BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

Office of the Secretary

Faculty Council for Undergraduate Studies

Ref: BKU/FCUG/177/2026 Date: 29/06/2026

NOTIFICATION

As directed, the undersigned is pleased to inform all concerned that Bankura University has initiated the process to implement New Curriculum and Credit Framework for Undergraduate Programme, UGC 2022 (as per NEP 2020) for 4-years Undergraduate programme with Electronics as Major, Minor etc. from the academic session 2023-2024. The syllabus as framed / drafted and partially implemented deserves to be analysed after receiving feedback from different stakeholders. As an important corollary to the process, a workshop will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme/course are requested for their kind participation in the workshop and to present their views/ observations, etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on ugsecretaryoffice@bankurauniv.ac.in within seven days from the date of publication of this notice.

Date: 03.07.2026
Time: 10:30 am

Sd/-
Dr. Arindam Chakraborty
Secretary
Faculty Council for Undergraduate Studies

Ref: BKU/FCUG/176(6)/2026 Date: 29/06/2026

1. Registrar (Addl. Charge), Bankura University.
2. Dean (Officiating), Faculty Council of P.G. Studies in Arts, Science etc. Bankura University.
3. Chairperson / Convenor, Undergraduate Board of Studies in Electronics, Bankura University with request for necessary action.
4. System Administrator, Bankura University with request to upload this in website.
5. Secretary, Hon'ble Vice Chancellor, Bankura University.
6. Guard File.

Sd/-
Dr. Arindam Chakraborty
Secretary
Faculty Council for Undergraduate Studies

SYLLABUS

FOR

FOUR YEARS UNDERGRADUATE PROGRAMME

IN

ELECTRONICS

Curriculum and Credit Framework for Undergraduate Programmes (CCFUP) Based on NEP 2020

With effect from the Academic Session 2023-2024

BANKURA UNIVERSITY

BANKURA

WEST BENGAL

PIN 722 155

Scheme for Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)

Programme and User Structure with Credit Distribution: UG Degree Programmes with Single Major										
Category of User (Credit)	Major (4)		Minor Stream (4)	Multidisciplinary (3)	Skill Enhancement User (SEC) (3)	Ability Enhancement User (AEC) (2)	Value Added Users mmon for all (4)	Summer Internship (2)	Research Project / Dissertation (12)	Total Credit / Number of Users
Semester	DSC	DSE								
I	1× 4 =4		1× 4=4	1×3=3	1×3=3	1× 2=2	1× 4=4			20/6
II	1× 4 =4		1× 4=4	1×3=3	1×3=3	1× 2=2	1× 4=4			20/6
Certificate (Total Credit)	8		8	6	6	4	8	1×4=4* (ADDITIONAL)		40/12
III	2×4 =8		1× 4=4	1×3=3	1×3=3	1 × 2=2				20/6
IV	4×4 = 16		1×4=4			1 × 2=2				22/6
Diploma (Total Credit)	32		16	9	9	8	8	1×4=4* (ADDITIONAL)		82/24
V	4×4 =16		1×4=4					1×2 =2 Mandatory		22/6
VI	4×4 = 16		1×4=4							20/5
UG Degree (Total Credit)	64		24	9	9	8	8	2		124/35
VII	4×4 =16		1×4=4							20/5
VIII	4× 4 =16		1×4=4							20/5
UG HONS. (Total Credit)	24×4 =96		32	9	9	8	8	2		164/45
UG HONS. With Research (Total Credit)	21×4= 84		32	9	9	8	8	2	12**	

Certificate User in ELECTRONICS 1 year duration (I-II Semester); Diploma User in ELECTRONICS 2 years duration (I-IV Semester); UG Degree in ELECTRONICS 3 years of duration (I-VI); UG Degree in ELECTRONICS Honours 4 years of duration (I-VIII; without Research) and

UG Degree in ELECTRONICS Honours 4 years of duration (I-VIII; with Research).

