Electronics Engineering</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">The objective of this course is to build a firm foundation of Electrical Transformers and DC machines</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">After successful completion of this course students will be able to:
CO1: Understand the principles of electromechanical energy conversion
CO2: Understand various tests performed on single phase transformer and working of autotransformer
CO3: Understand working of three-phase transformer and parallel operation of transformers
CO4: Analyze different types of DC generators their characteristics, industrial applications, effect of armature reaction and its assessment
CO5: Explain the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Principles of Electromechanical Energy Conversion
Introduction, Energy in Electro-Magnetic System, Flow of Energy in Electro-Mechanical Devices, Field Energy and mechanical force, Forces/torque in systems with permanent magnets, Dynamics of Electromechanical Systems, Singly and multiply excited systems, energy conversion via electric field

Unit II: Single-phase Transformers
Introduction, Transformer construction and practical considerations, Transformer on No-load, Ideal Transformer, Equivalent Circuit of ideal and practical transformer, EMF equation, Transformer losses, Transformer Testing, Per unit System, Efficiency and voltage regulation, phasor diagram, open circuit and short circuit tests, polarity test, autotransformer

Unit III: Three-phase Transformers
Construction and working of operation, Parallel operation of transformers, three winding transformers, vector groups, phase conversion, tap changing transformers, voltage and current transformers, grounding transformer, welding transformer, cooling of transformers</td></tr>
</table>

	Unit IV: DC Generator Constructional features, Types of armature winding, EMF equation, torque equation, armature reaction, commutation, compensating winding and its necessity, methods of improving commutation, Types of DC generators, Characteristics of DC generators, Application, DC generator losses, power flow diagram, efficiency and condition for maximum efficiency **Unit V: DC Motor** Working principle, back emf, electromagnetic torque developed in DC motor, shaft torque, comparison of generator and motor action, characteristics of DC motors, application and selection of DC motors, starting of DC motors, speed control of DC motors, speed regulation, electric braking Losses in DC machine, power flow diagram, efficiency of DC machine and condition for maximum efficiency, Brake test, Swinburne's test, Hopkinson's Test
Textbook	1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017. 2. P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021
References	1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 6th Edition 2017. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2018. 3. M. G. Say, "Performance and design of AC machines", CBS Publishers, Latest Edition. 4. Sahdev S. K. "Electrical Machines", Cambridge University Press, 2018
Laboratory Content	**List of Experiments** 1. To perform Open Circuit test of Single-Phase Transformer 2. To perform Short Circuit Test of Single-Phase Transformer 3. To study the constructional details of DC machine 4. To analyze and obtain the losses and efficiency of a DC Shunt Machine by Hopkinson's test 5. To depict and analyze No-Load Characteristic of DC Shunt Motor 6. To demonstrate Load Characteristic of DC Shunt Motor 7. To demonstrate speed control of DC Shunt Motor using armature voltage control method 8. To demonstrate speed control of DC Shunt Motor using flux field control method 9. To study Operational Working and Principle of DC Shunt Generator 10. To demonstrate Open Circuit Characteristic of DC Shunt Generator 11. To demonstrate Load Characteristic of DC Shunt Generator **Note: Minimum 8 experiments to be performed**

Course Title	Modelling and Simulation Lab (MATLAB)	Course Code	24UELE07			
Specialization	Professional Core	Structure (LTPC)	0	0	3	3
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Electrical Machines-I	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	The course aims to teach the generic (i.e., tool and application domain independent) concepts of modelling and simulation					
Contents of the course	List of Experiments 1. Introduction of MATLAB 2. Introduction of Simulink 3. To design DC machine in MATLAB 4. To model transformer using fundamental magnetic library blocks 5. To calculate and confirm nonlinear transformer core magnetization characteristics 6. To perform short circuit and open circuit test of transformer using SIMULINK 7. To design 3-phase transformer using MATLAB 8. To study speed control techniques of DC motor using Simulink 9. To design DC machine using MATLAB 10. To design single phase transformer **Note: Minimum 8 experiments to be performed**					
References	1. https://in.mathworks.com/help/simscape/ug/electrical-transformer.html?s_tid=srchtitle_transformer_2 2. https://in.mathworks.com/help/sps/ug/nonlinear-transformer-characteristics.html?s_tid=srchtitle_transformer_5					

Course Title	Database Management Systems	Course Code	24UCSE08			
Specialization	Open Elective	Structure (LTPC)	3	0	2	5
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Fundamentals of Programming using C	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			

Course Objective:

The objectives are:

- To inculcate the basic understanding of the basic concepts and applications of database systems
- To inculcate understanding of the relational database design principles

Course Outcome:

After completion of the course, the student will be able to:

CO1. Recite the fundamental concepts of database management system
CO2. Understand basics of database systems, need of normalization
CO3. Demonstrate the basic elements of a relational database management system
CO4. Identify a suitable data model for a given problem
CO5. Explain the main issues related to transaction and data storage with probable solution

Contents of the course

Unit I

Database system architecture: - Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: - Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

Unit II

Entity Relationship Modelling: Entity Type, Entity Set, Attributes, Keys, Relationship Degree, Role Names, and Recursive Relationships, Weak Entity Sets, ER Modelling, subclasses, Superclass, inheritance. ER to Relational Mapping

Unit III

Relational query languages:- Relational algebra, Tuple and domain relational calculus, SQL latest version, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB latest version, SQL server. Relational database design: - Domain and data dependency, Armstrong's axiom, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: - Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit IV

Database consistency, ACID properties.

Concurrency control Techniques: Two-Phase Locking Techniques for Concurrency Control- Basic, Conservative, Strict, and Rigorous Two-Phase

	Locking. Deadlock Prevention Protocol, Deadlock Detection, Concurrency Control Based on Timestamp Ordering **Unit V** Disk Storage: Secondary Storage Device, Buffering of Blocks, Records and Record Types, Allocating File Blocks on Disk, and its operations, Hashing Techniques: Internal and External Hashing Techniques, Parallelizing Disk Access Using RAID Technology File structure: Indexing structure for files, Primary Indexes, Clustering Indexes, Secondary Indexes, Multilevel Indexes, Indexes on Multiple Keys
Textbook	1. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education.
References	1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.2. 2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press. 3. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

SYLLABUS

SECOND YEAR (SEMESTER-IV)

B.Tech (Electrical Engineering)

(Academic Session: 2024-2025 onwards)

