RBU

RAMDEOBABA UNIVERSITY, NAGPUR

Formerly Shri Ramdeobaba College of Engineering & Management (RCOEM) Est. 1984

RAMDEOBABA UNIVERSITY (RBU)
NAGPUR–440013

Established by the Maharashtra Private Universities (Establishment and Regulation) Act 2023
(Mah. Act No VIII of 2024)

Formerly, Shri Ramdeobaba College of Engineering and Management, Nagpur 440013

School of Electrical and Electronics Engineering

(Department of Electronics Engineering)

PROGRAMME SCHEME & SYLLABI
of First year as per National Education Policy (NEP)
(With Effect from Academic Year 2024-25)

B.Tech.
Biomedical Electronics Engineering

Semester I

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	BSC	24HS05TH0103	Semiconductor Physics	3	0	3	50	50	100	3
2	BSC	24HS05PR0103	Semiconductor Physics Lab	0	2	1	25	25	50	-
3	BSC	24HS03TH0101	Calculus, Probability, and Statistics	3	0	3	50	50	100	3
4	BSC	24HS03PR0102	Computational Mathematics Lab	0	2	1	25	25	50	-
5	BSC	24EE03TH0101	Fundamental of Electrical and Electronics Engineering	3	0	3	50	50	100	3
6	ESC	24EE03TH0102	Digital Logic Design	3	0	3	50	50	100	3
7	ESC	24EE03PR0102	Digital Logic Design	0	2	1	25	25	50	-
8	ESC	24EE03TH0103	Fundamentals of Programming	3	0	3	50	50	100	3
9	ESC	24EE03PR0103	Fundamentals of Programming	0	2	1	25	25	50	-
10	AEC	24HS02TH0101	English for Professional Communication	2	0	2	50	50	100	2
11	AEC	24HS02PR0101	English for Professional Communication	0	2	1	25	25	50	-
12	CCA	24HS02PR0105	Liberal/Performing Art Lab	0	2	1	25	25	50	0
13	VEC	24HS02TH0104	Foundational course in Universal Human Value	1	0	1	25	25	50	0
			TOTAL	**18**	**12**	**24**				
				30Hrs.						

Semester II

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	BSC	24HS01TH0203	Engineering Chemistry	2	0	2	50	50	100	2
2	BSC	24HS01PR0203	Engineering Chemistry	0	2	1	25	25	50	-
3	BSC	24HS03TH0218	Linear Algebra and Multivariate Calculus	3	0	3	50	50	100	3
4	PCC	24EE03TH0201	Electronic Devices and Circuits	3	0	3	50	50	100	3
5	PCC	24EE03PR0201	Electronic Devices and Circuits	0	2	1	25	25	50	-
6	ESC	24EE03TH0202	Network Theory	3	0	3	50	50	100	3
7	VSEC	24EE03TH0203	Object Oriented Programming	3	0	3	50	50	100	3
8	VSEC	24EE03PR0203	Object Oriented Programming	0	2	1	25	25	50	-
9	IKS	24HS02TH0203	Foundational Literature of Indian Civilization	1	0	1	50	-	50	-
10	CCA	24HS04PR0201	Sports-Yoga-Recreation	0	2	1	25	25	50	-
11	ESC	24EE03PR0204	Electronics and Computer workshop	0	2	1	25	25	50	-
			TOTAL	**15**	**10**	**20**				
				25 Hrs.						

Exit option: Award of UG Certificate with additional 8 credits			
Exit Courses			
1	IT Support Engineer	Online/Offline Certification Course	8
2	Python Programmer		8
3	Web Designer		8

Semester III

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE03TH0301	Human Anatomy and Physiology for Engineers-I	4	0	4	50	50	100	3
2	PCC	24EE03TH0302	Data Structures and Algorithms	3	0	3	50	50	100	3
3	PCC	24EE03PR0302	Data Structures and Algorithms	0	2	1	25	25	50	-
4	PCC	24EE03TH0303	Analog Circuits	3	0	3	50	50	100	3
5	PCC	24EE03PR0303	Analog Circuits	0	2	1	25	25	50	-
6	PCC	24EE03TH0304	Microcontrollers and its application in healthcare	3	0	3	50	50	100	3
7	PCC	24EE03PR0304	Microcontrollers and its application in healthcare	0	2	1	25	25	50	-
8	MDM	24EE03TH0305	MDM-1	3	0	3	50	50	100	3
9	OE	24EEOEC03TH0306	Open Elective-I/MOOCs	2	0	2	50	50	100	2
10	BSC	24HS01TH0301	Environmental Science	1	0	1	50	-	50	-
11	BSC	24HS01PR0301	Environmental Science	0	2	1	25	25	50	-
			TOTAL	**19**	**8**	**23**				
				27 Hrs.						

Semester IV

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE03TH0401	Human Anatomy and Physiology for Engineers-II	3	0	3	50	50	100	3
2	PCC	24EE03TH0402	Fundamentals of AI and Machine Learning	3	0	3	50	50	100	3
3	PCC	24EE03PR0402	Fundamentals of AI and Machine Learning	0	2	1	25	25	50	-
4	PCC	24EE03TH0403	Signals Processing and Analysis	3	0	3	50	50	100	3
5	PCC	24EE03PR0403	Signals Processing and Analysis	0	2	1	25	25	50	-
6	VSEC	24EE03PR0404	Introduction to Digital Fabrication & 3D Printing	0	2	1	25	25	50	-
7	MDM	24EE03TH0405	MDM-2	3	0	3	50	50	100	3
8	OE	24EEOEC03TH0406	Open Elective-II/MOOCs	2	0	2	50	50	100	2
9	PCC	24EE03TH0407	Biomechanics	3	0	3	50	50	100	3
10	AEC	24EE03PR0408	Basic Competitive coding	0	2	1	50	50	100	-
11	HSSM	24SM03TH0401	Innovations and Entrepreneurship	1	0	1	50	0	50	-
12	HSSM	24SM03PR0401	Innovations and Entrepreneurship	0	2	1	25	25	50	-
			TOTAL	**18**	**10**	**23**				
				28 Hrs.						

Exit Course Option for II year UG Diploma in Engineering/Tech.		
1	Design and Manufacturing of PCB- With Project	**8**
	OR	
2	Radiology Equipment (In Collaboration with Hospitals)/Online Courses	**8**

Semester V

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE03TH0501	Biomedical Sensors & Measurement Devices	3	0	3	50	50	100	3
2	PCC	24EE03PR0501	Biomedical Sensors & Measurement Devices	0	2	1	25	25	50	-
3	PCC	24EE03TH0502	Biomedical Image Processing	3	0	3	50	50	100	3
4	PCC	24EE03PR0502	Biomedical Image Processing	0	2	1	25	25	50	-
5	PCC	24EE03TH0503	Biomaterials	3	0	3	50	50	100	3
6	PEC	24EE03TH0504	Programme Elective-I	3	0	3	50	50	100	3
7	PEC	24EE03PR0504	Programme Elective-I	0	2	1	25	25	50	-
8	MDM	24EE03TH0505	MDM-3	3	0	3	50	50	100	3
9	OE	24EEOEC03TH0506	Open Elective-III/MOOCs	2	0	2	50	50	100	2
10	AEC	26HS02TH0501	Business Communication	1	0	1	50	0	50	-
11	AEC	26HS02PR0501	Business Communication	0	2	1	25	25	50	-
			TOTAL	**18**	**8**	**22**				
				26 Hrs.						

Semester VI

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE03TH0601	Biomicrosystems	3	0	3	50	50	100	3
2	PCC	24EE03TH0602	Medical Imaging	3	0	3	50	50	100	3
3	PEC	24EE03TH0603	Programme Elective-II	3	0	3	50	50	100	3
4	PEC	24EE03PR0603	Programme Elective-II	0	2	1	25	25	50	-
5	PEC	24EE03TH0604	Programme Elective-III	3	0	3	50	50	100	3
6	PEC	24EE03PR0604	Programme Elective-III	0	2	1	25	25	50	-
7	MDM	24EE03TH0605	MDM-4	3	0	3	50	50	100	3
8	VSEC	24EE03TH0606	Soft skill Development	1	0	1	50	-	50	-
9	AEC	24EE03PR0607	Advanced Competitive coding	0	2	1	25	25	50	-
10	CEP	24EE03PR0608	Project -I	0	4	2	50	50	100	-
			TOTAL	**16**	**10**	**21**				
				26 Hrs.						

Exit Course Option for III year Bachelor Degree		
1	Internship in Centre for Microsystems	8
OR		
2	Internship at Biomedical Dept. of Hospitals	8

Semester VII/VIII

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PCC	24EE03TH0701	Analytical & Diagnostic Equipment	2	0	2	50	50	100	2
2	PCC	24EE03PR0701	Analytical & Diagnostic Equipment	0	2	1	25	25	50	-
3	PEC	24EE03TH0702	Programme Elective-IV	3	0	3	50	50	100	3
4	VEC	24EE03TH0703	Cyber Laws and Ethics in IT	2	0	2	50	50	100	2
5	PRJ	24EE03PR0704	Project-II	0	8	4	50	50	100	-
6	FP	24EE03PR0705	Internship Evaluation	0	2	0	-	-		-
7	PCC	24EE03TH0706	Biomedical Engineering: Legal & Ethical Perspective	1	0	1	50	-	50	-
8	PCC	24EE03TH0707	FPGA Architecture & ASIC	2	0	2	50	50	100	2
9	PCC	24EE03PR0707	FPGA Architecture & ASIC	0	2	1	25	25	50	-
10	AEC	24EE03PR0708	Participative Learning	0	2	1	25	25	50	-
			TOTAL	**10**	**16**	**17**				
				26Hrs.						

Semester VIII/VII

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	PEC	24EE03TH0801	Programme Elective-V	3	0	3	50	50	100	3
2	PEC	24EE03TH0802	Programme Elective-VI	3	0	3	50	50	100	3
3	PRJ	24EE03PR0803	Project-III	0	12	6	50	50	100	-
			TOTAL	**6**	**12**	**12**				
				18 Hrs.						

OR

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	Internship/OJT	24EE03PR0804	Industry Internship/ TBI Internship/ Research Internship*	0	24	12	50	50	100	-
			TOTAL	0	24	**12**				
				24 Hrs.						

HONORS Specialization in Research

SN	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	VII	24EE03TH0701	Research Methodology	3	0	3	50	50	100	3
2	VII	24EE03PR0702	Research Project Phase -I	0	6	3	50	50	100	-
3	VIII	24EE03PR0801	Research Project Phase -II	0	24	12	50	50	100	-
			TOTAL	**3**	**30**	**18**				
				33 Hrs.						