Credit Distribution Across Users

User Type	Total Papers	Credits
Major re (MJC)	24	24×4 =96
Minor (MN)	8	8×4=32
Multidisciplinary (MD)	3	3×3=9
Skill Enhancement Users (SEC)	3	3×3=9
Ability Enhancement Language Users (AEC)	4	1×2=2 (ENG) 3×2=6 (MIL)
Value Added User (VAC)	2	2×4=8
Internship (INT)	1	1×2=2
Research Project/Dissertation	1	1×12=12**
Totals	**46**	**164**

Curriculum and Credit Framework for User in Electronics

SEMESTER–III

User de	User Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/ELE/ 301/MJC-3	MJCT-3: Seminductor Devices MJCP-3 Seminductor Devices Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 302/MJC-4	MJCT-4: Electronics Circuits MJCP-4: Electronics Circuits Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 303/MN-3	MNT-3: Seminductor Devices and Analog Electronics MNP-3: Seminductor Devices and Analog Electronics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 304/MD-3	MDT-3: Communication Systems	3	10	40	50	3	NA	NA
S/ELE/305/ SEC-3	SECP-2 Programming in Python Lab	3	10	40	50	NA	NA	6
ACS/306/ AEC-3	MIL-2	2	10	40	50	2	NA	NA
Total in Semester - III		**20**	**60**	**240**	**300**	**14**		**12**

N.B. MJC – Major re; MN – Minor; MD – Multidisciplinary; AEC- Ability Enhancement User; SEC- Skill Enhancement User.

Theory: - 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week

SEMESTER–IV

User de	User Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/ELE/ 401/MJC-5	MJCT-5: Signals & Systems MJCP-5: Signals & Systems Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 402/MJC-6	MJCT-6: Digital Electronics MJCP-6: Digital Electronics Lab	3 1	10	25 15	50	3		2
S/ELE/ 403/MJC-7	MJCT-7: C Programming and Data Structures MJCP-7: C Programming and Data Structures Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 404/MJC-8	MJCT-8: Operational Amplifiers and Applications MJCP-8: Operational Amplifiers and Applications Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 405/MN-4	MNT-4: Instrumentation MNP-4: Instrumentation Lab	3 1	10	25 15	50	3	NA	2
ACS/406/ AEC-4	English	2	10	40	50	2	NA	NA
ACS/407/ INT-2	Internship	4*		50	50	NA	NA	NA
Total in Semester - IV		**22+4***	**60**	**240**	**300**	**17**		**10**
Send Year (Diploma User) Total Credit		**(40+42) +4***	**120**	**480**	**600**			

****Degree in Electronics will be awarded to a student if he or she mpletes Internship of 2 credits in addition to total 124 credits in Semester I, II, III, IV, V & VI.**

N.B. MJC – Major re; MN – Minor; MD – Multidisciplinary; AEC- Ability Enhancement User; INT- Internship; 4*- Additional

Theory: 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week. * Diploma in Physiology will be awarded to a student if he or she mpletes Internship of 4 credits at least 1 in 2 years in addition to total 82 credits in Semester I, II, III & IV.

SEMESTER–V

User de	User Title	Credit	Marks			No of Hours/Week		
			IA	ESE	Total	Lec	Tu	Pr
S/ELE/501/MJC-9	MJCT-9: Microprocessor and Microntroller MJCP-9: Microprocessor and Microntroller Lab	3 1	10	25 15	50	3	NA	2
S/ELE/502/MJC-10	MJCT-10: Electromagnetics MJCP-10: Electromagnetics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/503/MJE-11	MJCT-11: Power Electronics MJCP-11: Power Electronics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/504/MJE-12	MJET-12: Electronic Instrumentation MJEP-12: Electronic Instrumentation Lab	3 1	10	25 15	50	3	NA	2
S/ELE/505/MN-5	MNT-5: Microprocessor and Microntroller MNP-5: Microprocessor and Microntroller Lab	3 1	10	25 15	50	3	NA	2
ACS/ELE/506/INT-3	INT-3: Internship**	2			50			
	Total in Semester – V	**22**	**50**	**250**	**300**	**15**		**10**