<table>
<tr><td>Course Title</td><td>Analog and Digital Electronics</td><td>Course Code</td><td colspan="4">24UECE01
24UECE02</td></tr>
<tr><td>Specialization</td><td>Professional Core</td><td>Structure (LTPC)</td><td>2</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td>Offered for</td><td>UG</td><td>Status</td><td colspan="2">Core √</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty</td><td>SFET</td><td>Type</td><td colspan="2">New √</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Electrical and Electronics Engineering</td><td>To take effect from</td><td colspan="4">2024-2025</td></tr>
<tr><td>Submission date</td><td>23-07-2024</td><td>Date of approval by BoS</td><td colspan="4">25-07-2024</td></tr>
<tr><td>Course Objective:</td><td colspan="6">• The course introduces analysis of elementary analog and digital circuits. It will give a basis for understanding and constructing simple systems of analog and digital electronic circuit elements</td></tr>
<tr><td>Course Outcome:</td><td colspan="6">After completion of the course, the student will be able to:
CO1. To introduce components such as LED, seven segment display and frequency response of amplifier.
CO2. Understand the principal of operation, analysis and design of op-amp
CO3. Understand the basic number systems codes, logical gates and methods for simplifying Boolean expressions
CO4. To understand the concepts of sequential circuits.
CO5. To understand the concepts of combinational logic circuits.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Unit I: Introduction
LED, Seven Segment Display, cut-off frequency, bandwidth, effect of various capacitors on frequency response, low frequency response of CE amplifier, low frequency response of common source amplifier, high frequency response of CE amplifier, high frequency response of common source amplifier

Unit II: Operational Amplifier
Introduction to Operational Amplifier, symbol, Ideal Op-amp and its parameters, voltage transfer curve, open loop and closed loop configuration, basic op-amp applications, Ideal v/s practical Op-amp, monostable and astable multivibrator, comparator (non-inverting and inverting), Schmitt trigger

Unit III: Boolean Algebra and Digital Logic gates
Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, : Digital (binary) operations of a system, OR gate, AND gate, NOT, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations, De Morgan Laws, The K-Map Method, Product-of-Sums Simplification, Sum of Product, Don't-Care Conditions, NAND and NOR Implementation</td></tr>
</table>

	Unit IV: Combinational Logic Circuits Multiplexer, Demultiplexer, Decoder-Binary decoder, cascading, BCD to Decimal Decoder, BCD to Seven Segment Decoder, Encoder-Decimal to BCD encoder, Octal to Binary Encoder, Priority encoder **Unit V: Sequential Logic Circuits and Converters** One-bit memory cell, gated latches, Flip-flops-SR, D, JK, Master Slave, T, Conversion from one type of Flip-Flop to another, applications of flip flops, Shift registers-mode of operation and applications, ripple counters, Synchronous Counters, half adder, full adder, half subtractor, full subtractor Digital to Analog conversion, performance parameters of DAC, sources of errors in DAC, A/D converters, performance parameters of ADC, basic conversion techniques
Textbook	1. Integrated Electronics: Analog and Digital Circuits and Systems, 2/e, Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2010. 2. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011.
References	1. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series, 1988. 2. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series, 1994.
Laboratory Content	**List of Experiments** 1. To plot V-I Characteristics of Light Emitting Diode (LED) 2. To plot Common Emitter Amplifier Characteristics 3. To plot Common Source amplifier Characteristics 4. To perform operation of digital multiplexer 5. To study the Wien Bridge Oscillator and effect on Output Frequency with variation in RC combination 6. To study operation of Binary Half Adder 7. To realize of Boolean Expressions using Gates 8. To study and verify Truth Table of Binary Full Adder 9. To study and verify Truth Table of Binary Half Subtractor 10. To study 4-bit binary addition and subtraction operation 11. To study 8-bit binary addition and subtraction 12. To design and realize logic gates using universal gates 13. To design and realize of a R-S flip flop 14. To design and realize of a J-K flip flop 15. To design and realize of a D flip flop 16. To design and realize of a T flip flop **Note: Minimum 8 experiments to be performed**

Course Title	Electrical Machines-II	Course Code	24UELE08 24UELE09			
Specialization	Professional Core	Structure (LTPC)	3	0	2	5
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Electrical Machines-I	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	23-07-2024			

Course Objective:

- To introduce the concepts of ideal synchronous machines and poly-phase induction machines.
- Applications which will be utilized in the electrical machines with its performance and theory of operation.
- Study of special machines.

Course Outcome:

After the completion of the course the student will be able to:

CO1: Explain the theory of ideal synchronous machines and basic machine relation.

CO2: Analyze and apply the concept of parallel operation of alternators.

CO3: Analyze working and power developed in synchronous motors

CO4: Examine the starting and running performance of single-phase and three-phase induction motor.

CO5: Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

Contents of the course

Unit I: Synchronous Generators

General aspects of synchronous machines, basic principle, generator and motor action, production of sinusoidal alternating emf, relation between frequency, speed and number of poles, constructional features of synchronous machines, excitation systems, coil span factor, distribution factor, winding factor, generation of three-phase emf, emf equation, armature reaction, voltage regulation, synchronous impedance method, short circuit ratio, Losses in a Synchronous Machine and Efficiency

Unit II: Parallel Operation of Alternators

Necessity, Requirements of parallel operation of alternators, synchronizing alternators, conditions for proper synchronizing, synchronizing single phase and three-phase alternators, load sharing between two alternators, Load Sharing between Two Alternators, Effect of change in input power and excitation of one of alternator, effect of reactance and governor's characteristics, hunting

Unit III: Synchronous Motors

Working principle, equivalent circuit, phasor diagram, relation between supply voltage and excitation voltage, torques in synchronous motor, power developed in

	salient pole and cylindrical rotor motor, power flow, V-curves and Inverted V-curves, starting methods, synchronous condenser, characteristics, Applications, merits, demerits **Unit IV: Induction Motors** Three-phase Induction Motors: Constructional features, Production of revolving field, principle of operation, slip, frequency of rotor currents, speed of rotor field, Reversal of Direction of Rotation of Three-Phase Induction Motors, Induction Motor on No-load and on load, cogging, crawling, losses, power flow diagram, Relation between Rotor Copper Loss, Slip and Rotor Input, Torque Developed by an Induction Motor, Torque-slip Characteristics and Operating Region, no-load and blocked-rotor tests, Simplified Equivalent Circuit of induction motor, types, advantages, disadvantages, applications, starting and speed control, soft starters Single-phase Induction Motor: Nature of Field Produced, Torque, Equivalent Circuit, Methods to make Single-phase Induction Motor Self-starting, phasor diagram, torque-slip characteristics, types of single phase IM **Unit V: Special Purpose Machines** Construction and working of Servomotor, Stepper motor, Switched Reluctance motor, linear induction motor, universal motor
Textbook	1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017. 2. P. S. Bimbhra, "Electric Machinery", Khanna Publishers, 2nd Edition, 2021
References	1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 6th Edition 2017. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2018. 3. M. G. Say, "Performance and design of AC machines", CBS Publishers, First Edition 2008. 4. Sahdev S. K. "Electrical Machines", Cambridge University Press, 2018
Laboratory Content	**List of Experiments** 1. To study V curve of Three Phase Synchronous Motor 2. To study Inverse V curve of the Three Phase Synchronous Motor 3. To study Running and Reversing of Three Phase Induction Motor 4. To study No Load Test performed in a Three Phase Induction Motor 5. To study Block Rotor Test performed in a Three Phase Induction Motor 6. To study Speed-Torque characteristics in a Three Phase Induction Motor 7. To study Operational Working and Principle of Single Phase Induction Motor 8. To study the No-Load Test in a Single Phase Induction Motor 9. To study the Blocked Rotor Test in a Single Phase Induction Motor 10. To study Load Test in a Single Phase Induction Motor **Note: Minimum 8 Experiments to be performed**