HONORS Specialization in Bioinformatics

Sr. No.	Semester	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	III	24EE03HT0301	Biological Data and Databases	3	0	0	3	50	50	100	3Hrs
2	IV	24EE03HT0401	Computational Biology and Bioinformatics	3	0	0	3	50	50	100	3Hrs
3	V	24EE03HT0501	Programming in Bioinformatics	3	1	0	4	50	50	100	3Hrs
4	VI	24EE03HT0601	Computer Aided Drug design and Chemoinformatics	3	1	0	4	50	50	100	3Hrs
5	VII	24EE03HP0701	Minor Project (Honors and Multidisciplinary Minor)	0	0	8	4	50	50	100	
			TOTAL	12	2	8	18				

Programme Electives

	Semester V	**Semester VI**		**Semester VII**	**Semester VIII**	
Sr. No.	**Programme Elective I**	**Programme Elective II**	**Programme Elective III**	**Programme Elective IV**	**Programme Elective V**	**Programme Elective VI**
Course Code	24EE03TH0504-1/24EE03PR0504-1	24EE03TH0603-1/24EE03PR0603-1	24EE03TH0604-1/24EE03PR0604-1	24EE03TH0702-1	24EE03TH0801-1	24EE03TH0802-1
1	Software Engineering	Natural Language Processing	Deep Learning	Database Management System	Operating System	Generative AI-I
Course Code	24EE03TH0504-2/24EE03PR0504-2	24EE03TH0603-2/24EE03PR0603-2	24EE03TH0604-2/24EE03PR0604-2	24EE03TH0702-2	24EE03TH0801-2	24EE03TH0802-2
2	Biostatistics	Biological Data and Databases	Computational Biology and Bioinformatics	Programming in Bioinformatics	Advanced Bioinformatics	Computer Aided Drug Designing
Course Code	24EE03TH0504-3/24EE03PR0504-3	24EE03TH0603-3/24EE03PR0603-3	24EE03TH0604-3/24EE03PR0604-3	24EE03TH0702-3	24EE03TH0801-3	24EE03TH0802-3
3	PCB designing	Embedded system	Medical Robotics and Automation	Control Systems	Chip Design Computing	Reliability of Healthcare Equipments

SYLLABUS FOR SEMESTER I
B. Tech. Biomedical Electronics Engineering
[School of Electrical and Electronics Engineering]

Course Code:24HS05TH0103 **Course: Semiconductor Physics**
L: 3 Hrs. P: 0 Hrs. per week **Total Credits: 3**

Course Outcomes

On successful completion of the course, student will be able to

1. Apply fundamental knowledge of quantum mechanics to examine electrons behavior in solids at the quantum level.
2. Classify materials on the basis of band theory and its importance for semiconductors.
3. Outline the difference between intrinsic and extrinsic semiconductors and explain their carrier transport phenomena in semiconductor.
4. Illustrate the working and design aspects for the various photonic devices like LEDs, solar-cells and LASER diodes.
5. Analyze the simple harmonic oscillator, damped oscillator and forced oscillator.

Unit 1: Introduction to Quantum Mechanics
Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Particle in an infinite potential well, Quantum tunneling

Unit 2: Electronic Materials
Formation of energy bands in solids, Classification of electronic materials, Kronig-Penny model, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics, Fermi level, Effective mass.

Unit 3: Intrinsic and Extrinsic Semiconductors
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier transport: diffusion and drift.

Unit 4: Non-Equilibrium Semiconductors
Carrier generation and recombination, Continuity equation, p-n junction diode, Zero-applied bias, forward bias, reverse bias.

Unit 5: Optoelectronic Devices
Optical absorption in semiconductors, Light emitting diodes, Laser diode, Stimulated emission and photon amplification, Einstein Coefficients, Solar Energy Spectrum, Solar Cells.

Unit 6: Oscillations
Quick review of simple harmonic motion, mechanical and electrical oscillators, vector and complex numbers, Phasor representation, damped oscillations: under, critical and over damping, forced oscillations, impedance, energy and power supplied by driving force, Q-

factor, related numerical/problems.

Text Book(s):

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.
2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall2001
3. The Physics of Vibrations and Waves (Sixth Edition), H J Pain John-Wiley 2005.

References:

1. Physics of Semiconductor Devices, Simon M. Sze, Wiley-Interscience (1981)
2. Semiconductor Device Physics and Design, Umesh K Mishra and Jasprit Singh, Springer 2008**.**

SYLLABUS FOR SEMESTER I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code: 24HS05PR0103 **Course: Semiconductor Physics Lab**

L: 0 Hrs. P: 2 Hrs. per week **Total Credits: 1**

Course Outcomes

At the end of the Course the students will learn to:

1. Develop skills required for experimentation and verification of physics laws.
2. Analyze the results obtained through proper graph plotting and Error analysis.
3. Conduct experiments to validate physical behavior of materials/components.
4. Analyze the behavior and characteristics of a basic PN Junction, Zener Diode and other optoelectronic devices.
5. Prepare laboratory reports on interpretation of experimental results

List of Experiments:

1. Basic Measurements
2. Parameter extraction from V-I characteristics of a diode
3. Resistivity measurement of semiconductor by Four Probe method
4. Performance and analysis of Hall Effect in semiconductor to determine the Hall coefficient and carrier concentration of the majority carriers in the given specimen
5. Estimation of energy gap in semiconductor
6. Characteristics and analysis of solar cells
7. Verification of Ohm's law and error analysis of the data using Linear Least Square Fit (LLSF) method
8. Analysis of energy values and wave function using Mathematica software
9. Verification of Planck's constant.
10. Determination of wavelength of LASER light by diffraction grating
11. To find acceleration due to gravity by Simple Pendulum.

Reference:

1. Laboratory manual of the Physics Department
2. Principles and Practices by S. O. Kasap, Prentice Hall2001

SYLLABUS FOR Semester I

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS03TH0101 **Course Name: Calculus, Probability, and Statistics**

L: 3Hrs., P: 0 Hrs., Per week **Total Credits: 03**

Course Outcomes:

On successful completion of the course, the students will able to:

1. Recognize first order ordinary differential equations that can be solved by each of thefour methods – Linear DE, exact DE, reducible to linear DE and reducible to exact differential equationsand use the appropriate method to solve them.
2. Solve higher order ordinary differential equations with constant and variable coefficients.
3. Find best fit curve by method of least square method and calculate correlation, regressions.
4. Recognize and understand discrete, continuous probability distributions and apply Binomial distribution, Poisson distribution and Normal distribution to appropriate problems.
5. Internalize multivariable calculus and apply it find Jacobians, maxima and minima of function.

Module 1:First order ordinary differential equations(7 hours) :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'stype, Applications of First order Differential Equations.

Module 2:Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation. Applications of Higher order Differential Equations.

Module 3: Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation and its application in Engineering.

Module 4: Differential Calculus (10 hours**)**

Taylor's and Maclaurin's series expansions, radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Euler's Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 5: Probability: (8 hours)

Probability spaces, conditional probability, independence, Bay's Theorem, Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and BoundaryValue Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice HallIndia, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.
7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

SYLLABUS FOR B. Tech Semester I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code: 24HS03PR0102 **Course: Computational Mathematics Lab**

L:0 HrP:2Hrs., Per week **Total Credits:1**

Course Outcomes:

By using open source software SageMath Students will be able to

CO1: Download SageMath and use it as an advance calculator.

CO2: Sketch and analyze function graphs.

CO3: Apply the concepts of differential calculus to find extreme value of continuous functions and analyze solutions of differential equations

CO4: Evaluate improper integrals and its applications to find length, area, volume, centre of gravity and mass.

CO5: Analyze and calculate eigen values, eigen vectors, rank nullity, and solve system of linear equations of a matrix / linear map.

CO6: Analyze the data to find best fit curve.

Mapping of Course outcomes (COs) withExperiments

Exp. No.	Name of Experiments	Mapped COs
1	To use SageMath as advanced calculator	CO1
2	2D Plotting with SageMath	CO2
3	3D Plotting with SageMath	CO2
4	Differential Calculus with SageMath	CO3
5	Solution of differential equations in SageMath	CO3
6	Basics of Linear Algebra	CO5
7	Curve Fitting by using SageMath	CO6
8	Integral Calculus with SageMath	CO4

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code:24EE03TH0101 **Course: Fundamentals of Electrical and Electronics Engineering**

L: 3Hrs, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

At the end of this course, students will be able to

1. Apply the knowledge of basic laws to analyze simple DC circuits.
2. Construct and analyze the behavior of simple AC circuits.
3. Apply the knowledge of transformer operation to calculate and analyze different parameters, including voltage, current, efficiency and losses.
4. Discuss the performance parameters of induction motors and BLDC motor.Identify, characterize diodes and analyze their behavior in simple electronic circuits.

Module I: (6 Hours)

DC Circuits: circuit elements resistor, inductor and capacitor, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel circuits excited by independent voltage sources; energy sources, dependent sources, star- delta transformation.

Module II: (8 Hours)

A.C. Circuits: Generation of sinusoidal voltage, basic terminologies associated with AC quantity, phasor representation of alternating quantities, Real power, reactive power, apparent power and power factor, Analysis of basic series and parallel AC circuit.

Three Phase A.C. Circuits: Basic concepts; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits.

Module III: (8 Hours)

Single Phase Transformer: Basic principle and construction of single-phase transformer; Operation under no load and load condition, equivalent circuit, voltage regulation and efficiency.

Module IV: (6 Hours)

Induction Motors: Construction, working principle and applications of single-phase motors. Working principle of three phase induction motor; Introduction to BLDC motors: working principle, construction with its applications.

Module V: (6 Hours)

PN diode operation: forward bias and reverse bias , Volt-Ampere characteristics of p-n diode, Temperature dependence of VI characteristics, Current components in p-n diode, Diode equation, Transition and Diffusion capacitances, Breakdown Mechanisms in Semiconductor diodes, Rectifiers: half wave and full wave, Wave shaping circuits

Module VI: (6 Hours)

Special Purpose diodes and their applications: Zener diode characteristics and application, Tunnel Diode, LED, LDR, Varactor, Photo diode, PIN diode, Schottky diode, LASER, Applications.

Text books

1. Basic Electrical and Electronics Engineering by S.K.Bhattacharya, Pearson Publications
2. Basic Electrical and Electronics Engineering by D.P. Kothari and I J Nagrath, TMH.
3. A Textbook of Electrical Technology, volume I & II B. L. Theraja S. chand

4. BasicElectricalEngineering, D.C.Kulshreshtha, McGraw Hill 2009.

5. BasicElectricalEngineering:S.B. Bodkhe,N.M.Deshkar,P.P.H.Pvt.Ltd.

Reference Books

1. Basic Electrical Engineering by Fitzerald and Higginbotham, TMH.

2. Basic Electrical Engineering by I.J Nagrath, TMH.

3. Millman's Integrated Electronics: Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE03TH0102 **Course: Digital Logic Design**

L: 3 Hrs, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Understand Number Systems and its conversions
2. Apply various optimization techniques to minimize digital circuits.
3. Design combinational logic circuits.
4. Analyze and design asynchronous and synchronous sequential circuits.