SEMESTER–VI

User de	User Title	Credit	Marks			No of Hours/Week		
			IA	ESE	Total	Lec	Tu	Pr
S/ELE/601/MJC-13	MJCT-13: Communication Electronics MJCP-13: Communication Electronics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/602/MJC-14	MJCT-14: Photonics MJCP-14: Photonics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/603/MJE-15	MJCT-15: ntrol Systems MJCP-15: ntrol Systems lab	3 1	10	25 15	50	3	NA	2
S/ELE/604/MJE-16	MJCT-16: Numerical Techniques MJCP-16: Numerical Techniques Lab	3 1	10	25 15	50	3	NA	2
S/ELE/605/MN-6	MNT-6: Photonic Devices and Power Electronics MNP-6: Photonic Devices and Power Electronics Lab	3 1	10	25 15	50	3	NA	2
	Total in Semester – VI	**20**	**50**	**250**	**250**	**15**		**10**

Third Year (UG Degree User) Total Credit	**82+42**	**100**	**500**	**550**	

SEMESTER–VII

User de	User Title	Credit	Marks			No. of Hours/Week		
			IA	ESE	Total	Lec	Tu	Pr
S/ELE/ 701/MJC-17	MJCT-17: Transmission Lines, Antenna and Wave Propagation MJCP-17: Transmission Lines, Antenna and Wave Propagation Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 702/MJC-18	MJCT-18: Modern Communication Systems MJCP-18: Modern Communication Systems Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 703/MJE-19	MJCT-19: Digital Signal Processing MJCP-19: Digital Signal Processing Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 704/MJE-20	MJCT-20: Applied Physics MJCP-20: Applied Physics Lab	3 1	10	25 15	50	3	NA	2
S/ELE/ 705/MN-7	MNT-7: Communication Systems MNP-7: Communication Systems Lab	3 1	10	25 15	50	3	NA	2
	Total in Semester – VII	20	50	200	250	15		10

N.B.: MJC – Major re, MN – Minor; MD – Multidisciplinary; INT- Internship **(Mandatory)
Theory: - 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week

MJC-17: Transmission Lines, Antenna and Wave Propagation (Credits: Theory-03)

User de: S/ELE/701/MJC-17 User ID: F.M. = 25

User Learning Objectives

This User introduces the basic ncepts of electromagnetic wave propagation. It explains different types of transmission lines and their parameters. Students also learn about wave propagation in waveguides and their modes. The User further vers antenna fundamentals, antenna parameters, and different types of antennas used in Communication systems.

User Learning Outmes: At the end of this User, students will be able to

1: Explain the basic principles of electromagnetic wave propagation and related effects.

2: Describe different types of transmission lines and analyse their performance parameters such as losses and Standing Wave Ratio (SWR).

3: Calculate input impedance and reflection efficient of transmission lines and use the Smith Chart for related calculations.

4: Explain electromagnetic radiation and antenna characteristics, including the half-wave dipole antenna and Radar range equation.

Unit-1: Transmission Lines (15 Lectures)

Types of transmission lines such as axial line, two-wire line, microstrip line, planar line and slot line, Transmission line parameters and equations, wave propagation in transmission lines, low-loss, lossless and distortion-less lines, input impedance, Standing Wave Ratio (SWR), power in transmission lines, short-circuited, open-circuited and matched lines, Smith Chart, and applications of transmission lines.

Unit-2: Radiation of Electromagnetic Waves (15 Lectures)

ncept of retarded potentials and radiation mechanism, Antenna parameters such as radiation pattern, radiation power density, radiation intensity, beamwidth, directivity, antenna efficiency, gain, beam efficiency, bandwidth, polarization,

input impedance, effective length, effective area, maximum directivity, Friis transmission equation, and Radar range equation.

Types of Antennas: Hertzian dipole, half-wave dipole, quarter-wave dipole, Yagi-Uda antenna, microstrip antenna, parabolic antenna, helical antenna, and antenna arrays.

Unit-3: Waveguides and Waveguide Devices (15 Lectures)

Wave propagation in waveguides, parallel-plate waveguides, modes of propagation (TEM, TE, TM modes), rectangular waveguides, power transmission and attenuation, rectangular cavity resonators, and waveguide devices such as directional upler, isolator and circulator.