Course Title	Signals and Systems	Course Code	24UECE03 24UECE04			
Specialization	Professional Core	Structure (LTPC)	2	0	2	4
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Engineering Mathematics-II	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			

Course Objective:	• To familiarize different types of signals and systems typically encountered in Communication engineering • To expose students to different transformation techniques to apply and analyze different real-life periodic and aperiodic signals to systems (typically LTI). • To provide valuable insights of complex systems/signals analyzed through different techniques learnt • To provide sufficient understanding of different types of signals and systems and transformation techniques for future courses in Signal Processing, Image processing and so on.
Course Outcome:	Students completing the course should be able to CO1: Understand and represent signals and perform basic operations on signals. CO2: Determine Fourier representations for continuous-time and discrete-time signals. CO3: Understand LTI systems CO4: Analyze and design signals and systems using transformation techniques. CO5: Use the unilateral Z transform. CO6: Apply the Fourier representation properties and z- transform properties to solve problems.
Contents of the course	**Unit I: Introduction to Signals and systems** Classification of signals, Continuous-time and discrete-time signals, Transformations of the independent variable, Exponential and sinusoidal signals, The unit impulse and unit step functions, Sa(x)/Sinc functions, Importance of sinc function, Continuous-time and discrete time systems, Basic system properties. **Unit II: Linear time-invariant systems** Discrete-time LTI systems: The convolution sum, Continuous-time LTI systems: The convolution integral, Properties of LTI systems, Causal LTI systems described by difference equations (Natural, Forced, and Complete Response) **Unit III: Representation of Periodic (Continuous Time & Discrete-Time) Signals Using Fourier Series** Explanation of Complex Exponentials, Response of LTI systems to complex

	exponentials, Trigonometric Fourier Series, Fourier series representation of continuous-time periodic signals, Convergence of the Fourier series (brief discussion only), Properties of continuous time Fourier series (CTFS), Fourier series representation of discrete-time periodic signals, Properties of Discrete-time Fourier series(DTFS) **Unit-IV: Continuous-time Fourier transform** (i) Representation of aperiodic signals: the continuous-time Fourier transform (CTFT), The Fourier transform for periodic signals, Properties of continuous-time Fourier transform, Fourier transform pairs; (ii) Introduction to sampling: Sampling theorem, Nyquist frequency; (iii) The discrete-time Fourier transform: Representation of aperiodic signals: the discretetime Fourier transform (DTFT), The Fourier transform for discrete periodic signals, Properties of discrete-time Fourier transform, Fourier transform pairs, Duality. **Unit V: Z-transformation** The Z-transform, The region of convergence (ROC) for the Ztransform, The inverse Z-transform, Properties of the Z-transform, Z-transform pairs, Analysis and characterization of LTI systems using Z-transforms. The unilateral Z-transform and solution of difference equations.
Textbook	1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP. 2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.
References	1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed., 2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH 3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition. 4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, 3 Ed., 2004, PE. 5. Signals and Systems – K. Deergha Rao, Birkhauser, 2018.
Laboratory Content	**List of Experiments** 1. Introduction to MATLAB functions. 2. Plotting discrete and continuous time signals. 3. Calculation of energy and power of signals. 4. Basic Operations of signals. 5. Impulse response and step response of LTI systems 6. Discrete and Continuous convolution 7. Solution of difference equations to find the zero input and the zeros state responses. 8. Obtaining the Fourier series of a given signal. Displaying partial sums. 9. Obtaining the Fourier Transform of a given signal and plotting its spectrum 10. Verification of properties of Fourier representations of continuous signals. 11. Obtaining the DTFT of a given signal. Verification of its properties. 12. Obtaining the impulse response and frequency response of a LTI system from its Z-Transform. 13. Study of Analog Filters Using MATLAB **Note: Minimum 8 Experiments to be performed**

Course Title	Automatic Control System	Course Code	24UELE10 24UELE11			
Specialization	Professional Core	Structure (LTPC)	3	0	2	5
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Basic Electrical and Electronics Engineering, Engineering Mathematics-II	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	To equip the students with the concepts in automatic control systems					
Course Outcome:	After the completion of course, the student will be able: CO1: To know different basic concepts, components of a control system and transfer functions of basic control system components. CO2: To perform stability analysis using time domain response on a given system CO3: To perform stability analysis using frequency domain response on a given system CO4: To understand and analyze state variable technique. CO5: To design and analyze controllers and compensators.					
Contents of the course	**Unit I: Mathematical Modelling of Systems** Introduction, Examples of control systems, Open loop and closed loop control system, mathematical modelling of: electrical systems, mechanical systems, thermal systems, transfer functions, transfer function of armature controlled and field-controlled DC motor, electrical analogues of other dynamical systems, Block diagrams, block diagram reductions, Signal flow graph, Mason's gain formula, block diagram from signal flow graph **Unit II: Time response of dynamical systems** Test input signals for transient analysis, time response of first order and second order system (with unit step, unit ramp and unit impulse input), time-domain specifications and their formulae, Error analysis **Unit III: Stability and Frequency domain analysis** Definition of stability. Routh-Hurwitz criterion, Bode plot, frequency domain specifications, correlation between time and frequency response, Nyquist plot, Nyquist stability criterion, gain and phase margins, robustness, Root Locus Technique: Definitions - Root locus diagram - Rules to construct root loci - Effect of pole-zero additions on the root loci					