Module-I

Basics of Digital Electronics: Motivation for digital systems: Number Systems and arithmetic's, Representation of Signed Numbers, Boolean algebra, Logic gates, SOP, POS, Minimization of Switching functions using Karnaugh-maps.

Module-II

Timing issues in Digital Circuit: Fan-In, Fan-Out, Propagation Delay, Power Dissipation, Noise Margin

Module-III

Combinational Circuit Design: Adders, Subtractors, Multiplexer,,De-multiplexers, Encoders, Decoders, Code Converters, Comparators.

Module-IV

Sequential Circuit Design-I: Storage elements, Flip-flops and latches: D, T, JK, SR flip-flops: level triggered, edge triggered, Master Slave flip-flop, flip flop conversion, timing analysis.

Module-V

Sequential circuit Design-II: Design of asynchronous and synchronous counters, Registers & Shift registers, Application of shift register: Ring counter, Johnson counter.

Module-VI

Design of synchronous sequential circuit using Mealy model and Moore model

Textbooks:

1. D.V.Hall,"DigitalCircuitsandSystems",TataMcGrawHill,1989.
2. Modern Digital Electronics :R.PJain,TataMcGrawHill,3rd Edition.

ReferenceBooks:

1. Digital Logic and ComputerDesign: MorrisMano,PHI,3rd Edition.

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE03PR0102 **Course: Digital Logic Design Lab**

L:0Hrs, P: 2Hrs. Per week **Total Credits: 01**

ListofExperiments

1. To verify truth table of different logic gates.
2. Design basic logic gates using universal gate and verify its truth table.
3. To verify following Boolean expressions.

   Y=A+AB+A'B'
4. To implement the following arithmetic circuits using logic gates IC's
   a) Half adder
   b) Full subtractor
5. Implement the function F = Σm (1,3,5,7,8,9,11,13,15) +d (12,14) using 16:1 and 8:1 multiplexer.
6. Verify the truth table of SR, JK, T and D flip flop.
7. To study the following functions of Shift register.
   a) SIPO
   b) PIPO
   c) PISO
   d) SISO
8. Design and verify 2-bit synchronous down counter using S-R flip-flop.
9. Design and verify the functionality of a sequence detector to detect the sequence 101 using Mealy and Moore model and use J-K flop-flop to implement the design.

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE03TH0103 **Course: Fundamentals of Programming**
L:3Hrs, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

On successful completion of the course, students will be able to:

1. Develop the fundamentals of C programming and choose the loops and decision-making statements to solve and execute the given problem.
2. Formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs, test and execute the programs, and correct syntax and logical errors.
3. Use arrays, pointers, structures, and I/O operations for the formulation of algorithms and programs.
4. Apply programming concepts to solve matrix addition, multiplication problems, and searching & sorting problems.
5. Implement iterations and recursions, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.

Syllabus

Module 1: Introduction to Programming
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers, etc.).
Idea of Algorithm: Steps to solve logical and numerical problems.
Representation of Algorithm: Flowchart/Pseudocode with examples.
Arithmetic expressions and precedence.

Module 2: C Programming Language
Introduction to C language: Keywords, Constants, Variables, Data types, Operators, Types of Statements, Pre-processor Directives.
Decision Control Statements: if, if-else, nested if-else statements, switch case.
Loops and writing and evaluation of conditionals and consequent branching.

Module 3: Arrays and Basic Algorithms
Arrays: 1-D, 2-D, Character arrays and Strings.
Searching, Basic Sorting Algorithms, Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

Module 4: Functions and Recursion
User-defined and Library Functions, Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.
Recursion: A different way of solving problems.
Example programs: Finding Factorial, Fibonacci series.

Module 5: Pointers and Structures
Structures: Defining structures, Array of Structures.
Introduction to pointers: Defining pointers, Pointer arithmetic, Pointer operators.
Use of Pointers in self-referential structures.

Module 6: File Handling

Streams in C, Types of Files, File Input/Output Operations: Modes of file opening, Reading and writing the file, Closing the files using fflush().

Text Books

1. *Programming in ANSI C* – E. Balagurusamy, McGraw-Hill
2. *Mastering C* – K. R. Venugopal and S. R. Prasad, Tata McGraw-Hill

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Reference Books

1. *Programming with C* – Byron Gottfried, Schaum's Outline Series
2. *Let Us C* – Yashwant Kanetkar, BPB Publications

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24EE03PR0103	**Course: Fundamentals of Programming Lab.**
L: 0 Hrs, P: 2 Hrs. Per week	**Total Credits: 01**

List of Experiments

1. Using basic data types of C, implement arithmetic expressions.
2. Implement programs using Decision Control Structures.
3. Demonstrate use of Loop Control Structures.
4. Implement programs using Multi-way Decision Control Structures (Switch Case).
5. Apply Functions and Recursion to simplify programs.
6. Initialize array and apply it to solve problems of 1D and 2D arrays.
7. Demonstrate use of Structures and Pointers.
8. Apply file handling concepts in C.

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24HS02TH0101 **Course: English for Professional Communication**
L: 2 Hrs, P: 0Hr, Per Week **Total Credits: 2**

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate effective use of word power in written as well as oral communication.

CO2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.

CO3.Apply the principles of functional grammar in everyday as well as professional communication.

CO4. Effectively implement the comprehensive principles of written communication by applying various writing styles.

CO5. Create precise and accurate written communication products.

Module-1: Vocabulary Building

1.1 Importance of using appropriate vocabulary

1.2 Techniques of vocabulary development

1.3 Commonly used power verbs, power adjectives and power adverbs.

1.4 Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations

Module -2: Listening and Reading Comprehension

2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a

good listener, and barriers to effective listening

2.2 Reading Comprehension: types and strategies.

Module -3: Functional Grammar and Usage

3.1 Identifying Common Errors in use of: articles, prepositions, modifiers, modalauxiliaries, redundancies, and clichés

3.2 Tenses

3.3 Subject-verb agreement, noun-pronoun agreement

3.4 Voice

Module-4: Writing Skills

4.1 Sentence Structures

4.2 Sentence Types

4.3 Paragraph Writing: Principles, Techniques, and Styles

Module-5: Writing Practices

5.1 Art of Condensation: Précis, Summary, and Note Making

5.2 Correspondence writing techniques and etiquettes – academic writing

5.3 Essay Writing

Reference Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press.2011.

2. Practical English Usage. Michael Swan. OUP. 1995.

3. Remedial English Grammar. F.T. Wood. Macmillan.2007

4. On Writing Well. William Zinsser. Harper Resource Book. 2001

5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code: 24HS02PR0101 **Course: English for Professional Communication Lab**
L: 0 Hrs, P: 2Hr, Per Week **Total Credits: 1**

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

CO1: Apply effective listening and speaking skills in professional and everyday conversations.

CO2: Demonstrate the techniques of effective Presentation Skills

CO3: Evaluate and apply the effective strategies for Group Discussions

CO4: Analyze and apply the effective strategies for Personal Interviews

CO5: Implement essential language skills- listening, speaking, reading, and writing Syllabus

List of practicals:

Computer Assisted + Activity Based Language Learning

Practical 1: Everyday Situations: Conversations and Dialogues – Speaking Skills

Practical 2: Pronunciation, Intonation, Stress, and Rhythm

Practical 3: Everyday Situations: Conversations and Dialogues – Listening Skills

Activity Based Language Learning

Practical 4: Presentation Skills: Orientation & Mock Session

Practical 5: Presentation Skills: Practice

Practical 6: Group Discussions: Orientation & Mock Session

Practical 7: Group Discussions: Practice

Practical 8: Personal Interviews: Orientation & Mock Session

Practical 9: Personal Interviews: Practice

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-1	**Fundamentals of Indian Classical Dance: Bharatnataym**	I/II	2	1	50

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Bharatnataym as an Indian dance form CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Pratham*(1st level formal exam Of Bharatnatayam).

Syllabus

Practical -1: Orientation in Bharatnatayam

Practical-2: TattuAdavu till 8, NaattaAdavu 4 Steps, PakkaAdavu 1 step, MettaAdavu 1 Step, KudittaMettaAdavu 4 Steps,

Practical -3: Practice sessions

Practical-4: TattaKudittaAdavu (Metta), TattaKudittaAdavu (Metta) 2 Steps, TirmanamAdavu 3 Steps, KattuAdav - 3 Steps, KattuAdav - 3 Steps

Practical-5: Practice sessions

Practical-6: Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps,

Practical-7: practice sessions

Practical – 8: final practice sessions and performances.

Recommended reading

1. *Introduction to Bharata'sNatyasastra*, AdyaRangacharya, 2011
2. *The Natyasastra and the Body in Performance: Essays on the Ancient Text*, edited by Sreenath Nair, 2015
3. *Bharatanatyam How to ... : A Step-by-step Approach to Learn the Classical Form*, EshwarJayalakshmi, 2011

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-2	**Fundamentals of Indian Classical Dance: Kathak**	I/II	2	1	50

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Kathak as an Indian dance form CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Prarambhik*(1st level formal exam of Kathak).

Syllabus

Practical -1: Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 count (Bhramari),

Practical -2: practice sessions of practical 1

Practical -3: Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings

Practical -4: practice sessions of practical 3

Practical -5: Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,

Practical -6: practice sessions of practical 5

Practical -7: 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions

Practical -8: Final performances.

Recommended reading

1. Kathak Volume1 A "Theoretical & Practical Guide" (Kathak Dance Book), MaramiMedhi&DebasishTalukdar, 2022, Anshika Publication (13 September 2022)

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02 PR0105-3	**Introduction to Digital Photography**	I/II	2	1	50

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Develop an understanding of the technical aspects and aesthetics of Photography.
CO2: Apply the rules of digital photography for creating photographs.
CO3: Develop skills to enhance photographs through post processing.
CO4: Create a portfolio of their photographs in selected genre.