Unit-4: Electromagnetic Wave Propagation (15 Lectures)

Propagation of electromagnetic waves in good nductors, skin effect, reflection of plane waves at normal and oblique incidence, propagation in dispersive media, phase velocity and group velocity, different modes of propagation, ionospheric propagation, MUF (Maximum Usable Frequency), skip distance, critical frequency, plasma frequency, virtual height, and ducting.

Suggested books:

1. Sadiku, M. N. O. (2001). *Principles of electromagnetics*. Oxford University Press.
2. Lonngren, K. E., Savov, S. V., & Jost, R. J. (2007). *Fundamentals of electromagnetics with MATLAB*. Prentice Hall of India.
3. Hayt, W. H., & Buck, J. A. (2006). *Engineering electromagnetics* (7th ed.). Tata McGraw-Hill.
4. Cheng, D. K. (2001). *Field and wave electromagnetics* (2nd ed.). Pearson Education.
5. Edminister, J. A. (2006). *Electromagnetics* (Schaum's Outline Series). Tata McGraw-Hill.
6. Rao, N. N. (2006). *Elements of engineering electromagnetics* (6th ed.). Pearson Education.
7. Raju, G. S. N. (2001). *Antennas and propagation*. Pearson Education.

MJC-17: Transmission Lines, Antenna and Wave Prop. *Lab (Credits: Practical-01)*

User de: S/ELE/701/MJC-17 User ID: F.M: 15

(Use Scilab/MATLAB/Other Mathematical Simulation Software)

User Learning Outmes: At the end of this User, students will be able to

1: Analyse transmission line behaviour by evaluating line parameters, wave propagation, input impedance, power flow, and Standing Wave Ratio (SWR) under different termination nditions.

2: Apply graphical techniques such as the Smith Chart for solving impedance matching and transmission line problems.

3: Understand the radiation mechanism of electromagnetic waves and analyse various antenna parameters.

4: Evaluate ionospheric propagation parameters such as Maximum Usable Frequency (MUF), critical frequency, skip distance, plasma frequency, and ducting for Communication applications.

List of Experiments

1. Program to determine the phasor of a forward propagating field.
2. Program to determine the instantaneous electric field of a plane wave.
3. Program to calculate phase nstant, phase velocity, electric field intensity and intrinsic impedance.
4. Program to calculate skin depth, loss tangent and phase velocity.
5. Program to determine total voltage as a function of time and position in a lossless transmission line.
6. Program to calculate characteristic impedance, phase nstant and phase velocity.
7. Program to calculate output power and attenuation efficient.
8. Program to determine power dissipated in a lossless transmission line.

9. Program to calculate total loss in lossy transmission lines.
10. Program to calculate input impedance of a transmission line terminated with a capacitive load.

MJC-18: Modern Communication Systems (Credits: Theory-03)

User de: S/ELE/702/MJC-18 User ID: F.M. = 25

User Learning Objectives

This User introduces the basic ideas of modern Communication systems. It vers digital modulation and ding techniques, optical fibre Communication, cellular mobile Communication, and satellite Communication. Students will also learn about multiple access methods and basic networking technologies such as LAN, Bluetooth, Wi-Fi and WiMAX.

User Learning Outmes: At the end of this User, students will be able to

1: Explain digital modulation techniques such as DPCM, DM, ADM and QAM, and understand different line ding methods.

2: Describe the working of optical fibre Communication systems and understand attenuation and dispersion in optical fibres.

3: Explain the basic ncepts of cellular Communication, including frequency reuse, cell splitting, roaming, handoff, authentication and encryption.

4: Explain the basic principles of satellite Communication, including satellite orbits, subsystems, transponders and earth stations.

