UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(23/June/Adp./51)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the revised Syllabi and Courses of Studies in the subject of **Electronics** for Master Degree Programme of **Semester Ist, IInd, IIIrd and IVth** under the **Choice Based Credit System (as given in the annexure)** for the examinations to be held in the years as per the details given below:

Subject	Semester	For the examinations to be held in the year	% of Change
Electronics	Semester-I	Dec. 2022, 2023 and 2024	**Less than 20%**
	Semester-II	May 2023, 2024 and 2025	
	Semester-III	Dec. 2023, 2024 and 2025	
	Semester-IV	May 2024, 2025 and 2026	

The Syllabi of the courses is also available on the University website: www.jammuuniversity.ac.in.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/ 5698-5708.
Dated: 23-6-2023

Copy for information and necessary action to:

1. Dean Faculty of Science
2. HOD/Convener, Board of Studies **Electronics**
3. All members of the Board of Studies
4. C.A. to the Controller of Examinations
5. Director, Computer Centre, University of Jammu
6. Deputy Registrar/Asst. Registrar (Conf. /Exams. PG)
7. Incharge University Website for necessary action please

Sumita Sharma 20/6/23
Deputy Registrar (Academic)

19/6/23

REVISED SYBALLABI in the subject of Electronics of Master Degree Programme **M. Sc. (Electronics)** for semester 1 under **Choice Based Credit System** for the examinations to be held in the years mentioned below:

Semester-I: Validity December 2022, 2023 and 2024			
Course Title		**Course Code**	**Credits**
1. ***Network Analysis***	(4 Credits)	**PSELTC111**	**24**
2. ***Digital System Design***	(4 Credits)	**PSELTC112**	
3. ***Electronic Materials and Semiconductor Devices***	(4 Credits)	**PSELTC113**	
4. ***Computational Techniques in Electronics***	(4 Credits)	**PSELTC114**	
5. ***Lab course on Network Analysis***	(2 Credits)	**PSELPC115**	
6. ***Lab course on Digital System Design***	(2 Credits)	**PSELPC116**	
7. ***Lab course on Electronic Material & Semiconductor Devices*** (2 Credits)		**PSELPC117**	
8. ***Lab course on Computational Techniques in Electronics*** (2 Credits)		**PSELPC118**	

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC111

Course No: PSELTC111 (Core Course)
Title: ***Network Analysis***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2022, 2023, and 2024 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objectives:
To equip the students with rigorous theoretical and practical knowledge to analyze electrical networks.

Course Outcomes: At the end of the course the students should be able to

- Learn basic circuital laws and network theorems for simplification of electrical networks.
- Perform time domain analysis of networks using differential equations and Laplace transform.
- Describe different types, configurations, two port network parameters and interrelations between them.
- Evaluate network functions and determine network stability.

Unit I: **Network Theorems**
Nodal and Mesh analysis; Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Millman's theorem, Reciprocity theorem, Compensation theorem, Numerical problems.

Unit II: **Graph theory and Time Domain Analysis of Networks**
Graph Theory: Graph tree, Link branches, Tie and Cut set matrices, Duality and Dual networks. Differential equation approach (first, second and higher order differential equations), Initial conditions in networks; Laplace transformation, Properties of Laplace transforms, Partial fraction expansion, Heaviside's expansion theorem, State variable analysis: State variable approach, state space representation, transfer function.

Unit III: **Two Port Network Parameters**
Network elements; Classification of networks; Network configurations; Impedance parameters; Admittance parameters; Transmission parameters; Inverse transmission parameters; Hybrid and Inverse hybrid parameters; Interrelation of different parameters; Interconnection of two port networks.

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(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC111

Unit IV: **Network Functions**

Network functions of one and two port networks, Poles and Zeros of network function, Restrictions on poles and zero locations for driving-point functions and transfer function, Time domain behavior from pole and zero plot, Routh-Hurwitz's criterion of stability.