Syllabus

Practical 1: **Orientation in digital photography:** Genres, camera handling and settings Practical 2: **Rules of Composition**
Practical 3: **Rules of Composition**: practice sessions
Practical 4: **Understanding Exposure and Art of Pre-Visualization**
Practical 5: **Rules of Composition and Art of Pre-Visualization:** practice sessions Practical 6: **Post Processing Photographs and Portfolio creation**
Practical 7: **Post Processing Photographs:** practice sessions

Practical 8: **Portfolio finalization and presentation in selected genre.**

Reference material

1. Scott Kelby (2020) *The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros*, Rocky Nook, USA
2. Larry Hall (2014) *Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography*, Speedy Publishing LLC, Newark
3. J Miotke (2010) *Better Photo Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro, AMPHOTO Books, Crown Publishing Group, USA*

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-04	**Introduction to basic Japanese Language**	I/II	2	1	50

Course outcome

CO1: Gain a brief understanding about Japan as a country and Japanese culture.
CO2: Develop ability to use vocabulary required for basic level communication in Japanese language.
CO3: Able to write and read the first script in Japanese language.
CO4: Able to frame simple sentences in Japanese in order to handle everyday conversations
CO5: Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical-1: Orientation about Japan, its language, and its culture
Practical-2: Communication Skills 1: Vocabulary for basic Japanese language
Practical -3: Practice sessions
Practical-4: Writing Skills 1: Reading and writing first script in Japanese
Practical-5: Practice sessions
Practical- 6: Communication Skills 2: framing sentences
Practical- 7: Practice sessions
Practical- 8: Writing Skills 2: Write basic Japanese and practice

Recommended reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by AmeyaPatki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-05	**Art of Theatre**	I/II	2	1	50

Course Outcomes:

On completion of the course, students will be able to achieve the following:

CO1: Understand and synthesize the working of the prominent genres of theatre across the world.
CO2: Apply the skill of voice and speech in theatre and public speaking
CO3: Apply the art of acting and also develop generic skills such as confidence, communication skills, self-responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.
CO4: Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus:

Syllabus

Practical 1: **Orientation in theatre**
Practical 2: **Voice and Speech training**
Practical 3: **Voice and Speech training**: practice sessions
Practical 4: **Art of acting**
Practical 5: **Art of acting:** practice sessions Practical 6:
Art of script writing
Practical 7: **Art of script writing:** practice sessions Practical 8:
Final performances

Reference books:

1. Boleslavsky, R. (2022). *Acting: The First Six Lessons* (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). *No Drama Just Theatre* (1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., &Zigler, S. (1986). *A Practical Handbook for the Actor* (1st ed.). Vinatge Books New York.

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR 0105-06	**Introduction to French Language**	I/II	2	1	50

Course outcomes:

On successful completion of the course the students will be able to achieve the following:
CO1. Demonstrate basic knowledge about France, the culture and similarities/differences between India and France
CO2. Learn to use simple language structures in everyday communication.
CO3. Develop ability to write in basic French about themselves and others.
CO4. Develop ability to understand beginner level texts in French

Syllabus
List of Practicals

Practical-1: Orientation about France, the language, and culture
Practical-2: Communication Skills 1: Vocabulary building for everyday conversations
Practical -3: Practice sessions
Practical-4: Reading and writing Skills : Reading and writing simple text in French
Practical-5: Practice sessions
Practical-6: Communication Skills 2: listening comprehension
Practical-7: Practice sessions
Practical-8: Writing Skills: Write basic French and practice

Recommended reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de CivilisationFrançaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course outcomes:

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR 0105-07	**Introduction to Spanish Language**	I/II	2	1	50

On successful completion of the course the students will be able to achieve the following:
CO1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France CO2. Learn to use simple language structures in everyday communication. CO3. Develop ability to write in basic Spanish about themselves and others. CO4. Develop ability to read and understand beginner level texts in Spanish

Syllabus
List of Practicals

Practical-1: Orientation about Spain, the language, and culture
Practical-2: Communication Skills 1: Vocabulary building for everyday conversations
Practical -3: Practice sessions
Practical-4: Reading and writing Skills : Reading and writing simple text in Spanish
Practical-5: Practice sessions
Practical-6: Communication Skills 2: listening comprehension
Practical-7: Practice sessions
Practical-8: Writing Skills: Write basic Spanish and practice

Recommended reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas ,Eva Garcia, Agustin Garmendia.
3. ChicosChicasLibro del Alumno by MaríaÁngeles Palomino

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR01 05-08	**Art of Painting**	I/II	2	1	50

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of painting.
CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.
CO3: Develop the ability to observe and render simple natural forms.
CO4: Enjoy the challenging and nuanced process of painting.

Syllabus

Practical 1: **Orientation in Painting tools & basics of lines, shapes, light, shadows and textures**
Practical 2: **The art of observation** how to see shapes in drawing Practical 3: **Introduction Water color** how to handle water paints Practical 4: **Introduction to acrylic colors** how to handle acrylic paints

Practical 5: **Explore layering paint and capturing the quality of light with paint.**
Practical 6: **Create landscape painting**
Practical 7: **Create Abstract painting**
Practical 8: **Paint on Canvas** (try to recreate any famous painting)

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-09	**Art of Drawing**	I/II	2	1	50

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of drawing.

CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.

CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical 1: **Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures**

Practical 2: **The art of observation** how to see shapes in drawing Practical 3: **One/two-point basic linear perspective**

Practical 4: **Nature drawing and landscapes**

Practical 5: **Gestalt principles of visual composition**

Practical 6: **Figure drawing**: structure and proportions of human body

Practical 7: **Gesture drawing:** expression and compositions of human figures Practical

8: **Memory drawing:** an exercise to combine the techniques learnt

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling

Syllabus for Semester I

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0105-10	**Nature camp**	II	2	1	50

Course outcome:

After the completion of the course the students will be able to do the following:

CO1: Develop an affinity with nature by observing and understanding it marvels with guidance from experts

CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

Course content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Central Indian region or Forest fringe villages or work with an NGO from Central Indian region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, other wildlife etc)
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs
4. Man-animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department
5. Traditional practices in environment conservation – role of local communities and local NGOs

Syllabus for Semester I

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24HS02TH0104 **Course: Foundational course in Universal Human Value**

L: 1 Hrs, P: 0 Hr, Per Week **Total Credits: 1**

Course outcomes

On completion of course, students will be able to achieve the following:

CO1: Develop a holistic perspective of life.

CO2: Better understanding of inter-personal relationships and relationship with society and nature.

CO3: An ability to strengthen self-reflection.

Course Content:

Module 1:- Aspirations and concerns

Need for Value Education: Guidelines and content of value education.

Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations

Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being.

Module 2:- Health

Harmony of the Self and Body, Mental and physical health; Health for family, friends and society.

Module 3:- Relationships and Society

Harmony in relationships, Foundational values: Trust, Respect, Reverence for excellence, Gratitude and love; harmony in society; harmony with nature.

Reference Material

The primary resource material for teaching this course consists of

Text book:

R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174- 46781-2

Reference books:

a) B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

b) PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

c) Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

d) Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA

e) Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.

f) SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, Amravati.

g) A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.

h) E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

i) A.N. Tripathy, 2003, Human Values, New Age International Publishers.

SYLLABUS FOR SEMESTER II

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS01TH0203 **Course: Engineering Chemistry**

L: 2 Hrs, P: 0 Hrs. Per week **Total Credits: 02**

Course Outcomes

After the successful completion of the course, students shall be able to

- CO1 Discuss the unique properties of nano-materials and applications in various field.
- CO2 Analyze the principles of various spectroscopic techniques and utilize them for qualitative and quantitative analysis.
- CO3 Learn the harnessing of energy in various energy storage devices.
- CO4 Illustrate the importance of thermodynamic functions and discuss the types and prevention measures for the corrosion.

Course Content:

Unit 1: Nano-material (7 Hours)

Nano-materials: Introduction, Classification and size dependent properties (surface area, Optical and catalytic properties). Synthesis of nano-materials (Solution combustion and Sol-gel methods).

Carbon nano-materials: Introduction, types, synthesis by modified CVD method, functionalization and applications of CNT and Graphene.

Applications of Nanomaterials

Unit 2: Material Characterization using different Spectroscopic Techniques (7 Hours)

Spectroscopy: Fundamentals of spectroscopy, Interaction of light with matter, Beer's-Lambert's Laws of absorption.

Electronic Spectroscopy: Types of transitions, Chromophores, auxochrome, different type of absorption shifts, Woodward-Fieser Rule.

Nuclear Magnetic Resonance Spectroscopy: Phenomenon of NMR, important aspects of NMR, Prediction of NMR spectrum.

Unit 3: Energy Storage and conversion devices (8 Hours)

Battery: Fundamentals of electrochemistry, Introduction to battery, types, characteristics, components/materials, working and applications of Lead acid battery, Lithium-cobalt oxide and metal air batteries, battery aging and battery waste management.

Energy conversion devices: Introduction, characteristics, materials, working and applications of H_2-O_2 fuel cells, amorphous Si and quantum dye sensitized solar cells.

Unit 4: Chemical Thermodynamics and Corrosion Science (7 Hours)

Thermodynamic functions: Energy, work, entropy, enthalpy and free energy

Corrosion: Introduction, mechanisms of corrosion, types of corrosion and its prevention.

Text Books

1. Energy storage and conversion devices: Super capacitors, batteries and hydroelectric cells, Anurag Gaur, A. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-

2 An introduction to nanomaterials and Nano science, A. K. Das and M. Das, CBS Publishers and Distributors.

3. Organic Spectroscopy, William Kemp, Third Edition, Palgrave Publication, 1991.

4. A Textbook of Engineering Chemistry, Dr. RajshreeKhare, published by S. K. Katariya and Sons, New Delhi.

Reference Books

1. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C. N. Rao, A Muller and A. K. Cheetam, Wiley-VCH, 2004

2. Electronics properties of materials, Rolf E, Hummel, 2012, Springer Publications New York, 4th Edition, ISBN 9781441981639.

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24HS01PR0203 Course: Engineering Chemistry Lab

L: 0 Hrs, P: 2 Hrs. Per week Total Credits: 01

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Apply the fundamental principles of measurement, preparation of solution, handling of hazardous chemicals and also estimate the amount of different elements present in the given samples.
2. Measure molecular /system properties such as surface tension, viscosity and other properties of aqueous or other industrially important liquids.
3. Analyze the spectral properties for qualitative and quantitative analysis.

List of Experiments

(Any eight experiments from the given list)

[1] Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.

[2] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration in their various forms.

[3] Determination of Surface tension of a given liquid/mixture.

[4] Determination of Viscosity of a given liquid/mixture at room temperature and different temperatures using Viscometer.

[5] Estimation of Cu and Zn in a brass sample using iodometric titration method.

[6] Estimation of Chromium ions from e-waste sample.

[7] Determination of the end point of the acid-base titration (Strong acid Vs Strong base and Weak acid Vs Strong base conductometrically.

[8] Estimation of Fe (II) ions spectrophotometrically / calorimetrically.

[9] Estimation of acid value of oil.