Unit-1 (16 Lectures)

Advanced Digital Modulation Technique: DPCM, DM, ADM, Binary Line ding Technique, Multi-level ding, QAM (Modulation and Demodulation)

Unit-2 (10 Lectures)

Optical Communication: Introduction of Optical Fiber, Types of Fiber, Guidance in Optical Fiber, Attenuation and Dispersion in Fiber, Optical Sources and Detectors, Block Diagram of optical Communication system, optical power budgeting

Unit-3 (17 Lectures)

Cellular Communication: ncept of cellular mobile Communication – cell and cell splitting, frequency bands used in cellular Communication, absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, ncept of data encryption, architecture (block diagram) of cellular mobile Communication network, CDMA technology, CDMA overview, simplified block diagram of cellular phone handset, mparative study of GSM and CDMA, 2G, 3G and 4G ncepts.

Unit-4 (17 Lectures)

Satellite Communication: Introduction, need, satellite orbits, advantages and disadvantages of geostationary satellites. Satellite visibility, satellite system – space segment, block diagrams of satellite sub systems, up link, down link, cross link, transponders (C- Band), effect of solar eclipse, path loss, ground station, simplified block diagram of earth station, Satellite access, TDMA, FDMA, CDMA ncepts, mparison of TDMA and FDMA, Satellite antenna (parabolic dish antenna), GPS services like SPS & PPS.

Local area networks (LAN): Primary characteristics of Ethernet-mobile IP, OSI model, wireless LAN requirements-ncept of Bluetooth, Wi-Fi and WiMAX.

Suggested Books:

1. Tomasi, W. (2004). *Electronic Communication Systems: Fundamentals Through Advanced* (3rd ed.). Pearson Education.
2. Roden, M. S. (1996). *Analog and Digital Communication Systems* (3rd ed.). Prentice Hall, Englewood Cliffs, New Jersey.
3. Lathi, B. P. (2009). *Modern Digital and Analog Communication Systems* (4th ed.). Oxford University Press.
4. Vishwanathan, T. (1992). *Telemmunication Switching Systems and Networks* (1st ed.). Prentice Hall of India.
5. Rappaport, T. S. (2002). *Wireless Communications: Principles and Practice* (2nd ed.). Pearson Education Asia.

MJC-18:* Modern Communication Systems *Lab (Credits: Practical-01)

User de: S/ELE/702/MJC-18 User ID: F.M: 15

(Implementation with Hardware and/or SciLab/MATLAB/Any Circuit Simulation Software)

User Learning Outmes: At the end of this User, students will be able to

1: Analyse and observe modulation and demodulation techniques for AM and FM signals using practical Communication system setups.

2: Implement and study pulse modulation techniques such as PAM, PWM, and PPM.

3: Perform experiments on digital modulation techniques such as ASK, FSK, and PSK and analyse their signal characteristics.

4: Use Communication laboratory equipment such as signal generators, oscillospes, spectrum analysers, and Communication trainers for signal analysis.

5: Analyse experimental results, mpare them with theoretical ncepts, and prepare systematic laboratory reports.

List of Experiments

1. Study LED modulation and detection using a photodetector.
2. Calculate transmission losses in an optical Communication system.
3. Study 16-QAM modulation and detection and generate a nstellation diagram.
4. Study DPCM modulation and demodulation.
5. Study Delta Modulation (DM) and Adaptive Delta Modulation (ADM).
6. Study the architecture of a mobile phone.
7. Study the optical fibre Communication system.

***MJC-19*: Digital Signal Processing (Credits: Theory-03)**

User de: S/ELE/703/MJC-19 User ID: F.M. = 25

User Learning Objectives

The main objectives of this User are to introduce the basic ncepts of discrete-time signals and systems and their mathematical representation, understand the principles of signal analysis in time and frequency domains using tools such as

DTFT, DFT, and FFT and develop skills in implementing DSP algorithms using mputational tools such as MATLAB or similar software.

User Learning Outmes: At the end of this User, students will be able to

1: Analyse discrete-time signals and systems using difference equations and determine system properties such as stability and causality.

2: Apply Z-transform techniques to analyse discrete-time systems and determine system functions and stability.

3: mpute and analyse signals using DFT and FFT algorithms for frequency domain representation.

4: Design and realize digital filters including FIR and IIR structures and analyse their system functions.

Unit- 1 (15 Lectures)

Discrete Time systems: Discrete sequences, linear efficient difference equation, Representation of DTS, LSI Systems, Stability and causality, frequency domain representations and Fourier transform of DT sequences.