	Unit IV: State Space Analysis State space analysis advantages, state space representation, solution of time invariant state equation, transfer matrix, computation of state transition matrix, block diagram of linear system in state variable form, controllability and observability (Time variant systems) **Unit V: Controllers and Compensators** Basic idea of feedback control systems. Error analysis. P, PI, PD, PID controller, action, Lead compensator, lag compensator, lead-lag/lag-lead compensators
Textbook	1. H. Saeed, Automatic Control System, Katson Books, 2013 2. Katsuhiko Ogata, 'Modern Control Engineering', Pearson Education Publishers, 5th Edition, 2010. 3. Nagrath I.J. and Gopal M, 'Control Systems Engineering', New Age International Publications, 5th Edition, 2010. 4. Benjamin C. Kuo and Farid Golnaraghi, 'Automatic Control Systems', John Wiley & Sons Publications, 8th Edition, 2002.
References	1. Richard C. Dorf and Robert H. Bishop. 'Modern Control Systems', Pearson Prentice Hall Publications, 12th Edition, 2010. 2. Gene F. Franklin, J. David Powell and Abbas Emami-Naeini, 'Feedback Control of Dynamic Systems', Pearson Education India Publications, 6th Edition, 2008
Laboratory Content	**List of Experiments** 1. To simulate saw tooth, sine, triangular and ramp inputs signals using MATLAB 2. To study block diagram reduction technique using MATLAB 3. To simulate DC motor characteristics using MATLAB 4. To determine poles and zeros of a transfer function using MATLAB 5. To determine the transfer function for given closed loop system in block diagram representation 6. To plot unit step response of given transfer function and finds delay time, rise time, peak time and peak overshoot 7. To study stability analysis of a given transfer function using bode plot in MATLAB 8. To study stability analysis of a given transfer function using root locus in MATLAB 9. To study stability analysis of a given transfer function using Nyquist plot in MATLAB 10. To determine the steady state errors of a given transfer function 11. To study the effect of variation of Kp , Kd and Ki of PID controller on system parameters 12. To study state space model for classical transfer function using MATLAB 13. To study the characteristics of a small AC servomotor and determine its transfer function 14. To design, implement and study the effects of different cascade compensation networks for a given system 15. To study the performance characteristics of a DC motor speed control system 16. To design lead, lag and lag-lead compensator using MATLAB **Note: Minimum 8 Experiments to be performed**

SYLLABUS

for

B.Tech. (Electrical Engineering)

MINOR/HONS. in

Electric Vehicles

(Academic Session: 2024-2025 onwards)

Scheme of Minor/Hons. in Electric Vehicles																
Course Code	Course Name	Credits				Hrs				Marks						
										Theory(T)			Practical(P)			Total
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)
24UELE21 24UELE22	Fundamentals of Electric Vehicles & Hybrid Vehicles	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100
24UELE23	EV Battery Technology	3	0	0	3	45	0	0	45	30	70	100	0	0	0	100

Course Title	Fundamentals of Electric Vehicles & Hybrid Vehicles	Course Code	24UELE21 24UELE22			
Specialization	Minor/Hons.	Structure (LTPC)	3	0	1	4
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New √		Modification	
Pre-requisite	Basics of Electrical and Electronics Engineering	To take effect from	2024-2025			
Submission date	23-07-2027	Date of approval by BoS	25-07-2027			
Course Objective:	To understand the basic principles, operation, performance of Electric Vehicles					
Course Outcome:	After the completion of course, the student will be able to: CO1: Gain knowledge about components and layout of electric vehicle CO2: Understand layout and components of hybrid electric vehicle CO3: Acquire knowledge of electric vehicle fundamentals CO4: Understand working and operations of various motors used in electric vehicles CO5: Gain knowledge of Indian and global scenario of electric vehicles					
Contents ofthe course	**Unit I: Electric Vehicles** History, Components of Electric Vehicles, general layout of EV, EV classification, comparison with internal combustion engine: technology, advantages & disadvantages of EV, Overview of Tesla Car **Unit II: Hybrid Electric Vehicles** History, components of hybrid EV, general layout of hybrid EV, comparison with EV, advantages & disadvantages of HEV, overview of Toyota Prius **Unit III: Vehicle Fundamentals** Vehicle resistance, Types: Rolling resistance, grading resistance, aerodynamic drag vehicle performance, calculating the acceleration force, maximum speed, finding the total tractive effort, torque required on drive wheel, Transmission: Differential, clutch & gear box, braking performance **Unit IV: Motors** Principle and working of DC motors, Characteristics and types of DC motors, speed torque characteristics of Permanent magnet motor, BLDC motor, induction motor, comparison of all motors in context with EVs					

	Unit V: Indian and Global Scenario Technology Scenario, Market Scenario, Policies and Regulations, Payback and Commercial model, Policies in India
Textbook	1. Electric Vehicle Technology Explained by J. Lowry and J. Larminie, 2nd Edition, Wiley Publications 2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design by M. Ehsani, Yimin Gao, Stefano Lono and Kamiz Ebrahimi, 3rd Edition, CRC Press 3. Power Electronics and Applications Series, Second Edition, By Bei Gou, Woonki Na, Bill Diong, CRC Press 4. Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Husain, 3rd Edition, CRC Press
References	1. Build Your Own Electric Vehicle by Seth Leithman and B. Brant, 3rd Edition, McGraw Hill TAB 2. Introduction to Hybrid Vehicle System Modeling and Control by Wei Liu, Wiley Publication
	List of Experiments 1. To study three phase induction motor 2. To study speed control of DC shunt motor 3. To study speed control of BLDC motor 4. To study speed reversal of BLDC motor 5. To study various elements of transmission systems (clutch, differentials, gearbox etc.) 6. To calculate and compare the brake power, torque and mechanical efficiency of IC engine and electrical motor of same configuration 7. To study various types of braking systems 8. Case study of Tesla car or any EV 9. Case study of Toyota Prius or any hybrid EV **Note: Minimum 8 Experiments to be performed**

	Battery Formation, Effects of Excessive Heat on Battery Cycle Life, Failure modes of battery, Battery Storage **UNIT IV: EV Battery Capacity and Performance** Battery Capacity, The Temperature Dependence of Battery Capacity, State of Charge of a VRLA Battery, Energy Balances for the Electric Vehicle, Electrical insulation breakdown detection, battery pack safety, Building Standards **UNIT V: Energy Management System** In vehicle Networks: CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of energy management strategies and implementation issues of energy management strategies
Textbook	1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles by M. Ehsani, Y. Gao, S.Longo and K. Ebrahimi, CRC Press, 2018 2. Supercapacitors-Materials, Systems and Applications by F. Beguin and E. Frackowiak, Wiley-VCH Verlag GmbH & Co., 2013 3. Electric Vehicle Battery Systems by S. Dhameja, Newnes, 2002
References	1. Electric Vehicle Components and Charging Technologies by S. Singh, S. Gairola and S. Dwivedi, The Institution of Engineering and Technology, 2024 2. Fuel Cells and Hydrogen: From Fundamentals to Applied Research by V. Hacker, S. Mitsushikam, Elsevier, 2018

SYLLABUS

for

Minor Degree in

Cyber Security

(Academic Session: 2024-2025 onwards)