[10] Estimation of saponification value of oil.

[11] Predict and Interpret the NMR spectra (Demonstration Experiment).

[12] Spectroscopic/colorimetric determination of wavelength of maximum absorption and determination of unknown concentration by Beers-Lamber Law.

Suggested Books

1. Experiments and Calculation in Engineering Chemistry by S. S. Dara, S. Chand Publications.
2. Advanced Practical Physical Chemistry by J.B.Yadav, Krishna's Prakashan Media (P) Limited.

Reference Books

1. College Practical Chemistry by V. K. Ahluwalia, S. Dhingra and A. Gulati, Universities Press Publications.

B. Tech Semester II
B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code:24HS03TH0211 **Course Name: Linear Algebra and Multivariate Calculus**
L: 3Hrs, P: 0 Hrs, Per week **Total Credits: 03**

Course Outcomes:
On successful completion of the course, the students will able to:

1. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
2. Evaluate definite and improper integrals using Beta, Gamma functions. Also trace cartesian curves.
3. Solve multiple integration by change of order, change of variable methods and apply it to find area, volume, mass and center of gravity.
4. Understand geometric meaning of gradient, curl, divergence
5. Perform line, surface and volume integrals of vector-valued functions.
6. Analyze and compare different sets of data and classify the data by means of diagrams and graph.

Module 1: Matrices: (8 hours)
Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional space.

Module 2: Integral Calculus: (8hours)
Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves(Cartesian form)

Module 3: **Multiple Integrals** (10 hours)
Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module 4: Vector Calculus (Differentiation)(7hours)
Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalarpotential function.

Module 5: Vector Calculus (Integration)(7 hours**)**
Vector integration: Line integrals, work done, conservative fields, surface integrals and
volume integrals, Stoke's theorem, Gauss divergence theorem, Green's theorem and their simple applications.

Topics for self learning
Rolle's theorem, Mean value theorems, Indeterminate forms, Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &

Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).
6. Biomedical Statistics –ShantikumarYadav,Sompal Singh, Ruchika Gupta
7. Theory and Problems of Probability and Statistics - M.R. Spiegal (McGraw Hill) Schaum Series

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code:24EE03TH0201	**Course: Electronic Devices and Circuits**
L: 3 Hrs, P: 0 Hrs. Per week	**Total Credits: 03**

Course Objectives

The objective of the course is to prepare the students:

1. To learn electrical properties, characteristics and behavior of basic solid state devices.
2. To develop applications in circuit design using device models.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Understand characteristics of electronic devices and their applications.
2. Comprehend the fundamentals of feedback amplifiers.
3. Apply biasing techniques in amplifiers.
4. Estimate performance parameters of amplifiers.
5. Analyze the need of multistage amplifiers.

Module I

Transistors and Biasing:AC/DC load line concept, Operating Point Analysis, need of biasing, biasing techniques, bias stabilization, compensation techniques, Application of BJT as Amplifier, Introduction to h-parameters, Introduction JFET and MOSFET

Module II

Feedback Amplifiers: Feedback Topologies, effect of feedback on bandwidth, gain, stability.

Module III

Multistage Amplifiers

Calculation of Gain, Methods of Coupling – RC Coupling, Transformer Coupling, Direct Coupling, Techniques of improving input impedance – Darlington transistors and Bootstrapping, Frequency response of RC Coupled transistor amplifier.

Module IV

Power amplifiers: Class A, B, AB, C amplifiers, Operation and Analysis, Merits and Demerits, Push-pull amplifier configurations.

Module V

Power Electronics Devices: Characteristics and working principle of Power devices such as SCR, UJT, TRIAC, DIAC.

Text Books:

1. Integrated Electronics: Jacob Millman , Christos Halkias, Chetan Parikh, Second Edition,TMH.
2. An Introduction to semiconductor Devices: Donald Nemen, Tata-McGraw Hill
3. CMOS VLSI Design – A Circuits and Systems Perspective: Neil Weste and David Harris, Addison-Wesley, 4th Edition, Pearson.
4. Power Electronics: M. D. Singh and K. B. Khanchandani, Second Edition, TMH.

Reference Books:

1. Electronic devices and Circuit Theory: R. Boylestad, 9th edition, Pearson Education
2. Electronic Devices and Circuits: David A. Bell, 4th Edition, PHI.
3. Electronic Circuits – Analysis and Design: Donald Nemen, Tata-McGraw Hill
4. Power electronics: P. S. Bimbhra, Fifth edition,khanna Publication.
5. Basic VLSI Design: Douglas Pucknell and Kamran Eshraghian, Third Edition, PHI
6. **S**olid State Electronic Devices: Ben G Streetman, Sanjay Kumar Banerjee, Sixth Edition, PHI.

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24EE03PR0201 **Course: Electronic Devices and Circuits Lab**

L: 0 Hrs, P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Plot V-I characteristics of electronic components and verify parameters.
2. Estimate the frequency response of multistage amplifier.
3. Investigate Characteristics of power electronic devices.
4. Analyze the feedback topologies for amplifier configuration.
5. Analyze electronic circuitsusing EDA tool.

Experiments based on:

- Circuit Simulations using EDA tool
- Characteristics of transistors
- Biasing of Transistor
- Characteristics of Power Devices
- Single Stage and Two stage RC coupled amplifier using BJT
- Oscillator
- Feedback Amplifier

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code: 24EE03TH0202 **Course: Network Theory**

L: 3 Hrs, P: 0 Hrs. Per week **Total Credits: 03**

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of nodal and mesh analysis.
2. Analyze the transient and steady state behavior of electrical networks.
3. Apply network theorems to calculate electrical circuit parameters.
4. Estimate the network characteristics from pole-zero locations of network functions.
5. Model two port electrical networks.

Module I: Node and mesh analysis, matrix approach of networks containing voltage sources, current sources, reactance, Dependent sources, source transformation, duality properties in the electrical networks.

Module II: Network theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Compensation theorem, Millman's theorem, as applied to D.C. and AC. Circuits with their applications.

Module III: Evaluation of initial conditions in RL, RC and RLC networks. Laplace transforms and properties: Partial fraction, inverse Laplace transform, analysis of RC, RL, and RLC networks with and without initial conditions using Laplace Transforms. Steady state response of electrical networks to sinusoidal and non-sinusoidal inputs using Laplace transforms.

Module IV: Concept of complex frequency, driving points and transfer functions of ladder and non-ladder network structures,Polesandzerosof immittancefunction, their properties, sinusoidal response from pole-zero locations. Behaviors of resonant circuits designed using RLC components.

Module V: Two port network calculations for impedance, admittance, ABCD and hybrid parameters. Interconnections of 2-port networks. Introduction to passive low-pass, high-pass, band-pass filters using RLC.

Text Books:

1) Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.
2) Ravish R. Singh, "Network Analysis & Synthesis" Tata McGraw Hill Education (India) Private Limited (2013).
3) Van, Valkenburg.; " Network analysis" ; Prentice hall of India, 2000.

Reference Books:

1) A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education.

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]

Course Code:24EE03TH0203 **Course:ObjectOrientedProgramming**
L: 3Hrs, P: 0Hr, Per Week **Total Credits: 3**

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Understand the principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Apply the concepts of generics and implement collection classes and develop reusable programs using the concepts of OOP.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free Codes for solving classic synchronization problems.

MODULE I: Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding, Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading and overriding.

MODULE II: Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

MODULE III: Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, file handling in Java, Serialization, Generics, generic class with two type parameter, bounded generics. Collection classes: Arraylist,Linked List, Hashset, Treeset.

MODULE IV: Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, InterThread communications.

Text Books:

1. Herbert Schildt; JAVA, the Complete Reference; Ninth Edition, TataMcGraw- Hill Publishing Company Limited.
2. Design Patterns by Erich Gamma, Pearson Education.

Reference Books:

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw HillEducationPrivateLtd2013.

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24EE03PR0203 **Course: Object Oriented Programming Lab**

L: 0 Hrs, P: 2 HrPer Week **Total Credits: 1**

Course Outcomes

On completion of the course the student will be able to

1. Design solution to problems using concepts of object oriented programming like classes, objects, inheritance with proper exception handling.
2. Use collection classes, generic classes to design programs and perform database connectivity.
3. Implement programs based on streams and multithreading.

Experiments based on

- Data types, variable, operators, arrays and control structures
- Class, methods and objects
- Exception Handling
- Multithreading
- I/O operations
- Applet structure and event handling

Syllabus for Semester II

B. Tech. Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24HS02TH0205 Course: Foundational Literature of Indian Civilization

L:1Hrs, P: 0 Hrs. Per week Total Credits: 01

Course outcome

At the end of the course the students will be able to achieve the following:

CO1: Understand the Indian knowledge system and its scientific approach

CO2: Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus

CO3: Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools

CO4: Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

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Course Content:

Module 1: Overview of Indian Knowledge System: Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.

Module 2: The Vedic corpus: Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

Module 3: Indian Philosophical systems: Development and unique features, Vedic schools of philosophy, Samkhya and Yoga School of philosophy, Nayay and Vaisesika school of philosophy, Purva-mimamsa and Vedanta schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches

Module 4: Indian wisdom through ages: Panchtantras, Purans: contents and issues of interests, Itihasa: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: Kalidas, Vishakadutta, Bhavbhuti, Shudraka*

*any one text as decided by the course teacher

Reference material

1. B. Mahadevan, VinayakRajatBhar, NagendraPavana R. N., “Introduction to Indian Knowledge System: Concepts and Applications” PHI, 2022

2. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984

Syllabus for Semester II

B. Tech Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code: 24HS04PR0201 **Course: Sports-Yoga-Recreation Lab**

L: 0Hrs, P: 2Hrs. Per week **Total Credits: 01**

Aim of the Course: The course aims to foster Health and wellness through Healthy and Active Lifestyle and creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness through practical experiences and hands on activities.

Objectives of the Course:

1. To impart the students with basic concepts of Sports, Yoga and Recreational activities for health and wellness.
2. To familiarize the students with health-related Exercise and evaluate their Health-related Fitness.
3. To make Overall growth & development with team spirit, social values and leadership qualities among students through various sports, games and Yogic activities.
4. To create Environment for better interaction and recreation among students as neutralizer for stress through various minor and recreational games.

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

1. Understand fundamental skills, basic principle and practices of sports and Yoga.
2. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
3. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
4. Practice Healthy & active living with reducing Sedentary Life style.

Course Content:

Module – 1:

- Warm up and Cool Down and Stretching Exercises.
- General and Specific Exercises.
- Calculation of BMI & Resting Pulse Rate.
- General and Specific exercises for strength, Speed, Agility, Cardiovascular Endurance, Flexibility, Coordinative abilities.
- Practice of Fundamental Skills of Volleyball, Table Tennis and Chess, etc.
- Knowledge and practice of the Equipment used in a Gymnasium and its application.