Unit- 2 (15 Lectures)

Z-Transform: Definition and properties, Inverse Z Transform and stability, Parseval's Theorem and applications.

System Function: signal flow graph, its use in representation and analysis of Discrete Time Systems, Techniques of representations, Matrix generation and solution for DTS evaluations.

Unit- 3 (15 Lectures)

Discrete Fourier Transform: DFT assumptions and Inverse DFT, Matrix relations, relationship with FT and its inverse, circular nvolution, DFT theorems, DCT, mputation of DFT, FFT Algorithms and processing gain, Discrimination, interpolation and extrapolation, Gibbs phenomena, FFT of real functions interleaving and resolution improvement, Word length effects.

Unit- 4 (15 Lectures)

Digital Filters: Analog filter review. System function for IIR and FIR filters, network representation, Canonical and demposition networks, IIR filter realization methods and their limitations, FIR filter realization techniques, Discrete rrelation and nvolution; Properties and limitations.

Suggested Books:

1. Oppenheim, A. V., & Schafer, R. W. (1989). *Discrete-time signal processing*. Prentice Hall.
2. Proakis, J. G., & Manolakis, D. G. (1997). *Digital signal processing: Principles, algorithms, and applications* (3rd ed.). Prentice Hall.
3. Tan, L., & Jiang, J. (2013). *Digital signal processing: Fundamentals and applications*. Academic Press.
4. Ingle, V. K., & Proakis, J. G. (2012). *Digital signal processing using MATLAB* (3rd ed.). Cengage Learning.

MJC-19: Digital Signal Processing Lab (Credits: Practical-01)

User de: S/ELE/703/MJC-19 User ID: F.M. = 15

(Use Scilab/MATLAB/Other Mathematical Simulation software)

User Learning Outmes: At the end of this User, students will be able to

1: Generate and analyse discrete-time signals and sequences using software tools such as MATLAB/Scilab.

2: Perform fundamental DSP operations such as signal addition, multiplication, time shifting, scaling, and folding.

3: Analyse signals using Discrete-Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) techniques.

4: Study the frequency response and stability of digital filters through simulation and analysis.

List of Experiments

1. Generate basic sequences such as unit sample, unit step, ramp and sinusoidal sequences.
2. Generate and plot discrete-time sequences over a given interval.
3. Write a program to find the Z-transform of a given sequence.
4. Study Fourier Transform, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT).
5. Design Butterworth analog filters (low-pass and high-pass).
6. Design digital filters.

MJC-20: Applied Physics (Credits: Theory-03)

User de: S/ELE/704/MJC-20 User ID: F.M. = 25

User Learning Objectives

The objective of this User is to develop a basic understanding of crystalline solids and different types of bonding in solids. It explains the limitations of classical physics and introduces the need for quantum mechanics. It also discusses the mechanical, thermal, electrical, and magnetic properties of materials, which are important in modern science and technology.

User Learning Outmes: At the end of this User, students will be able to

1: Explain the structure of crystalline solids and different types of bonding in them
2: Apply the basic principles and formalism of quantum mechanics, including wavefunctions, operators, eigenvalues, and Schrödinger equation to simple physical systems.
3: Explain the thermal behaviour of solids
4: Analyse the electrical properties of metals and seminductors, including nductivity, carrier ncentration, and Fermi level.
5: Classify and describe magnetic materials and explain their magnetic properties.

Unit-1 (10 Lectures)

Physics of Crystalline Solids: Crystalline Materials, Crystal Structure in Solids, ncept of Lattice and Basis, Crystal Axes and Planes, Primitive and Unit Cells, Packing Fraction for Simple, Body-Cantered and Face-Cantered Cubic Lattices, Calculation of Interplanar Spacing for Cubic Lattice, Miller Indices, ncept of Reciprocal Lattice, Bragg's Equation in Direct and Reciprocal Lattice (no derivation), Bonding in Solids, Basic ideas of Metallic Bonds, Ionic Bonds, valent Bonds, Vander Waal's Bonds.