References:

1. M. E. Van Valkenburg, 'Network Analysis', 3rd ed., PHI.
2. D Roy Choudhary, Networks and Systems, New Age International Publishers.
3. DeCarlo, R.A. and Lin, P. M., 'Linear Circuit Analysis: Time Domain, Phasor and Laplace transform Approaches', Oxford University Press.
4. Hayt, Kemmerley and Durbin, 'Engineering Circuit Analysis', 8th ed. Tata McGraw-Hill.
5. Kuo, F. F., 'Network Analysis and Synthesis', 2nd ed., Wiley India.
6. Raman Pilla, Network analysis and synthesis, Universities Press
7. Sudhakar Shyammohan, Circuits and Networks: Analysis and Synthesis, Tata McGraw Hill.
8. M. E. Van Valkenburg, 'Network Synthesis', PHI.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC112

Course No: PSELTC112 (Core Course)
Title: ***Digital System Design***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2022, 2023, and 2024 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objective:

- The course offers students to learn how to minimize the Boolean expression by using K maps, designing of combinational and sequential logic circuits, learn different types of memories and their architecture. Also course explains concepts PLDs, PAL, GAL, FPGA and VHDL programming language.

- **Course Outcomes: At the end of the course students should be able to**
  - Simplify Boolean expressions using K maps and design combinational logic circuits like adders, subtractors, encoders, decoders, multiplexers and demultiplexers. To learn how to design digital systems, from specification and simulation to construction and debugging.
  - Design sequential logic circuits like synchronous/asynchronous counters and registers.
  - Describe memory operation, timing, its types and architecture. Familiarize with PLDs, GAL and FPGA.
  - Learn basics of VHDL programming like data types, operators, Behavior modelling, data flow modelling and structural modelling.

UNIT I *Combinational Logic design*

Canonical and Standard forms, Karanaugh Map: SOP & POS minimization, Five variable K-maps; Binary Adder, Carry look ahead Adder, 4-bit Adder-Subtractor, Comparator: 2 bit, 3 bit, 4 bit and higher comparators, Decoder: Basic binary decoder,4-bit decoder, BCD to Decimal decoder, BCD to seven segment decoder; Encoder: Decimal to BCD encoder, 8:3 encoder, Priority encoder; Multiplexer: 2:1, 4:1, 8:1 and logic function generator, Demultiplexer.

UNIT II *Sequential Logic design*

Review of Flip-flop; Asynchronous counter: Two bit, Three bit, Decade and Four bit counters, Synchronous counter: Two bit, Three bit, Decade and Four bit counters; Up/Down synchronous counters; Design of synchronous counters; Construction of State Diagrams; Shift registers: Basic function, SISO,SIPO, PISO,PIPO, Bidirectional; Johnson and Ring counters

UNIT III *Memory and Programmable Logic*

General Memory Operation; CPU-Memory Connections; ROM: Architecture, Timing, Types: MROM PROM, EPROM, EEPROM, Flash Memory; RAM: Architecture & Operation of SRAM, DRAM; Memory Expansion; Introduction to Programmable Logic Devices (PLDs): PLA, PAL, GAL, CPLD, FPGA.

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(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC112

Unit IV Introduction to VHDL

Introduction to VHDL, Identifiers, Data objects, Data types, Operators, Types of delays, Behavior Modeling: Entity declaration, Architecture body, Process statement; Dataflow modeling: Concurrent signal assignment statement, Concurrent versus sequential assignment statement; Structural modeling: Component declaration, component instantiation; Sub programs and overloading, Generics.

