Shiksha Mandal's

Bajaj College of Science, Wardha

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

CREDIT STRUCTURE

B.Sc. Sem – VII (Honors in Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (Hrs.)			Total Credits
				TH	TU	PR	
1	DSC – IX	Electronic Devices and Circuit	UEL470T	4	-	-	4
2	DSC – X	Linear Integrated Circuits	UEL475T	4	-	-	4
3	Practical – I	Electronic Devices and Circuit Practical	UEL470P	-	-	6	3
4	Practical – II	Linear Integrated Circuits Practical	UEL475P	-	-	6	3
5	DSE - III	Electrical Engineering and Network Analysis/ Operating System	UEL474T	4	-	-	4
6	RM	Research Methodology	UEL476T	4	-	-	4
Total				16	-	12	22

SYLLABUS FOR Fourth Year B.Sc. (HONORS in ELECTRONICS)

(Approved in BoS Meeting held on 24.03.2026 to be implemented from the academic Session 2026-27)

SEMESTER VII

Course Name: DSC-IX Electronic Devices and Circuit

Course code: UEL470T

Credits: 4 **No. of Hrs.: 60**

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
	Students will learn:	Students will:
1	concepts of Semiconductor materials and devices	Understand semiconductor devices and their operations
2	P-N Junction diode, rectifiers filters, Zener diode	Comprehend the knowledge of diode and its applications in rectifier and regulator circuits.
3	Bipolar Junction Transistor, JFET, MOSFET, UJT, biasing, Transistor Configuration, hybrid parameters	Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters
4	Transistor Amplifiers, Coupling, feedback in amplifiers	Understand feedback concept, topologies and their applications.

5	Various types of Oscillators	Implement and analyse various electronic circuits such as oscillators, multistage amplifiers and power amplifiers using BJT
6	Different types of diodes	Understand the characteristics and application of various diodes.

Unit-I:P-N Junction diode theory, Rectifiers - Half wave, full wave and bridge, Filters-C, LC and their analysis, analysis of clipping and clamping circuits using diodes, Zener diode and its application (as voltage regulator, wave protection).

Unit II: Theory and Analysis of Bipolar Junction transistor, Configurations, transistor as a switch, 'Q' and stability factor, Methods of biasing, their needs, 'h' Parameter (CE, CB, CC analysis)

Unit III: FETs (JFET & MOSFET): Types, Characteristics and parameters (μ, gm, Rd), Biasing of FET, MOS capacitor, Equivalent circuits of JFET and MOSFETs, CMOS characteristics.

Unit IV: Study of typical transistor amplifier circuits: BJT: RC coupled amplifier, Transformer coupled amplifier, Direct coupled amplifier, Cascade stage, Emitter follower, Darlington emitter follower, Bootstrap emitter follower, Feedback amplifiers. FET Amplifier-Common Source & Common Drain.

Unit V: Class 'A', 'B', 'AB' and 'C' amplifiers, Calculations of power gain, efficiency, power dissipation and distortion, Oscillators, their criteria, Hartley, Colpitts and R-C Oscillators, Crystal Oscillator.

Unit VI: Theory, Construction and applications of Schottky diode, Tunnel diode, Varactor diode, LED, Photo diode, Phototransistor, PIN diode.

SEMESTER VII

Course Name: DSC-IX Electronic Devices and Circuit Practical

Course code: UEL470P

Credits: 2 (4Prs.) **No. of Hrs.: 60**

Students are expected to perform at least 10 experiments from Electronic Devices and Circuit course (DSC-IX).

Text Books:

1. Electronic Devices and: David A.Bell, Oxford University Press
2. Electronic Devices and Circuits: Millman and Halkias,TMGH
3. Integrated Circuits: Millman and Halkias,TMGH 4)
4. Microelectronics: Millman and Halkias,TMGH 5)
5. Millman and Taub: Pulse, Digital and Switching wave forms (TMGH,

Reference Books:

1. Microelectronic Circuits: Sedra/Smith,5e, Oxford University Press
2. Electronic Devices & Circuit Theory: R. L. Baylestad & L. Nashlsky (6th Edition), Pearson Education
3. Semiconductor Devices and Circuits: Aloke K. Dutta, Oxford University, Press

SEMESTER VII
Course Name: DSC-X Linear Integrated Circuits

Course code: UEL475T

Credits: 4 **No. of Hrs.: 60**

Course Objective and Course Outcome

SN	**Learning Objectives**	**Course Learning Outcomes**
	Students will try to learn:	After successful completion of the course student will be able to:
1	Difference Amplifiers, Parameters of op-amp	Comprehend the knowledge of basic concepts and performance parameters of Op-Amp.
2	Linear and non-linear applications of op-amp	Analyse and design electronic circuits for various linear and non-linear applications
3	Voltage regulators using transistors and ICs	Acquire and apply knowledge for design of voltage regulator circuits using ICs and discrete components.
4	Timer IC555 and its applications	Analyze and design electronic circuits using timer IC
5	Phase locked loops and	Comprehend the knowledge of PLL, its applications and data converters.