Minor Degree in Cyber Security Structure																			
S. No.	Course Code	Course Title	Hours per week			Credits	Total Hours per semester				Category	Theory Marks			Practical Marks			Total Marks
			L	T	P	C	L	T	P	TO		I	E	TO	I	E	TO	
1	24UCEM01 24UCEM02	Information Theory for Cyber Security	3	0	2	4	45	0	60	105	ME	30	70	100	15	35	50	150
2	24UCEM03 24UCEM04	Data Encryption and Compression	3	0	2	4	45	0	60	105	ME	30	70	100	15	35	50	150
3	24UCEM05	Steganography and Digital Watermarking	3	0	0	3	45	0	0	45	ME	30	70	100	0	0	0	100
4	24UCEM06	Security Assessment and Risk Analysis	3	0	0	3	45	0	0	45	ME	30	70	100	0	0	0	100
5	24UCEM07 24UCEM08	Database Security and Access Control	3	0	2	4	45	0	60	105	ME	30	70	100	15	35	50	150
Total			**15**	**0**	**6**	**18**	**225**	**0**	**180**	**405**	**21**	**150**	**350**	**500**	**45**	**105**	**150**	**650**

Chairperson
SDCT, SFET
SVSU

Syllabus

Course Code: Theory: 24UCEM01 Lab: 24UCEM02	**Information Theory for Cyber Security**	**Credits: 4** (L-T-P-C): (3-0-2-4)	Int. Th. Examination: 30 Ext. Th. Examination: 70 Duration of Exam: 3 hours	
Offered for	UG	Course Type	Core	Elective √
Date of BoS Approval	July, 2024	Course Status	New √	Modification
To take effect from	2024-25	Prerequisite	NIL	

Course Objective:

The objective of this course is to provide an insight to information coding techniques, error correction mechanisms for cyber security.

Course Content:

Unit I

Shannon's foundation of Information theory, Random variables, Probability distribution factors, Uncertainty/entropy information measures, Leakage, Quantifying Leakage and Partitions, Lower bounds on key size: secrecy, authentication and secret sharing. provable security, computationally-secure, symmetric cipher.

Unit II

Secrecy, Authentication, Secret sharing, Optimistic results on perfect secrecy, Secret key agreement, Unconditional Security, Quantum Cryptography, Randomized Ciphers, Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.

Unit III

Information-theoretic security and cryptography, basic introduction to Diffie-Hellman, AES, and side-channel attacks.

Unit IV

Secrecy metrics: strong, weak, semantic security, partial secrecy, Secure source coding: rate-distortion theory for secrecy systems, side information at receivers, Differential privacy, Distributed channel synthesis.

Unit V

Digital and network forensics, Public Key Infrastructure, Lightweight cryptography, Elliptic Curve Cryptography and applications.

Suggested Text/ Reference Books:

1. Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley & Sons.
2. Communication Systems: Analog and digital, Singh and Sapre, Tata McGraw Hill.
3. Fundamentals in information theory and coding, Monica Borda, Springer.
4. Information Theory, Coding and Cryptography R Bose.
5. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House.
6. Multimedia System Design, Prabhat K Andleigh and Kiran Thakrar.

Course Outcomes:

After completion of course, students would be able:
CO1. To introduce the principles and applications of information theory.
CO2. To justify how information is measured in terms of probability and entropy.
CO3. To learn coding schemes, including error correcting codes.

Course Code: Theory: 24UCEM03 Lab: 24UCEM04	**Data Encryption and Compression**	**Credits: 4** (L-T-P-C): (3-0-2-4)	Int. Th. Examination: 30 Ext. Th. Examination: 70 Duration of Exam: 3 hours	
Offered for	UG	Course Type	Core	Elective √
Date of BoS Approval	July, 2024	Course Status	New √	Modification
To take effect from	2024-25	Prerequisite	NIL	

Course Objective:

This course will cover the concept of security, types of attack experienced, encryption and authentication to deal with attacks, what is data compression, need and techniques of data compression.

Course Content:

Unit I

Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.

Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Unit II

Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm.

Unit III

Case Studies of Cryptography: Denial of service attacks, IP spoofing attacks, Conventional Encryption and Message Confidentiality, Conventional Encryption Algorithms, Key Distribution.

Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management, Firewall.

Unit IV

Introduction: Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Requirements of data compression, Classification.

Methods of Data Compression: Data compression-- Lossless & Lossy.

Unit V

Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term).

Recent trends in encryption and data compression techniques.

Suggested Text/ Reference Books:

1. Cryptography and Network Security, Mohammad Amjad, John Wiley & Sons.
2. Cryptography & Network Security by Atul Kahate, TMH.
3. Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley & Sons.
4. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
5. The Data Compression Book by Nelson, BPB.
6. Cryptography & Network Security, V.K. Jain, Khanna Publishing House.

Course Outcomes:

At the end of this course the student will have the knowledge of

CO1. plain text, cipher text,
CO2. RSA and other cryptographic algorithm, Key Distribution
CO3. communication model,
CO4. various models for data compression.

Course Code: Theory: 24UCEM05	**Steganography and Digital Watermarking**	**Credits: 3** (L-T-P-C): (3-0-0-3)	Int. Th. Examination: 30 Ext. Th. Examination: 70 Duration of Exam: 3 hours	
Offered for	UG	Course Type	Core	Elective √
Date of BoS Approval	July, 2024	Course Status	New √	Modification
To take effect from	2024-25	Prerequisite	NIL	

Course Objective:

The objective of course is to provide an insight to steganography techniques. Watermarking techniques along with attacks on data hiding and integrity of data is included in this course.

Course Content:

Unit I

Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.).

Steganalysis: Active and Malicious Attackers, Active and passive Steganalysis.

Unit II

Frameworks for secret communication (pure steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive).

Unit III

Steganography techniques: Substitution systems, SpatialDomain, transform domain techniques, Spread spectrum, Statistical steganography.

Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets.

Unit IV

Digital Watermarking: Introduction, Difference between Watermarking and Steganography, Classification (Characteristics and Applications), types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Watermark security & authentication.

Unit V

Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.

Suggested Text/ Reference Books:

1. Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.
3. Information Hiding: Steganography and Watermarking - Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.
4. Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas.

Course Outcomes:

At the end of this course the student will have the knowledge of

CO1. plain text, cipher text,
CO2. RSA and other cryptographic algorithm, Key Distribution,
CO3. communication model,
CO4. various models for data compression.

Course Code: Theory: 24UCEM06	**Security Assessment and Risk Analysis**	**Credits: 3** (L-T-P-C): (3-0-0-3)	Int. Th. Examination: 30 Ext. Th. Examination: 70 Duration of Exam: 3 hours	
Offered for	UG	Course Type	Core	Elective √
Date of BoS Approval	July, 2024	Course Status	New √	Modification
To take effect from	2024-25	Prerequisite	NIL	

Course Objective:

Describe the concepts of risk management in information security. Define and differentiate various Contingency Planning components. Define and be able to discuss incident response options, and design an Incident Response Plan for sustained organizational operations.

Course Content:

Unit I

SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security countermeasures-education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security countermeasures-policy, procedures and practices, threats, vulnerabilities.

Unit II

Threats to and Vulnerabilities of Systems: Threats, major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS).

Countermeasures: assessments (e.g., surveys, inspections).
Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis and implementation of controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information).

Unit III

Security Planning: directives and procedures for policy mechanism.

Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event.