Module – 2:

- Yoga: Standing, Sitting, Prone & Supine positions.
- Suryanamaskar.
- Pranayama, Meditation and Relaxation Techniques.
- Recreational Games.
- Practice of Fundamental Skills of Basketball, Football, Carrom, etc.
- Health related Physical Fitness Test.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Physical Efficiency Test – 30 Marks Sports/Games skill Activity/Project – 10 Marks Yoga Activities – 10 Marks	50
		Total – 50 Marks

References:

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

Syllabus for Semester II

B. Tech Biomedical Electronics Engineering[School of Electrical and Electronics Engineering]

Course Code:24EE03PR0204 Course: Electronics and Computer Workshop

L: 0 Hrs, P: 2Hr, Per Week Total Credits: 1

Course Outcomes

After successful completion of this course, the student will be able to,

1. Understand components functioning of a computer and procedure to assemble- disassemble it.
2. Install operating system and configure the computer as per the external devices.
3. Install necessary tools and packages to use them maintaining cyber hygiene.
4. Troubleshoot the fault in hardware and software and suggest the preventive measures.
5. Demonstrate an application on computer.

Module-1: Computer Hardware

Identification of hardware components of computer, configuration of each peripheral, disassemble and assemble the PC back to working condition, installation of operating system like Linux or Windows on the personal computer, Hardware troubleshooting and Software troubleshooting.

Module-2: Internet & World Wide Web

Local Area Network configuration and TCP/IP setting to access the Internet, Web Browsers, plugins, proxy settings. Using search engines, installation of antivirus and block active x downloads to avoid viruses and/or worms. Basics of HTML.

Laboratory Exercise:

1. Personal Computer (PC) identification of components, functionality, its assembly -disassembly and configuration.
2. Installation of Operating system and configuring it for dual boot.
3. Hardware troubleshooting of peripherals and devices like printer, scanner, mouse, keyboard, monitor and other devices.
4. Software installation and troubleshooting of licensed and open source softwares and packages like Matlab, Orcad, Simulink, Multisim, Python, Scilab, etc.
5. Local Area Network (LAN) configuration and TCP/IP setting using user interface and Command Line Interface (CLI) like ping, if config, ipneigh, nslookup, etc.
6. Antivirus setup and configuration for online protection, scheduled scan, definition updates, etc.
7. Web Browser configuration and customization for search engine, addons and plugins, proxy settings.
8. Example of HTML web page including text fields (plain and urls), images, animation, etc.

Text Books:

1. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
2. Comdex Information Technology course tool kit by Vikas Gupta, WILEY Dreamtech

Course Code	24EE03TH0301			
Category	Programme Core Course			
Course Title	Human Anatomy and Physiology for Engineers - I			
Scheme and Credits	L	P	Credits	Semester
	4	0	4	III

Course Outcomes:

1. After completion of the course student will be able to:
2. Understand human physiology at a cellular, tissue, and organ systems level.
3. Recognize the integration and control of the different physiological systems and their roles in maintaining homeostasis.
4. Identify the structural and functional aspects of Human Anatomy
5. Classify the process of development and aging of organ systems

Syllabus:

Module I: (8 Hrs.)

Fundamentals of Anatomy, Cells and Tissues:

Introduction to Human Body; Cell Level Organization; Types of cell and their function; Tissue Level Organization; Types of Tissue and there function.

Module II: (06 Hrs.)

Integumentary System and Special senses:

Structure and Function of Skin; Accessory structures of skin; Skin Wound Healing; Development and Aging of Integumentary System; Anatomy and Physiology of Olfaction, Gustation, Vison, Hearing and Equilibrium senses; Aging of senses

Module III: (05 Hrs.)

Skeletal System:

Structure and Function of Bone and the Skeletal System; Bone formation; Fracture and Repair; Types of Bones; Structure and Function of Axial and Appendicular Skeleton; Joint and its classification; Types of Movements at Synovial Joints and Types of Synovial Joints; Aging of Joints

Module IV: (04 Hrs.)

Muscular System:

Overview of Muscular Tissue; Skeletal Muscle Tissue; Working of Muscle Fibers; Metabolism; Control of Muscle Tension; Types of Muscle Fiber and Tissue; Regeneration; Development and Aging of Muscle.

Module V: (04 Hrs.)

Digestive System:

Overview of the Digestive System; Layers of the GI Tract; Neural Innervation of the GI Tract; Structure and Function of Organs of Digestive system; Phases of Digestion; Development and Aging

Module 6: (04 Hrs.)
Excretory system
Overview of Renal Physiology; Anatomy and Physiology of the Kidney; Glomerular Filtration; Reabsorption and Secretion; Waste Management of in other body system; Aging of Urinary System

Text Book:

1. Principles of Anatomy & Physiology, 13th Edition, Gerard J. Tortora and Bryan Derrickson, John Wiley & Sons, Inc
2. Human Anatomy & Physiology Standalone Book, Marieb, Human Anatomy & Physiology, 11th Edition, Pearson.

Reference Books:

1. Atlas of Human Anatomy Professional Edition, 7th Edition, Frank H. Netter
2. Ross & Wilson Anatomy and Physiology in Health and Illness, 13th Edition.
3. Clinical Anatomy: Applied Anatomy for Students and Junior Doctors, 14th Edition.
4. Gray's Anatomy for Students, 4th Edition.

Course Code	**24EE03TH0302**			
Category	**Programme Core Course**			
Course Title	**Data Structures and Algorithms**			
Scheme & Credits	**L**	**P**	**Credits**	**Semester**
	3	**0**	**3**	**III**

Course outcomes:

By the end of this course, students will be able to:

1. Apply programming logic using variables, operators, control flow, and loops to solve basic computational problems.
2. Utilize Python's built-in data structures (lists, tuples, dictionaries) and apply functional programming concepts like higher-order functions, map, and list comprehensions for efficient problem-solving.
3. Implement file handling, exception handling, and modular programming using Python classes and objects to develop robust and reusable code.
4. Design and implement algorithms for stacks, queues, trees, graphs, sorting, and searching while also performing basic image processing using OpenCV in Python.

Syllabus:

Module – I (07Hrs) :
Introduction to programming, algorithms and data structures, Introduction to Python variables, operators, control flow statements, loop statements.

Module –II (08 Hrs):
Python strings, lists, tuples, array, dictionary. Python functions: optional arguments, default values, passing functions as an argument, Nested functions, higher order functions on lists: map, list

comprehension.

Module – III (07 Hrs):
Exception handling, Basic input/output, Handling files, String processing. Introduction to Python object-oriented Programming, Abstract data-types, Classes and objects in Python.

Module – IV (08 Hrs):
Introduction to Data structures and algorithm: stack, queue, Heaps. Sorting, Hashing &Searching, Linked lists, Trees and tree algorithm, graphs and graph algorithm. Introduction to Open CV python, reading, writing and storing images. Various operations on images with OpenCV python.

Text Book:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley, 2013. 2. Kenneth A. Lambert, "Fundamentals of Python: Data Structures" Cengage Learning PTR, 2014.

Reference Books:

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2019. ISBN-13:978-0-8153-9437-2

2. Benjamin Baka, "Python Data Structures and Algorithms" Published by Packt Publishing Ltd.,2017. 3. Gary Bradski, Adrian Kaehler, "Learning OpenCV Computer Vision with the OpenCV Library", O'ReillyMedia,2008.

Course Code	**24EE03PR0302**			
Category	**Programme Core Course**			
Course Title	**Data Structures and Algorithms Lab**			
Scheme & Credits	**L**	**P**	**Credits**	**Semester**
	0	**2**	**1**	**III**

List of Experiments Based on the Syllabus:

1. **Basic Python Programming & Control Structures:** Writing Python programs using variables, operators, and control flow statements (if-else, loops).

2. **Working with Python Data Types:** Implementing operations on strings, lists, tuples, arrays, and dictionaries.

3. **Functions and Higher-Order Functions:** Creating and using Python functions, optional arguments, default values, and applying higher-order functions like map(), filter(), and list comprehensions.

4. **Exception Handling and File Operations:** Writing Python programs to handle exceptions and performing basic file handling operations (reading, writing, and appending data to a file).

5. **Object-Oriented Programming in Python:** Implementing classes and objects in Python, including constructors, methods, and inheritance concepts.

6. **Sorting and Searching Algorithms:** Implementing sorting algorithms (Bubble Sort, Merge Sort, Quick Sort) and searching algorithms (Linear Search, Binary Search) in Python.

7. **Linked List Operations:** Implementing a singly linked list with operations such as insertion, deletion, and traversal.

8. **Image Processing using OpenCV:** Reading, writing, and performing basic image transformations (grayscale conversion, edge detection, image filtering) using OpenCV in Python.

Course Code	24EE03TH0303			
Category	Programme Core Course			
Course Title	Analog Circuits			
Scheme& Credits	L	P	Credits	Semester
	3	0	3	III

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand characteristics of operational amplifiers and its inverting and non-inverting configuration.
2. Analyze inverting and non- inverting configurations of operational amplifier with negative feedback
3. Elucidate and design the linear and non-linear applications of an op amp.
4. Use operational amplifier in the design of Oscillators and Filters.
5. Use IC 555 Timer, ADC/DAC for designing electronic circuits for desired applications and describe the operation PLL IC 565 and its applications

Syllabus:

Module – 1 Op-amp fundamentals (06 Hrs):

Block schematic, Ideal and practical operational amplifier characteristics, open loop Op-amp circuits, concept of virtual ground and negative feedback in Op_amp circuits.

Module – 2 Op_amp basic circuits (06 Hrs):

Inverting and Non inverting Op-amp circuits with negative feedback, Voltage gain, input resistance, output resistance, Bandwidth of Op_amp with negative feedback, Op-amp parameters: Offset voltage, bias and offset current, CMRR, Slew rate.

Module – 3 Op-amp linear applications (06 Hrs):

Voltage follower, summing amplifiers, signal conditioning circuits integrators and differentiators, difference amplifiers, instrumentation amplifiers, Current to voltage and voltage to current converters, logarithmic amplifiers.

Module – 4 Oscillators and Active filters design (05 Hrs):

Precision rectifiers, Op-amp based sinusoidal oscillators, design of Active filters: Low pass, High pass, Band pass and Band stop first order and higher order Butter worth filters.

Module – 5 Op-amp Non-linear applications (06 Hrs):

Clipper, Clamper, Comparators, Schmitt trigger circuits, Comparator IC 339, Triangular wave generator, multivibrator circuits using op-amps, Sample/Hold circuits, Digital to analog converters (DAC), Analog to digital converters (ADC)

Module – 6 Timer IC and PLL IC (06 Hrs):

Timer IC 555: Internal block schematic and operating principle, multivibrator configurations. Operating principle of Phase lock loop (PLL) IC 565 and its applications, Basic concept and configurations of Switched capacitor circuits.