Unit I: Operational Amplifier: Differential amplifier: gain expression using H parameters, transfer-characteristics, constant current source, level shifting, block diagram of op-amp, frequency response, frequency compensation methods, study of IC, measurement of parameters of op-amp, off set nulling and their importance.

Unit II: Linear Applications of Op-amp Inverting and non-inverting amplifiers, voltage followers (ACDC), integrator, differentiator, Differential amplifier, bridge amplifier, Instrumentation amplifiers, precision rectifier, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III: Non-Linear Applications of Op-Amp and Filter Circuits Clipping and clamping circuits, comparator, astable, monostable and bistable multivibrator, Schmitt Trigger, voltage sweep generator, active filters: Butterworth (First Order and Second Order), Band pass and band reject filters using op-amp,

Unit IV: Voltage Regulator Transistorized series and shunt voltage regulators, Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78xx, 79xx, and LM 317.

Unit V: Timers: Block schematic of regulator IC 555, application of timer 555 as astable, monostable and bistable multivibrator, Delayed timer, sawtooth generators, function generator using 8038, Sample & Hold circuit

Unit VI: Phase Locked Loops Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its application as AM detector, FM detector and Frequency translator.

SEMESTER VII
Course Name: DSC-X Linear Integrated Circuits Practical
Course code: UEL475P
Credits: 2 (4Prs.) **No. of Hrs.: 60**

Students are expected to perform at least 10 experiments from Linear Integrated Circuits course (DSC-X).

Text Books:

1) Gayakwad R.A.: Op-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (2nd edition)

2) Robert F. Coughlin: Operational Amplifiers & Linear Integrated Circuits, and F. F. Driscoll Pearson Education

Reference Book:

Sedra/Smith: Microelectronics Circuits, 5e, Oxford University Press

SEMESTER VII

(Elective)

Course Name: DSE III Electrical Engineering and Network Analysis

Course code: UEL474T

Credits: 4 **No. of Hrs.: 60**

Course Objective and Course Outcome Framework

SN	Course Objectives	Course Outcomes
	Students will try to learn:	After successful completion of the course student will be able to:
1.	Fundamentals of Electrical Engineering Basic concepts	Analyse electrical circuits using mesh and node analysis.
2.	Network theorems	Apply suitable network theorems to analyse electrical circuits.
3.	Laplace Transformation and its applications	Apply Laplace Transform for circuit analysis.
4.	Graph theory and network equations	Draw oriented graph of network to determine their currents and voltages
5.	Two port Network and parameters using h-parameters	Relate various two port network and apply two-port network theory for network analysis

Unit I: Fundamentals of Electrical Engineering Basic concept of voltage, current, work, power and energy, relationships between them, Resistance, resistivity, conductivity, Ohm's law, series and parallel connections of resistors, voltage and current division, Star to delta and delta to star transformations, Kirchhoff's laws applied to dc circuits, single phase AC Circuits (sinusoidal waveforms only), R-L-C series circuits and parallel circuits, phasor diagram, impedance triangle, active reactive power.

Unit II: Single phase transformer Principle of operation, construction, EMF equation of transformer, voltage transformation ratio, transformer on no load, transformer on load, losses in transformer, voltage regulation of transformer, efficiency of transformer, condition for maximum efficiency. Basic Network Elements and sources Network elements, circuit components, assumptions for circuit analysis, voltage and current sources, Standard input signals, source transformations, mesh and node analysis.

Unit III: Graph theory and network equations Graph of a network, Trees, co trees and loops, Incidence matrix, Cut-set matrix, Tie set matrix and loop currents, possible trees, analysis of a network using Kirchoff's laws, network equilibrium equation and Duality network transformations.

