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			Maximum marks			ESE Duration (Hrs)
				L	P	C	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	L	P	C	Continuous Evaluation	End Sem/ Internal Eval	Total	ESE Duration (Hrs)
				Hours/week			**Maximum marks**			
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	24HS03TH0211	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	24HS02TH0205	Foundational Literature of Indian Civilization	1	0	1	50	50	100	-
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

S N	Course Type	Code	Course	Hours/week			Maximum marks			ESE Duration (Hrs)
				L	P	C	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			Maximum marks			ESE Duration (Hrs)
				L	P	C	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			Maximum marks			ESE Duration (Hrs)
				L	P	C	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			Maximum marks			ESE Duration (Hrs)
				L	P	C	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	50	50	100	-
			TOTAL	**10**	**16**	**17**				
				26Hrs.						

Semester VIII/VII

S N	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

S N	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

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Evaluation	End Sem/ Internal Eval	Total	
1	VII	24EE03TH0709	Research Methodology	3	0	3	50	50	100	3
2	VII	24EE03PR0710	Research Project Phase -I	0	6	3	50	50	100	-
3	VIII	24EE03PR0805	Research Project Phase -II	0	24	12	50	50	100	-
			TOTAL	**3**	**30**	**18**				
				33 Hrs.						

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

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 Coefficents, 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**.**

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

B. Tech. Biomedical Electronics Engineering [School of Electrical and Electronics Engineering]
Course Code: 24HS03TH0101   Course Name: Calculus, Probability, and Statistics
L: 3 Hrs., 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.

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

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

L:0 Hr P:2 Hrs., 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

Course Code: 24EE03TH0101　　　　**Course: Fundamentals of Electrical and Electronics Engineering**
L: 3 Hrs, 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. Basic Electrical Engineering: 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

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

Text books:

1. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989.

2. Modern Digital Electronics: R. P Jain, Tata McGraw Hill, 3rd Edition.

Reference Books:

1. Digital Logic and Computer Design: Morris Mano, PHI, 3rd Edition.

List of Experiments

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 $F = \Sigma m$ (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.

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

Course Code: 24EE03TH0103	**Course: Fundamentals of Programming**
L: 3 Hrs, 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 solveand execute the given problem.
2. Formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs, testand 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 completeprogram 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/Pseudo code with examples. Arithmetic expressions and precedence.

Module 2 C Programming Language
Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Pre-processor Directives, Decision Control Statement-if, if-else, nested if-else statement, 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: As a different way of solving problems. Example programs, such as 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 f flush ().

Text Books
1. Programming in ANSIC: E. Balguruswami Mc GrawHill
2. Mastering C: K. R. Venugopal and S.R. Prasad, Tata Mc GrawHill
Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, B P B Publication

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 simply 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.

Note :- 2/3 Practice Programs will be taken on each of the experiments mentioned above.

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

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

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

Course Code: 24HS02PR0101   **Course: English for Professional Communication Lab**

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

Course Outcomes

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

CO1: Apply effective listening and speaking skills in professional and everydayconversations.

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 writingSyllabus

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

[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

[School of Electrical and Electronics Engineering]

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
24HS02PR0 105-2	**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)

[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)

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.

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)	On
24HS02PR 0105-07	**Introduction to Spanish Language**	I/II	2	1	50	

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

Course Code	Course Name	Sem.	Hours/wee k	Credi ts	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

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.

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.

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.

Course Code: 24HS03TH0211	**Course Name: Linear Algebra and Multivariate Calculus**
L: 3 Hrs, 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

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. Solid State Electronic Devices: Ben G Streetman, Sanjay Kumar Banerjee, Sixth Edition, PHI.

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

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,Polesandzeros of 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.

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

Course Code: 24EE03TH0203
L: 3 Hrs, P: 0 Hr, Per Week

Course:Object Oriented Programming
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.

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

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

L: 0 Hrs, P: 2 Hr Per 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

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

Course Code: 24HS02TH0205	**Course: Foundational Literature of Indian Civilization**
L: 1 Hrs, 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

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

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

Course Code: 24HS04PR0201	**Course: Sports-Yoga-Recreation Lab**
L: 0 Hrs, P: 2 Hrs. 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: RashtrothannaPrakashana.

5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

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

Course Code: 24EE03PR0204   **Course: Electronics and Computer Workshop**

L: 0 Hrs, P: 2 Hr, 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