Unit IV

Personnel Security Practices and Procedures: access authorization/verification (need-to-know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel.

Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs.

Unit V

Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography-encryption (e.g., point-to-point, network, link).

Case study of threat and vulnerability assessment.

Suggested Text/ Reference Books:

1. Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, John Wiley & Sons.
2. Principles of Incident Response and Disaster Recovery, Whitman & Mattord, Course Technology ISBN: 141883663X.

Corresponding Online Resources:

1. Introduction to Cyber Security, https://swayam.gov.in/nd2_nou20_cs01/preview
2. (Web Link) http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf

Course Outcomes:

After completion of course, students would be able:

CO1. To apply contingency strategies including data backup and recovery and alternate site selection for business resumption planning

CO2. To be Skilled to be able to describe the escalation process from incident to disaster in case of security disaster.

CO3. To Design a Disaster Recovery Plan for sustained organizational operations.

Course Code: Theory: 24UCEM07 Lab: 24UCEM08	Database Security and Access Control	Credits: 4 (L-T-P-C): (3-0-2-4)	Int. Th. Examination: 30 Ext. Th. Examination: 70 Duration of Exam: 3 hours	
Offered for	UG	Course Type	Core	Elective √
Date of BoS Approval	July, 2024	Course Status	New √	Modification
To take effect from	2024-25	Prerequisite	NIL	

Course Objective:

The objective of the course is to provide fundamentals of database security. Various access control techniques mechanisms were introduced along with application areas of access control techniques.

Course Content:

Unit I

Introduction to Access Control, Purpose and fundamentals of access control.

Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.

Unit II

Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access Control policy, Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments.

Unit III

Personnel Security Practices and Procedures: access authorization/verification (need-to-know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel.

Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs.

Unit IV

Smart Card based Information Security, Smart card operating system-fundamentals, design and implantation principles, memory organization, smart card files, file management. PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

Unit V

Cloud Data Security: Recent trends in Database security and access control mechanisms. Cloud Data Audit: Intro, Audit, Best Practice, Key management, Cloud Key Management Audit.

Suggested Text/ Reference Books:

1. Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.

Corresponding Online Resources:

1. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.
2. Advanced System Security Topics, https://www.coursera.org/lecture/advancedsystem-security-topics/role-based-access-contr ol-rbac-bYvzS.

Course Outcomes:

After completion of course, students would be able:
CO1. To understand and implement classical models and algorithms.
CO2. To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
CO3. To assess the strengths and weaknesses of various access control models and to analyze their behaviour.

Scheme and Syllabus

B.Tech (Electrical Engineering)

Minor Specialization: Robotics

(Academic Session: 2024-2025 onwards)

Scheme of Minor Specialization in Robotics																
Course Code	Course Name	Credits				Hrs				Marks						
										Theory(T)			Practical(P)			Total
		L	T	P	C	L	T	P	TO	I	E	TO	I	E	TO	(T+P)
24URBA01 24URBA02	Fundamentals of Robotics System	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100
24URBA14 24URBA15	Kinematics and Dynamics of Robot	2	0	1	3	30	0	30	60	15	35	50	35	15	50	100
24URBA20 24URBA21	Industrial Robotics and Material Handling	2	0	1	3	30	0	30	60	15	35	50	35	15	50	100
24URBA22 24URBA23	Mobile Robots	3	0	1	4	45	0	30	75	15	35	50	35	15	50	100
24URBA29 24URBA30	Robotic Design and Control	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
	Total	12	0	6	18	180	0	180	360	75	175	250	175	75	250	500

Chairperson
SDGT
SVSU

Dean Engineering
Shri Vishwakarma Skill University

Fundamental of Robotic System

Code: 24URBA01

Credit	Hour	Marks		
3	45	I	E	TO
		15	35	50

Course Objective:

This subject provides a comprehensive understanding of the core principles and components of robotic systems, including their design, operation, and control. It aims to equip students with the foundational knowledge necessary to analyse and develop robotic systems for various applications.

Course Outcomes:

CO1: List the primary components and fundamental concepts in robotics.
CO2: Describe the roles of sensors, actuators, and control systems in a robotic System. CO3: Demonstrate the use of robotic programming languages and simulation tools to model robotic behaviours.
CO4: Analyse the performance of different control strategies and their effects on robotic motion and accuracy.
CO5: Design and program a robotics system.

Unit-I

Introduction: Specifications of Robots (Manipulator & controller)- Classifications of robots, Flexible automation versus Robotic technology, Applications of Robots Operators, Translations, Rotations and Transformation.

Unit-II

Robot Drives and Power Transmission Systems: Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drive. Mechanical transmission method - Gear transmission link - Rod systems - Rotary-to-Rotary motion conversion. Applications - MIG & BIW welding lines, Handling system.

Unit-III

Manipulators: Overview and types of Construction of Manipulators, Manipulator Force Control, Electronic and Pneumatic manipulators, Robotic ARM, Application and importance in robotics

Unit-IV

Robot end Effectors: Classification of End effectors. Drive system for Grippers-Mechanical adhesive vacuum-magnetic-grippers. Hooks & scoops. Active and passive grippers.
Application: Robotic Gun, welding torch, Gripper, Automatic Tool changer.

Unit-V

Path planning Tools: Trajectory planning and avoidance of obstacles, path planning, joint integrated motion – straight line motion, Industry use cases, Advancement in path planning.

Text Books:

1. T. Papalambros and D. J. Wilde, "Principles of Robotic Design: From Theory to Practice," Cambridge University Press, 2022.
2. Anna B. Shishika, "Robotics: Concepts, Algorithms, and Systems," Springer, 2023.
3. Oussama Khatib and Bruno Siciliano, "Fundamentals of Robotics: A Hands-On Approach," Springer, 2021.
4. Albert Y. Wong and H. B. Kwan, "Introduction to Robotic Systems and Automation," CRC Press, 2022.

Reference Book:

1. Natalie K. McMillan and David E. Smith, "Foundations of Robotic Systems: Design, Analysis, and Control," Springer, 2021.
2. Luca G. Desimone, "Robotics Fundamentals: Modeling, Control, and Applications," Academic Press, 2022.
3. Samuel D. Clarke and Jodie G. Lee, "Robotic Systems: An Introduction to Fundamentals," Routledge, 2023.

Fundamental of Robotic System Lab

Code: 24URBA02

Credit	Hour	Marks		
1	30	I	E	TO
		35	15	50

List of Experiments:

1. Familiarize with the basic components and terminology used in robotics 2.
Study of different types of robots based on configuration and application.
3. Study of different type of links and joints used in robots
4. Study of components of robots with drive system and end effectors.
5. Determination of maximum and minimum position of links.
6. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
7. Estimation of accuracy, repeatability and resolution.
8. Robot programming exercises.
9. Use and Apply Path Planning Tools.