Unit IV: Laplace Transformation and its applications Laplace transformations, basic theorems, Laplace transform of some important functions, initial and final value theorem, gate function, impulse function, Solutions of linear differential equations with constant coefficients, Heaviside's partial fraction expansion.

Unit V: Network Theorems Introduction, Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem applied to DC and AC circuits.

Unit VI: Two-Port Network Open circuit impedance parameters, short circuit admittance parameters, Transmission or chain parameters, Hybrid parameters, Interrelationships between the parameters, Interconnection of two port networks, Input impedance in terms of two port parameters, Output impedance in terms of two port parameters.

Text Books:

1. De Carlo Lin : Linear Circuit Analysis, 2e, Oxford University Press
2. D. Roy Choudhary : Network and Systems (New Age International/ Wiley eastern ltd)
3. V .N. Mittle : Basic Electrical Engineering, (TMGH)

Reference Books:

1. M.E. Van Valkenburg : Network analysis 3rd Ed. (PHI)
2. Iskv Iyer : Circuit Theory, (TMGH)
3. Edminister : Electric Circuits, Schaum Outline Series

SEMESTER VII

(Elective)

Course Name: DSE III Operating System

Course code: UEL474T

Credits: 4 **No. of Hrs.: 60**

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
	Students will learn:	After successful completion of Biomedical Instrumentation
1	Fundamentals of OS	Understand GUI, OS structure, Layers, kernels
2	Process and Process management, CPU scheduling	Understand the process and Process management, CPU scheduling
3	Memory management	Address spaces, swapping, Paging, page replacement algorithms
4	File systems and distributed file systems	Understand file organisation and access, Disk Scheduling, linux and Mobile OS

Unit I: Graphical User Interface; System Calls; System Programs; Operating System Structure: Simple, Layered Approach; Micro-kernels, Modules; Virtual Machine; System Boot.

Unit II: Process Management: Process Concept, Process States, Process Control Block, Process Scheduling: Schedulers, Context Switch; Operations on Process: Creation, Termination, Inter Process Communication; Threads: Concept, Benefits; CPU Scheduling: Burst Cycle, Types of Scheduling, Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, Priority Scheduling, Round-Robin, [multiple processor scheduling]

Unit III: Process Synchronization and Deadlocks: Critical Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlock: System Model, Deadlock Characterization, Resource Allocation Grpah, Methods for handling Deadlock: Prevention, Avoidance and Detection; Recovery from Deadlock: Process Termination, Resource Preemption.

Unit IV: Memory Management: [Basic Hardware, Address Binding]; Logical and Physical Address Space, Swapping, Contiguous Allocation, Dynamic Storage Allocation: First-fit, Best-Fit, Worst-fit; Fragmentation; Paging; Segmentation. Virtual Memory: Introduction, Virtual Address Space, Demand Paging, Copy-on-write, Page Replacement: Concept, Page Replacement Algorithms: FIFO, Optimal Page Replacement, LRU, Second-Chance Page Replacement; Thrashing, I/O Interlock.

Unit V: File System: File: Concept, Attributes, Operations; File Organization and Access: Sequential, Index Sequential, Indexed, Direct or Hash File. Directory: Operations, Structures. Protection: Access Control and Permissions. File System Structure, Allocation Methods, Free Space Management. Disk Structure, Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK. [Disk Management, Swap Space Management], RAID: Concept. I/O Systems: I/O Hardware, Interrupts, DMA, Application I/O Interface, Kernel I/O Subsystem.

Unit VI: Distributed File System: Concept, Naming and Transparency, Remote File Access, Stateful Vs Stateless Service, File Replication, Remote Login, Remote File Transfer, Data Migration, Computation Migration, Process Migration. Embedded Operating Systems: Embedded Systems: Definition, Requirements and Constraints, Organization of Embedded System; Characteristics of Embedded Operating Systems. Case Studies: Linux and Mobile Operating Systems

Text Books:

1. Operating System Concepts – Seventh Edition: Abraham Silberschatz, Peter Galvin, Greg Gagne (John Wiley & Sons)
2. Operating Systems: William Stallings (Pearson)
3. Modern Operating System: Andrew S. Tanenbaum