Text Book

1. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad, 4th edition, Prentice Hall India.
2. Linear Integrated Circuits: D. Roy Choudhary, Shail Jain, 5th Edition, New Age International

Reference Books

1. Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition: Sergio Franco, TMH.

Course Code	24EE03PR0303			
Category	Programme Core Course			
Course Title	Analog Circuits Lab			
Scheme& Credits	L	P	Credits	Semester
	3	0	3	III

Course Outcomes

On successful completion of this laboratory students will be able to:

6. Understand characteristics of operational amplifiers and its inverting and non-inverting configuration.
7. Analyze inverting and non- inverting configurations of operational amplifier with negative feedback
8. Elucidate and design the linear and non-linear applications of an op amp.
9. Use operational amplifier in the design of Oscillators and Filters.
10. Use IC 555 Timer, ADC/DAC for designing electronic circuits for desired applications and describe the operation PLL IC 565 and its applications

Sr. No.	List of Experiments
Lab-1:	Design and verify gain and frequency response of Basic Op-amp circuits, a) Inverting amplifier. b) Non-Inverting amplifier.
Lab-2:	Design and verify Op-amp's application as an Adder/Subtractor Circuit.
Lab-3:	Design and verify Op-amp's application as Voltage Follower (Buffer)
Lab-4:	Construct Integrator circuit using Op-amp and plot output waveforms for different input waveforms.
Lab-5:	Construct differentiator circuit using Op-amp and plot output waveforms for different input waveforms.
Lab-6:	Design of Active filters using Op-Amp IC .
Lab-7:	Design and verify Op-amp's application as Schmitt Trigger
Lab-8:	Design and test application of IC 555 Timer as a) Monostable Multivibrator Circuit. b) Astable Multivibrator Circuit.
Lab-9:	Design of free running multivibrator using Op_Amp.

Course Code	24EE03TH0304			
Category	Programme Core Course			
Course Title	Microcontrollers and its application in Healthcare			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	III

Course outcomes:
By the end of this course, students will be able to:

1. Understand the architecture and organization of microprocessor & microcontroller.
2. Analyze the interrupts, timing diagram, and memory interface of microprocessors.
3. Create the basic programming of microprocessor & microcontroller.
4. Design the microcontroller-based system by interfacing the various peripheral devices.
5. Develop microprocessor and microcontroller-based systems in biomedical applications

Syllabus:

Module I: (6Hrs): Introduction to RISC and CISC processors architecture, Introduction to Intel's 8085, architecture, pin diagram, bus concepts, addressing modes. Instruction set, simple programs.

Module II: (6Hrs): Memory interfacing, Timing diagram of 8085, interrupts in 8085, Introduction to X86.

Module III: (4Hrs): Introduction to Microcontroller architecture and family, The Arduino Development Environment, creating sketches, including Libraries, using example codes, Arduino Playground, Debugging using the Serial Monitor. Power management in microcontroller: Sleep mode, idle mode, Run Mode.

Module IV: (7Hrs): Study of Interfacing of LED, SSD, LCD, Switches & Relays, DC motor, Stepper motor, Servo-motors.

Module V: (7Hrs): Sensors, Digital Versus Analog, Connecting Digital and Analog Sensors, Temperature sensors, Humidity Sensors, Obstacle sensors, Ultrasonic sensor, Real-Time Clock (RTC), Accelerometer and gyro.

Module VI: (5Hrs): Commutation Protocols used with microcontroller: Parallel communication, Serial communication, Serial Peripheral Interface (SPI), I2C Communication, Introduction to USB. Biomedical instrumentation with microcontrollers. Microcontroller based biomedical applications case study

Text books:

1. Microprocessor: Architecture, Programming & applications with 8085; Ramesh S. Gaonkar; Penram International, 5th Edition, 2000.

2. Arduino for Beginners: Essential Skills Every Maker Needs, John Baichtal, Pearson Education, Inc., 1st edition, 2013.

Reference books:

1. Advanced Microprocessors and Peripherals; A. K. Ray & K. M. Bhurchandi; McGraw Hill, 3rd Edition, 2017.

2. Arduino Cookbook by Michael Margolis, O'Reilly Media, Inc., 1st edition, 2011.

3. Beginning C for Arduino By Jack Purdum (ebook), 2012.

Course Code	24EE03PR0304			
Category	Programme Core Course			
Course Title	Microcontrollers and its application in Healthcare Lab			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	III

Course outcomes:
By the end of this course, students will be able to:

1. Create the basic programming of microprocessor & microcontroller.
2. Interface microcontroller with various hardware components
3. Design the microcontroller-based system by interfacing the various peripheral devices.
4. Demonstrate proficiency in sensor interfacing, data acquisition and control mechanisms.

List of Experiments:

1. **Programs based on 8085 microprocessors.**

2. **Real-Time Patient Monitoring System**

    a) Interfacing a **Real-Time Clock (RTC - DS1307)** with a microcontroller to log patient health data with accurate timestamps.

    b) Displaying recorded time and date on an **LCD screen** for real-time reference in patient monitoring systems.

3. **Temperature & Humidity Sensing for Medical Environments**

    a) Interfacing an **LM35 temperature sensor** to monitor patient body temperature.

    b) Using a **DHT11/DHT22 sensor** to track temperature and humidity in hospital rooms or incubators for neonatal care

4. **User Input & Patient-Controlled Devices**

    a) Reading **digital input from a button**, simulating patient-activated emergency call systems.

    b) Reading **analog sensor values**, such as a **pressure sensor or potentiometer**, to enable adaptive control in prosthetics or assistive devices.

5. **Motor Control in Medical Devices**

    a) Using **PWM control for a DC motor**, simulating applications in infusion pumps or ventilators.

b) Interfacing a **stepper motor** for precise speed and directional control in medical robotics, prosthetic limbs, or syringe pumps.

6. Medical Equipment Control & Safety Systems

a) Interfacing **multiple switches** to create a responsive user interface for medical devices, such as ECG monitors or diagnostic instruments.

b) Controlling a **relay with a microcontroller** to switch medical-grade AC/DC loads, such as automated hospital beds or sterilization equipment.

Course Code	24EE03TH0401			
Category	Programme Core Course			
Course Title	Human Anatomy and Physiology for Engineers-II			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	IV

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

1. Understand the concepts and knowledge of the cardiovascular, Respiratory, immune, reproductive and nervous system
2. Recognize the integration and control of the different physiological systems and their roles in maintaining homeostasis.
3. Classify the process of development and aging of organ systems
4. Communicate information related to these systems through written, verbal, or multimedia formats in order to assess current knowledge, answer investigative questions.

Syllabus:

Module I:(06 Hrs.)
Respiratory System:
Respiratory system Anatomy; Exchange of gases, Transport of Oxygen and Carbon dioxide; Control of respiration; Development and Aging of Respiration System

Module II: (08 Hrs.)
Cardiovascular System:
Blood and its Property and Function; Anatomy of Heart; Cardiac Muscle tissue and conduction system; the cardiac cycle and output; structure and function of blood vessels; Capillary exchange; Hemodynamics; Circulatory route; Aging and development of cardiovascular system

Module III: (08 Hrs)
Nervous System:
Overview of nervous system; Generation and transmission of electrical signals in neurons; Anatomy and Physiology of Spinal Cord; Brain; Somatic and Autonomic nervous systems

Module IV: (04 Hrs)
Fluid, Electrolyte & Acid Base Homeostasis:
Fluid compartment and Balance; Electrolyte in Body Fluids; Acid Base balance; Aging.

Module 5: (05 Hrs)
The Lymphatic and Immune system:
Structure and Function of Lymphatic system; Innate and Adaptive Immunity; Ceel and Antibody Mediated Immunity; Self recognition and Self Tolerance; Aging and stress on Immunity

Module 6: (05 Hrs.)
Reproductive system:
Male and Female Reproductive system; The Female reproduction cycle; Development and Aging of reproductive systems.

Text Book:

1. Principles of Anatomy & Physiology, 13th Edition, Gerard J. Tortora and Bryan Derrickson, John Wiley & Sons, Inc
2. Human Anatomy & Physiology Standalone Book, Marieb, Human Anatomy & Physiology, 11th Edition., Pearson.

Reference Books:

1. Atlas of Human Anatomy Professional Edition, 7th Edition, Frank H. Netter
2. Ross & Wilson Anatomy and Physiology in Health and Illness, 13th Edition.
3. Clinical Anatomy: Applied Anatomy for Students and Junior Doctors, 14th Edition.
4. Gray's Anatomy for Students, 4th Edition.

Course Code	24EE03TH0402			
Category	Programme Core Course			
Course Title	Fundamentals of AI and Machine Learning			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	IV

Course Outcomes:

On successful completion of the course, students will be able to:

1. Understand fundamental concepts and applications of Artificial Intelligence.
2. Understand fundamental concepts of machine learning algorithm.
3. Apply machine learning algorithms for solving Real-world problems.
4. Understand basic of Artificial Neural Network and apply ANN for solving Real-world problems in various domains.

Syllabus:

Module I: (05 Hrs)

Introduction To Artificial Intelligence : Definition – Future of Artificial Intelligence –Characteristic of Intelligent Agents – Typical Intelligent Agents –Problem Solving Approach to Typical AI problems. Problem solving by Searching: Uninformed and informed strategies and implementation, Path planning, Constraint Satisfaction Problems (CSP).

Module 2: (7 Hrs)

Knowledge Representation: Logical Agents– Propositional and first order Predicate logic-–inference– Knowledge representation and Automated Planning– Uncertain Knowledge and Reasoning: Quantifying uncertainty– probabilistic reasoning;

Module 3: (06 Hrs)

Introduction to machine learning, the concept learning task, Inductive Learning Bias, FIND-S and Candidate- Elimination algorithm, Decision Trees, Basic decision trees learning algorithm, inductive bias in decision tree learning, overfitting.

Module 4: (06 Hrs)

Supervised learning algorithms: Linear and Logistic Regression – Bias/Variance Trade-off, Regularization, Variants of Gradient Descent, Support Vector Machines, Kernel functions in SVM.

Module 5: (05 Hrs)

Artificial Neural Networks, Perceptron, Multilayer networks and Backpropagation algorithm, Introduction to Deep Neural networks, Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs).

Module 6: (06 Hrs)

Unsupervised learning algorithms: Instance based learning, K-Means clustering, and Gaussian Mixture Models. Dimensionality Reduction-PCA, PAC Learnability , Multi-class Classification

Text Book:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
2. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy, Francis Bach, MIT Press,2012.