Kinematics and Dynamic of Robot

Code: 24URBA14

Credit	Hour	Marks		
2	30	I	E	TO
		15	35	50

Course objective: This includes studying the motion (kinematics) and forces (dynamics) involved in robotic manipulation, and applying these concepts to solve problems related to robot motion planning, control, and performance optimization.

Course outcome:

CO1: Define and recall key concepts and terminology related to kinematics and dynamics of robotic systems, including types of motion, force analysis, and robot configuration.
CO2: Understand and Analyze robotic systems to identify and resolve issues related to kinematic and dynamic performance.
CO3: Apply the control mechanism and Analyse it.
CO4: Apply kinematic and dynamic models to solve practical problems in robot motion planning and control
CO5: Design and develop robotic systems.

Unit-I

Introduction to kinematics: Introduction, Link, Pair, chain, mechanism, Degree of freedom, four bar mechanism, slider crankmechanism, inversion. Equivalent linkages,Forward and inverse kinematics.

Unit-II

Kinematics of Rigid Body: Translation, rotation, Velocity of point and link, linear and angular velocities, absolute and relative velocity in plane motion, acceleration of a point and link, relative acceleration, instantaneous Centre, Coriolis acceleration.

Unit-III

Dynamic force analysis: Forces and torques, mass and weight, mass moment of inertia, laws of motion, static forces, dynamic forces, dynamic forces in mechanisms, Dynamic modelling.

Unit-IV

Spatial linkages: Introduction to spatial mechanisms, robotic mechanisms, Dynamics and Kinematics integration.

Unit-V

Balancing: Need of balancing, balancing of rotating masses, single plane, different planes, balancing and balancing machines.

Text Books:

1. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modeling and Control (2nd Edition)," Wiley, 2022.

2. R. C. Dubois and J. M. F. Silva, "Robotic Kinematics and Dynamics," Springer, 2023.
3. L. Sciavicco and B. Siciliano, "Modeling and Control of Robot Manipulators (3rd Edition)," Springer, 2022.
4. Oussama Khatib, "Robotics: Control, Sensing, Vision, and Intelligence," McGraw-Hill Education, 2021.

Reference Books:

1. C. A. Requicha and F. C. Park, "Kinematics and Dynamics of Robotic Systems," Elsevier, 2023.
2. S. R. M. Rajeev, "Fundamentals of Robotics: Kinematics, Dynamics, and Control," CRC Press, 2022.
3. H. K. B. K. Andreadis, "Dynamic Modeling and Control of Robots," Springer, 2023.

Kinematics and Dynamic of Robot Lab

Code: 24URBA15

Credit	Hour	Marks		
		I	E	TO
1	30	35	15	50

List of Experiments

1. Study of gear parameters.
2. Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
3. Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
4. Kinematics of single and double universal joints.
5. Determination of Mass moment of inertia of Fly wheel and Axle system.
6. Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
7. Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
8. Motorized gyroscope – Study of gyroscopic effect and couple.
9. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.Cams – Cam profile drawing, Motion curves and study of jump phenomenon
10. Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
11. Multi degree freedom suspension system – Determination of influence coefficient.

a) Determination of torsional natural frequency of single and Double Rotor systems. - Undamped and Damped Natural frequencies.

b) Vibration Absorber – Tuned vibration absorber.

Vibration of Equivalent Spring mass system – undamped and damped vibration

Industrial Robotics & Material Handling System

Code: 24URBA20

Credit	Hour	Marks		
2	30	I	E	TO
		15	35	50

Course Objective: The students will understand the principles and applications of industrial robotics and material handling systems, including robot kinematics, dynamics, and control. They will gain practical skills in designing, programming, and integrating robotic systems for efficient and automated material handling.

Course Outcomes:

CO1: Explain the applications and benefits of industrial robots and material handling systems in automated manufacturing processes
CO2: Apply theoretical knowledge to design basic robotic systems and material handling solutions for specific industrial tasks.
CO3: Analyze the performance and efficiency of various robotic systems and material handling methods, identifying strengths and areas for improvement.
CO4: Evaluate and design different robotic systems and material handling strategies, considering factors such as cost, efficiency, and integration feasibility. CO5: To Design the robot in real time.

Unit-I
Introduction: Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

Unit-II
Robots For Inspection: Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

Unit-III
Other Applications: Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications,sensor integration, Robot picking and packing

Unit-IV
End Effectors: Gripper design, degrees of freedom, Types of end effectors & their uses, Introduction to Robotic Arm and its Application, Safety Standards and Regulations (ISO, ANSI), Risk Assessment and Safety Protocols, Human-Robot Interaction and Safety Measures.

Unit-V

Material Handling: Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles, Future challenges.

Textbooks:

1. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, **"Robot Modeling and Control (2nd Edition),"** Wiley, 2022.
2. Mikell P. Groover,"Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley & sons, Inc, 2007.
3. John J. Craig, **"Introduction to Robotics: Mechanics and Control (4th Edition),"** Pearson, 2021.

Reference:

1. S. K. Saha, "Introduction to Robotics: Analysis, Control, Applications," McGraw-Hill Education, 2021.
2. Provides a detailed introduction to robotics, with emphasis on analysis and control of robotic arms.
3. Yoshikazu Kondo, "Robotic Arm Dynamics and Control," Springer, 2021.

Industrial Robotics & Material Handling System Lab

Code: 24URBA21

Credit	Hour	Marks		
1	30	I	E	TO
		35	15	50

1. Study the mechanical structure, control systems, and power supply of a robot.
2. Learn the robot programming interface (e.g., teach pendant or software).
3. To integrate sensors with an industrial robot for enhanced functionality.
4. Use of direction control valve and pressure control valves clamping devices for jig and fixture.
5. Study of robotic arm and its configuration.
6. Study the robotic end effectors.
7. Study of different types of hydraulic and pneumatic valves.
8. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves.
9. Study of power steering mechanism using cut piece model.
10. To integrate vision systems with robots for enhanced functionality.
11. Design and assembly of hydraulic / pneumatic circuit.

Mobile Robots

Code: 24URBA22

Credit	Hour	Marks		
3	45	I	E	TO
		15	35	50

Course Objective: The students will understand the fundamental principles and applications of mobile robots, including kinematics, control systems, sensor integration, and navigation algorithms. They will gain practical skills in programming and deploying mobile robots using contemporary tools and technologies, preparing them for advanced studies or careers in robotics

Course Outcomes:

CO1: Grasp the foundational principles of robotics, including mechanics, electronics, and programming.
CO2: Understand the components and architecture of mobile robots, such as sensors, actuators, microcontrollers, and communication systems.
CO3: Integrate various sensors like cameras, LiDAR, ultrasonic sensors, etc CO4: Apply the Robotics knowledge in current scenario..
CO5: to design algorithms for robot navigation in various environments, including obstacle avoidance, path planning, and localization techniques

UNIT-I

Introduction of Mobile Robots and Locomotion: A brief history of mobile robotics, Recent advances in the mobile robotics for RISE (Risky Intervention and Surveillance Environment) applications, Locomotion, Key issues in locomotion, legged, wheeled and aerial mobile robots.