Course Name: Research Methodology
Course code: UEL476T

Credits: 4 **No. of Hrs.: 60**

SN	Course Objectives	Course Outcome
	Students will learn:	Students will:
1	The basics of research and develop the ability to conduct basic research and identify scientific problems.	Understand the foundational principles and processes of research. ▪ Define research and differentiate its types: basic, applied, and patent-oriented. ▪ Explain the objectives of basic research, characteristics of a good investigator, and steps of action research.
2	Statistical analysis techniques and use software like MS Excel for data analysis.	Develop scientific thinking skills and conduct effective literature reviews. ▪ Identify and frame research problems using logical steps and appropriate sources. ▪ Organize and write a structured literature review using reliable reference sources.
3	Skills for scientific writing, structuring research papers, and understanding research indicators.	Apply statistical methods to analyze research data effectively. ▪ Distinguish between different types of errors and evaluate data using statistical measures like mean, standard deviation, and confidence limits. ▪ Apply tests such as F-test, t-test, Q-test, and regression analysis for data validation and comparison.
4	Intellectual property rights and their relevance to research.	Use digital tools for data analysis, visualization, and reference management. ▪ Perform statistical analysis using Microsoft Excel and visualize data using OriginLab. ▪ Manage references and bibliographic data using tools like Zotero and Mendeley.
5	The use of tools and techniques necessary for research, including reference management software	Acquire skills in scientific writing and research communication. ▪ Prepare scientific papers, reports, and theses following structured formats. ▪ Understand research metrics (e.g., Impact Factor, h-index) and use digital tools for effective writing and communication.

6	Research ethics and plagiarism.	Understand ethical practices and intellectual property rights in research. ▪ Explain the importance of research ethics and academic integrity. ▪ Identify different forms of IPR and apply plagiarism detection methods to ensure originality in research.

Unit I: Foundations of Research

1.1. Definition, general and specific characteristics of research
1.2. Types of research: Basic, applied, patent-oriented
1.3. Objectives of basic research
1.4. Characteristics of a good investigator
1.5. Steps of action (basic) research

Unit II: Scientific Thinking and Literature Review

2.1. Scientific thinking: Characteristics and process
2.2. Steps in problem identification
2.3. Criteria and sources for selecting a research problem
2.4. Review of literature: Meaning, need, objectives
2.5. Structure of literature review
2.6. Sources for literature collection
2.7. Simple rules for writing literature review

Unit III: Statistical Analysis in Research

3.1. Errors in chemical analysis: Systematic vs. random, additive vs. proportional, absolute vs. relative
3.2. Accuracy and precision
3.3. Mean, median, average deviation, standard deviation
3.4. Significant figures: Rules and calculations
3.5. Confidence limits, correlation coefficient, regression analysis
3.6. Comparison of methods: F-test, t-test
3.7. Q-test for rejection of data
3.8. Least squares method for calibration curves

Unit IV: Digital Tools for Data Analysis and Reference Management

4.1. Application of Microsoft Excel in statistical analysis (functions and spreadsheets)
4.2. Use of Certified Reference Materials (CRMs)
4.3. Software tools: MS Word, Excel, PowerPoint
4.4. OriginLab for graph plotting
4.5. Search methods for scientific literature
4.6. Reference styles and management tools: Zotero, Mendeley
4.7. Preparing a bibliography database

Unit V: Scientific Writing and Research Communication

5.1. Scientific writing: Types of publications (journals, reviews, magazines, newsletters)
5.2. Structure of scientific paper and thesis
5.3. Report writing: Types and layout
5.4. Research indicators and metrics: Impact Factor, Cite Score, h-index, i10-index, Citation Index
5.5. Referencing styles and bibliography tools

5.6. Use of writing software for thesis and paper structuring

Unit VI: Ethics, Integrity and Intellectual Property Rights (IPR)

6.1. Research ethics and academic integrity
6.2. Plagiarism: Types, prevention, and detection using software
6.3. Introduction to IPR: Patents, trademarks, copyrights, GI, neighbouring rights
6.4. Theories and concepts of IPR
6.5. Advantages and disadvantages of IPR in research

Reference/ Books:

1. Shanti Mishra, & amp; Alok, S. (2011). Handbook of Research Methodology: A Compendium for Scholars & Researchers. Educreation Publishing.
2. Singh, Y. kumar. (2006). Fundamentals of Research Methodology and Statistics. New Age International Publishers.
3. Walliman, N. (2010). Research Methods: The Basics. Routledge Taylor and Francis Group.
4. Research Methodology- C. R. Kothari
5. Best and Kahn, Research Methodology, PHI Limited
6. Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/cole.
7. Patrick Carey, Katherine T. Pinard, Ann Shaffer, Mark Shellman, New Perspectives Microsoft Office 365 and Office 2019 Introductory, 2020.

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