Unit-2 (20 Lectures)

Quantum Mechanics: Inadequacies of Classical Physics (in Relevance to Electron Diffraction

Experiment), mpton's Effect, Photo-Electric Effect, Blackbody Radiation, Wien's Law, Raleigh Jeans Law, Plank's Law, Introduction to Wave Particle Duality, de Broglie's Hypothesis, Heisenberg's Uncertainty Principle, Probability Density and Bohr Interpretation, Basic Postulates and Formalism of Quantum Mechanics, Wavefunctions, Operators in Quantum Mechanics, Eigenstates, Eigenvalues and Eigenfunctions, Schrodinger Wave Equation, Qualitative Discussion of Phenomenon of Tunnelling, Particle in a One-Dimensional Box, Extension to a Three-Dimensional Box, Potential Barrier Problems (Free Electron, Electron in an Infinite Well), Kronig-Penney Model and Development of Band Structure, E-k Diagram in Solids, Classification of nductors, Insulators and Seminductors. **Quantum statistics**: Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein probability distribution functions and their importance.

Unit-3 (10 Lectures)

Thermal Properties: Brief Introduction to Laws of Thermodynamics, ncept of Entropy, Enthalpy and Phonons, Heat Capacity, Debye's Law (ncept only), Lattice Specific Heat, Electronic Specific Heat (ncept only), Thermal nductivity, Thermoelectricity, Seebeck Effect, Peltier Effect, Thomson Effect.

Unit-4 (20 Lectures)

Electric Properties: Metals (nductors), Basic ncept of Free Electron Theory, nductivity of Metals, Ohm's Law, Relaxation Time, llision Time and Mean Free Path, Electron Scattering and Resistivity of Metals, Heat Developed in Current Carrying nductor, ncept of Supernductivity; Insulators, Dielectric Properties, ncepts of Polarization, Permittivity and Dielectric nstant; Seminductors, Bonding in Elemental and mpound Seminductors, Intrinsic and Extrinsic Seminductor, ncept of Holes, mputation of Carrier ncentrations, Fermi Level in Seminductors, E-k Diagrams to explain Direct and Indirect Bandgap Seminductors.

Magnetic Properties: Classification of Magnetic Materials, Magnetic Moment, Dia, Para, Ferro and Antiferro Magnetism, Ferrimagnetic Materials, Saturation Magnetisation, Curie Temperature.

Suggested Books:

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1. Vijaya, S., & Rangarajan, G. (2003). *Material Science*. Tata McGraw-Hill.
2. Callister, W. E. (2006). *Materials Science and Engineering: An Introduction*. Wiley India.
3. Beiser, A. (1987). *ncepts of Modern Physics*. McGraw-Hill.

4. Ghatak, A., & Lokanathan, S. (2004). *Quantum Mechanics: Theory and Applications*. Macmillan India.

MJC-20: Applied Physics (Credits: Practical-01)

User de: S/ELE/704/MJC-20 User ID: F.M. = 15

(Implementation with Hardware and/or SciLab/MATLAB/Any Circuit Simulation Software)

User Learning Outmes: At the end of this User, students will be able to

1: Determine electrical parameters of materials such as resistivity and nductivity of metals and seminductors through laboratory experiments.

2: Investigate seminductor characteristics including carrier ncentration, band gap, and the behaviour of intrinsic and extrinsic seminductors.

3: Use scientific instruments and experimental techniques to llect, analyse, and interpret experimental data.

4: Prepare systematic laboratory reports and interpret results by rrelating experimental observations with theoretical ncepts.

List of Experiments

1. Measure the resistivity of a germanium crystal with temperature using the four-probe method (from room temperature to 200°C).
2. Determine the Boltzmann nstant using the forward characteristics of a diode.
3. Determine Planck's nstant using LEDs of different wavelengths.
4. Measure the band gap of a thermistor.