Reference Books:

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.

2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.

3. Nils J. Nilsson, Quest for Artificial Intelligence, First Edition, Cambridge University Press, 2010.

4. The Elements of Statistical Learning Data Mining, Inference, and Prediction by Trevor Hastie, RoBert Tibshirani, Jerome Friedman, 2nd Edition, Springer, 2009.

5. Machine Learning by Mitchell Tom 1st Edition, McGraw Hill, 1997.

6. Deep Learning by Ian Good fellow, YoshuaBengio, Aaron Courville & Francis Bach, MIT Press, 2017.

7. Introduction to Machine Learning by Ethem Alpaydin, 3rd Edition, PHI Learning, 2015.

Course Code	24EE03PR0402			
Category	Programme Core Course			
Course Title	Fundamentals of AI and Machine Learning Lab			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	IV

Course Outcomes:

On successful completion of the course, students will be able to:

1. Understand fundamental concepts and applications of Artificial Intelligence.
2. Understand fundamental concepts of machine learning algorithm.
3. Apply machine learning algorithms for solving Real-world problems.
4. Understand basic of Artificial Neural Network and apply ANN for solving Real-world problems in various domains

List of Experiment:

1. Implement and compare BFS, DFS, A* Search, and Greedy Best-First Search for problem-solving.
2. Development of a rule-based expert system using Python.
3. Study of Linear Regression.
4. Study of Multiple variable Linear regression.
5. Study of logistic regression. (nonlinear/Linear)
6. Study of decision tree with scikit learn .
7. Study of basic experiment of support vector machine
8. Study of MODEL evaluation with ROC curve.
9. Study of ANN for regression and classification with scikit learn.
10. Study of k-means clustering.

Course Code	24EE03TH0403			
Category	Programme Core Course			
Course Title	Signals Processing and Analysis			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	IV

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand and Analyze Signals – Identify and classify various types of continuous and discrete-time signals, including biomedical signals, and perform basic operations on them.
2. Analyze Linear Time-Invariant (LTI) Systems – Apply convolution, correlation, and system properties such as causality, stability, and impulse response to analyze continuous and discrete-time systems.
3. Apply Transform Techniques – Utilize Laplace Transform, Fourier Transform, and Z-transform to analyze signals and systems, including their stability and frequency response.
4. Implement Fourier Analysis and DFT – Compute and interpret the Discrete Fourier Transform (DFT) and implement Fast Fourier Transform (FFT) algorithms for efficient spectral analysis.
5. Design Digital Filters – Design and implement FIR and IIR digital filters using various techniques, including window methods, frequency sampling, and Butterworth and Chebyshev filter designs.

Syllabus:

Module –I Introduction to Signals and Systems(6 hrs):

Elementary continuous & discrete time signals, introduction to biomedical signals like electroencephalogram (EEG), electrocardiogram (ECG),electro-oculography (EOG), surface electromyogram (EMG), galvanic skin response(GSR), basic operations on signals, classification of signals, introduction to system and system classification.

Module – II Continuous and Discrete Signal and Systems(8 hrs):

Continuous and Discrete Signal and Systems - Periodic, aperiodic and impulse signals; Sampling theorem; Classical method, convolution integral and their properties, causality, correlation, stability, step response, impulse response of interconnected systems, Periodic, aperiodic and impulse signals, transfer function, the frequency response of first and second-order linear time-invariant systems, convolution, correlation, Fourier transforms

Module –III Overview of Laplace Transform(8 hrs):

Need of Laplace Transform, Unilateral and bilateral Laplace Transform, properties criterion, concept of Region of Convergence (ROC), inverse of Laplace Transform, the S-plane and BIBO stability

criterion and Causality, Transfer function, Solution of differential equations, Analysis of LTI System Using L.T. and Applications, relation between Fourier Transform and Laplace Transform.

Module -IV Discrete Fourier Transform (DFT)(7 hrs):

Frequency Domain sampling, DFT and its properties, filtering of long data sequences using overlap-save method and overlap-add method, Radix-2 Fast Fourier Transform (FFT) algorithms.

Module – V Z-transform(8 hrs):

Z-transform and its properties, analysis of LTI discrete time system using Z transform, Relation between Laplace and Z transform, Inverse Z-transform, Unilateral Z- transform.

Module – VI Basic of FIR filter and IIR filter(8 hrs):

Digital filter concepts, FIR filters Design techniques: Fourier series, Windows (Rectangular, Bartlett, Hanning, Hamming, Blackman, Kaiser) and Optimal frequency sampling, structures for FIR systems. Design of Butterworth and Chebyshev filters, structures for IIR systems.

Text Book:

1. Signals and Systems: A.V. Oppenhemn, A.S. Willsky and Hamid Nawab; Pearson publication
2. Discrete Time Signal Processing, Alan V. Oppenheim & Ronald W. Schafer, 3 Edition, Pearson.

Reference Books:

1. Principles of Linear Systems & Signals: B.P. Lathi, Oxford Press, Second Edition, 2009
2. Signals and Systems; Simon Haykin, Barryvan Veen; John Wiley and Sons, 2nd edition, 2003.
3. Signals and Systems; A. NagoorKani, McGrawHill Education, 2015
4. Digital Signal Processing: A Computer based Approach, Sanjit K. Mitra, 4 Edition Mc-Graw Hill.
5. Digital Signal Processing: Principles, Algorithms & Applications, John G. Proakis & Dimitris G. Manolakis, PHI, 4 Edition
6. Digital Signal Processing, A NagoorKani, 2 Edition Mc-Graw Hill

Course Code	**24EE03PR0403**			
Category	**Programme Core Course**			
Course Title	**Signals Processing and Analysis Lab**			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	IV

Experiment List:

1. Generate various types of signals.
2. Perform basic operations on signals.
3. Write a program to verify the linearity and time invariance properties of a given continuous or discrete system.
4. Compute the Fourier Transform of a signal and plot its magnitude and phase response.
5. Obtain the Z-transform of a discrete-time (DT) system and plot its pole-zero diagram in the Z-domain. Analyze its stability and compute the inverse Z-transform.
6. Verify different properties of the Z-transform.
7. Perform circular convolution of the discrete-time sequences x1(n)x_1(n)x1(n) and x2(n)x_2(n)x2(n) using the Discrete Fourier Transform (DFT).
8. Plot the magnitude and phase response of commonly used filters.
9. Write a program to design FIR filters and verify their response using FDA tools.
10. Write a program to design IIR filters and verify their response using FDA tools.

Course Code	24EE03PR0404			
Category	VSEC			
Course Title	Introduction to Digital Fabrication & 3D Printing (Lab course)			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	IV

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Develop a 3-D solid model of a part
2. Understand FDM 3D printing method and its applications.
3. Create G-Code files through slicing process
4. Demonstrate proficiency in using tools like 3D printers and laser cutters
5. Digital portfolio, documenting the design project and fabrication process.

List of Experiments:

1. Prepare a solid 3-D model of a component or a part using geometric modeling software
2. Create a G-Code File through slicing the STL file of the 3-D part
3. Classification 3-D printing processes, materials used and applications
4. FDM machine nomenclature, operations and 3-D printing
5. Post processing of 3-D printed part
6. Laser cutting machine operations and profile cutting
7. Reverse Engineering though 3D Scanning operation and STL file generation
8. Report on design project and Rapid Prototyping

Course Code	24EE03TH0407			
Category	Programme Core Course			
Course Title	Biomechanics			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	IV

Course Outcome:

On successful completion of the course, students will be able to:

1. At the end of this course, students will demonstrate the ability to
2. Understand the Biomechanics of Biological systems
3. Determine the response behavior of bone subjected to external forces
4. Correlate the causes (loading) and effects (deformation) of soft tissue base
5. on viscoelasticity
6. Analyze the fluid flow parameters with elastic vessels.
7. Create a mathematical model for Tissue-implant pair

Syllabus:

Module 1: (5 Hrs)

Introduction to Biomechanics: Introduction to Biomechanics: Introduction, Newton's law-mechanical behavior of bodies; Stress, Strain, Elasticity; Hooke's Law; Introduction to biomechanics, work, power and energy relationship – Concepts of force, Moment and reaction. Bones and Skeletal system representation as springs and their behavioral response.

Module 2: (6 Hrs)

Biosolid Mechanics: Bone structure & composition, mechanical and viscoelastic properties of bone– Bone
growth and development – Bone response to stress – Osteoporosis – causes, diagnosis, treatment – Elasticity and strength of bone. Mechanical Properties of Bones, Axial and Bending Loading on bones

Module 3: (5 Hrs)

Soft Tissue Mechanics: Non-Linear Stress-Strain Relationship; viscoelastic properties of cartilage – Anisotropy and composite models Structure Function and Mechanical Properties of cartilage, Ligaments and Tendons and muscles. Factors affecting muscular force generation – Muscular strength, power and endurance – Muscle injuries.

Module 4: (6 Hrs)

Biofluid Mechanics: Nature of fluids, Types of flows, Newtonian Fluid; Non- Newtonian Fluid; Viscoelastic Fluids; non-viscous fluid, Blood as Newtonian and Non-Newtonian fluid, Velocity and Pressure of Blood Flow; Continuity equation, Bernoulli's equation, Laminar flow and Hagen Poiseuille equation. Velocity and shear stress distribution, Pressure drop.

Module 5: (5 Hrs)

Cardiovascular Mechanics: Mechanical Properties of Blood Vessels: Arteries, Function of Cardiac Chambers & Valves; Mechanics of Angiography and Angioplasty; Stent Deployment & Prosthetic. Radial strain in vessels.

Module 6: (4 Hrs)
Case Studies in Biomechanics: Computational Biomechanics, Tissue material models, Case studies in Biomechanical clinical research, Some Applications of Biomechanics and Sports Biomechanics

Text Book:

1. Fung, Y.C., 2013. Biomechanics: Mechanical properties of living tissues. Springer Science & Business Media.

2. Hall, S.J. and Lysell, D., 1995. Basic Biomechanics (Vol. 2). St. Louis: Mosby.

3. Knudson, D., 2007. Fundamentals of Biomechanics. Springer Science & Business Media.

Reference Books:

1. Peterson, D.R. and Bronzino, J.D. eds., 2014. Biomechanics: principles and practices. CRC Press.

2. Zamir, M., 2006. The physics of coronary blood flow. Springer Science & Business Media.

3. J. G Webster, "Medical instrumentation –Application & design", John Wiley and Sons Inc., 3rd edition, 2003.

4. D. J. Schneck and J. D. Bronzino, "Biomechanics- Principles and Applications", CRC Press, 2nd Edition,2000.