UNIT-II

Mobile Robot Kinematics: Introduction, robot position, forward kinematic models, mobile robot workspace with degree of freedom, Holonomic robots, beyond basic kinematics, motion control (kinematic control)

Perception: wheel/motor encoders, heading/orientation sensors, ground based beacons, active ranging, motion/speed sensors, vision-based sensors.

UNIT-III

Mobile Robot Localization: Introduction, The Challenge of Localization: Noise and Aliasing, To Localize or Not to Localize: Localization-Based Navigation versus Programmed Solutions, Map Representation and decomposition strategies, State of the art: current challenges in map representation, Probabilistic Map-Based Localization.

UNIT-IV

Control of multiple robot: Principles and Problems of Multiple-Robot System, A Brief History of Multiple Robots, Control Issues in Autonomous-Robot Colonies, Case Study: Centralized Control of Very Simple Robot, Some Multiple-Robot Architectures, Swarm and Cellular Robotics, Communication among Multiple Robots, Formation Control, Robot Soccer, Heterogeneous Robot Teams.

Unit V

Arduino: Introduction to Arduino, Pin configuration and architecture, Device and platform features., Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform III, Review of Basic Concepts, Arduino data types, Variables and constants, Operators, Control Statements, Arrays, Functions Arduino I/O Functions, basics of Arduino programming.

Text Books:

1. Herman Bruyninckx, "Mobile Robot Localization and Mapping," Springer, 2022.
2. R. C. Smith and P. Cheeseman, "Opening the Black Box: Mobile Robot Localization and Mapping," Springer, 2023.
3. John L. Crassidis and John L. Junkins, "Optimal Estimation of Dynamic Systems," CRC Press, 2022.

Reference:

1. G. C. Hsiao and Y. D. Shih, "Advanced Mobile Robots: Theory and Practice," Elsevier, 2022.
2. A. C. F. Dean and G. P. H. T. Chien, "Introduction to Mobile Robotics," Cambridge University Press, 2022.
3. Rajeev K. Gupta and S. A. C. Kim, "Mobile Robotics: Navigating the Real World," Springer, 2023.

Mobile Robots Lab

Code: 24URBA23

Credit	Hour	Marks		
		I	E	TO
1	30	35	15	50

List of Experiments

1. To study Line follower robot

   Students will study different types of line followers such as with and without microcontroller, then assemble a line follower robot using Arduino. They will do Arduino programming by themselves for line follower.

2. To study Bipedal Humanoid Robot

   Students will study difference between legged and wheeled robot. They will assemble a robot having legged with Arduino. They will do Arduino programming by themselves for legged robot.

3. To study Remote-Controlled Robot

   Students will study different types of remote-controlled robot having joystick or Bluetooth, then assemble a robot having Bluetooth with Arduino using Arduino. They will do Arduino programming by themselves for the remote-controlled robot.

4. To study Multipurpose Bot

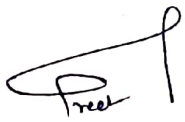
   Students will study how to use robotics in agriculture where lots of jobs are done at a time, then assemble a robot for the same.

5. To study Balancing Robot

   Students will study different types of balancing robots with and without Arduino, then assemble a robot having two wheeled with Arduino using Arduino. They will do Arduino programming by themselves for balancing robot.

6. To study Self-Watering Plant robot

   Students will study different types of self-watering robot having Arduino, then assemble a robot having Arduino using Arduino. They will do Arduino programming by themselves for self-watering plant robot.



Robotics Design and control

Code: 24URBA29

Credit	Hour	Marks		
2	30	I	E	TO
		15	35	50

Course Objective: The students will master the principles of robot design and control, including mechanical design, actuator and sensor integration, and the implementation of control algorithms. They will gain hands-on experience in designing, building, and programming robots, equipping them with the skills necessary for advanced robotics projects and professional applications Course Outcome:

CO1: Understand the fundamental principles of robotics
CO2: Knowledge of stability in robotics
CO3: Design and implement control algorithms for robotic systems CO4: Analyze complex problems in robotics.
CO5: develop innovative solutions usingInter disciplinary approaches.

Unit-I

Introduction & Overview of Robotic Systems & Their Dynamics: Forward and inverse dynamics. Properties of the dynamic model and case studies. Introduction to nonlinear systems and control schemes.

Unit-II

System Stability & Types of Stability: Lyapunov stability analysis, both direct and indirect methods. Lemmas and theorems related to stability analysis. Control of Robotic Systems, PID control, State-space representation, Trajectory planning and control.

Unit-III

Joint Space & Task Space Control Schemes: Position control, velocity control, trajectory control and force control.

Unit-IV

Nonlinear Control Schemes: Proportional and derivative control with gravity compensation, computed torque control, sliding mode control, adaptive control, observer-based control, robust control and optimal control.

Unit-V

Nonlinear Observer Schemes: Design based on acceleration, velocity and position feedback. Numerical simulations using software packages, Introduction to ROS and its Applications

Text Books:

1. Luis Payá and Fernando Torres, "Robot Path Planning and Cooperation: Strategies and Applications," Springer, 2020.

2. Aleksandar Rodic and Miomir Vukobratovic, "Robotics: Applications and Future Prospects," IntechOpen, 2021.
3. Edward X. Liu, "Advanced Control of Wheeled Inverted Pendulum Systems," CRC Press, 2021.
4. Olga Ivashchenko and Rustam Aliev, "Robotic Process Automation: A Guide to the Future of Work," Springer, 2022.

Reference:

1. Lentin Joseph, "Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy," Apress, 2021.
2. Francisco M. González-Longatt and Juan Carlos Hernández, "Control Applications for Biomedical Engineering Systems," Elsevier, 2021.
3. Brandon Cooney, "Introduction to Robotics with Arduinos: Learn to Plan and Build Your Own Robots at Home," Maker Media, 2022

Robotics Design and control Lab

Code: 24URBA30

Credit	Hour	Marks		
2	60	I	E	TO
		35	15	50

List of Experiments:

1. Forward and Inverse kinematics of two axis planar articulated robot using analytical and algorithm using Lego NXT.
2. Forward and Inverse kinematics to control hand movements in NAO.
3. Study and selection of Gripper.
4. Implementation of trajectory planning algorithm for straight line motion using Matlab and executing ased control of two axis planar articulated robot in Lego NXT.
5. Set up a robotic arm and write simple programs to move the arm to specified positions using a basic programming language like Python
6. Analysis and Simulation using Fanuc Robo guide software and real time Programming of Fanuc M 710i robot.
7. Programming of Adept Cobra S 600 SCARA robot.
8. Students work in teams to design, build, and program a robotic system to perform a complex task. This includes kinematics, dynamics, control, sensor integration, and autonomous operation.