MNT-7: Communication *Systems* (Credits: Theory-03)

User de: S/ELE/705/MNT-7 User ID: F.M. = 25

User Learning Objectives

The objectives of this User are to introduce the fundamental ncepts and principles of Communication systems and their role in modern Communication networks, study the principles and techniques of analog modulation and demodulation (AM, FM, and PM), pulse modulation techniques (PAM, PWM, PPM) and introduce the fundamentals of digital Communication systems and digital modulation techniques.

User Learning Outmes: At the end of this User, students will be able to

1: Understand the basic ncept of a Communication system and need for modulation

2: Evaluate modulated signals in time and frequency domain for various ntinuous modulation techniques

3: Describe working of transmitters and receivers and effect of noise on a Communication system

4: Understand Baseband Pulse Modulation and optical Communication fundamentals

Unit-1 (15 Lectures)

Electronic Communication: Introduction to Communication, Need for Modulation, Block diagram of an Electronic Communication System, Brief idea of Frequency Allocation for Radio Communication System in India (TRAI), Band Designations and Usage, Channels and Base-Band Signals, Noise, Internal and External Noises, Signal-to-Noise (S/N) Ratio and Noise Figure.

Amplitude Modulation: Definition, Representation, Modulation Index, Expression for Instantaneous Voltage, Power Relations, Frequency Spectrum, ncept of DSBFC, DSBSC, SSBSC Generation and Detection, Limitations of AM, AM Detection, Diode Detector Circuit, Principle of Working and Waveforms, Block Diagram of AM Transmitter and Receiver.

Unit-2 (15 Lectures)

Frequency and Phase Modulation: Definition, Representation, Modulation Index, Frequency Spectrum, Bandwidth Requirements, Frequency Deviation and Carrier swing, Equivalence between FM and PM, Generation of FM using V, Demodulation, FM Detector, Slope Detector Circuit, Principle of Working and Waveforms, Block Diagram of FM Transmitter and Receiver, mparison of AM and FM, Qualitative Idea of Super Heterodyne Receiver.

Unit-3 (20 Lectures)

Digital Communication: Introduction to pulse and digital Communications, digital radio, sampling theorem, types-PAM, PWM, PPM, PCM–quantization, advantages and applications, digital modulations (FSK, PSK, and ASK). Advantage and disadvantages of digital Communication.

Unit–4 (10 Lectures)

Optical Communication: Introduction of Optical Fiber, Types of Fiber, Guidance in Optical Fiber, Attenuation and Dispersion in Fiber, Optical Sources and Detectors, Block Diagram of optical Communication system.

Suggested Books:

1. Kennedy, G. (1993). *Electronic Communication Systems* (3rd ed.). Tata McGraw-Hill.
2. Roddy, D., & olen, J. (2002). *Electronic Communications* (4th ed.). Prentice Hall of India.
3. Kennedy, G., & Davis, B. (1992). *Electronic Communication Systems* (4th ed.). Tata McGraw-Hill.
4. Tomasi, W. (2004). *Advanced Electronic Communication Systems* (6th ed.). Pearson Education.

MNP-7: Communication *Systems Lab* (Credits: Practical-01)

User de: S/ELE/705/MNP-7 **User ID:** **F.M. = 15**

(Implementation with Hardware and/or SciLab/MATLAB/Any Circuit Simulation Software)

User Learning Outmes: At the end of this User, students will be able to

1: Analyse and observe modulation and demodulation techniques for AM and FM signals using practical Communication system setups.

2: Implement and study pulse modulation techniques such as PAM, PWM, and PPM.

3: Perform experiments on digital modulation techniques such as ASK, FSK, and PSK and analyse their signal characteristics.

4: Use Communication laboratory equipment such as signal generators, oscillospes, spectrum analysers, and Communication trainers for signal analysis.

List of Experiments

1. Study of amplitude modulation and demodulation.
2. Study of FM modulator using IC 8038.
3. Study of Voltage ntrolled Oscillator (V) using IC 566.
4. Study of Time Division Multiplexing (TDM) and demultiplexing.
5. Study of AM transmitter and receiver.
6. Study of FM transmitter and receiver.
7. Study of ASK modulator and demodulator.
8. Study of FSK modulation.
9. Study of PWM and PPM techniques.
10. Study of PAM modulator and demodulator.