References:

1. T. L. Floyd & R. P. Jain, **Digital fundamentals,** Pearson Education India, New Delhi.
2. M. Moris Mano, **Digital Design,** PHI Learning Pvt. Ltd. New Delhi.
3. A. P. Malvino & D. P. Leach, **Digital Principals and Applications**, Tata McGraw Hill, New Delhi.
4. A. P. Malvino & J. A. Brown, **Digital Computer Electronics**, Tata McGraw Hill, New Delhi.
5. A. Anand Kumar, **Fundamentals of Digital Circuits,** PHI Pvt. Ltd. New Delhi.
6. R. J. Tocci & N. S. Widmer, **Digital Systems**, Pearson Education India, New Delhi.
7. John. M. Yarbough, **Digital Logic: Applications and Design**, Thomson Brooks/Cole, Boston.
8. John F. Wakerly, **Digital Design Principles and Practices**, Pearson Education India, New Delhi.
9. M. Moris Mano, **Computer System Architecture**, PHI Pvt. Ltd. New Delhi.
10. VHDL, Primer: J Bhasker, 3rd Edn- Pearson Education
11. VHDL, Programming by Example: Douglas L. Perry, 4thEdn.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC113

Course No. PSELTC113 (Core Course)
Duration of Examination: 3 hrs

Title: ***Electronic Materials and Semiconductor Devices***
Credits: 4
Minor I & Minor II: 40 Marks
Max. Marks: 100
Major Test: 60 Marks
Contact Hours: 60

Validity: 2022, 2023, and 2024 December Exams

Course Objective: To provide basic knowledge and concepts of Semiconductor devices and materials.

Course Outcomes: At the end of the course, student would be able to

- Learn the carrier transport phenomenon in semiconductors.
- Describe the device physics of PN junction, Tunnel diode, BJT and MOSFET.
- Learn the behaviour of photonic devices like LEDs and solar cells.
- Learn the basic concepts and their application potential of advanced materials in Electronics.

UNIT I Carrier Concentration & Transport

Semiconductor materials; Energy bands; intrinsic carrier concentration; donors and acceptors; carrier drift: mobility, resistivity; Hall Effect; carrier diffusion: diffusion process, Einstein relation, current density equations; generation & recombination processes: direct, indirect, continuity equation; high field effects.

UNIT II P-N Junction

Thermal equilibrium condition: band diagram, equilibrium Fermi levels, space charge; depletion region: abrupt junction; depletion capacitance: C-V characteristics, Varactor; I-V characteristics: ideal characteristics, high-injection and temperature effects; diffusion capacitance, transient behavior; junction breakdown: tunneling effect, avalanche multiplication, Tunnel diode and its characteristics.

UNIT III Bipolar Transistor & MOSFET

Transistor action: operation in active mode, current gain; static characteristics of bipolar transistor: carrier distribution in each region, modes of operation, I-V characteristics of CE configuration; frequency response of bipolar transistor; Basic HBT structure, MOS diode: Ideal MOS diode; surface depletion region and ideal MOS curves; Sio_2 – Si MOS diode: work-Function difference, interface traps and oxide charges; MOSFET fundamentals: basic characteristics (linear, saturation and sub threshold regions)

UNIT IV Photonic Devices & Advanced Materials

Radiative transitions and optical absorption; light emitting diodes: visible and infrared LEDs; semiconductor LASERS: semiconductor materials, structure and

operation; Photo detectors: photoconductor, photodiodes (avalanche, pin and heterojunction); Solar cell: PN junction solar and conversion efficiency.

Polymers: introduction, broad classification and basic concepts; introduction to thermo-optics, thermo-electric, magnetic materials, and nano-magnetics.

References:

1. S. M. Sze: Semiconductor Devices Physics and Technology, John Wiley and Sons, New Delhi.
2. B. G. Streetman: Solid State Electronics Devices, Prentice-Hall of India Ltd.
3. M Shur: Physics of Semiconductor Devices, Prentice-Hall of India Ltd.
4. S. L. Kakani, Amit Kakani: Material Science, New Age international publishers
5. A. K. Boandypadhyay: Nano-materials, New Age international publishers
6. Cao Guozhang, Wang Ying: Nano-structures and Nano materials, World Scientific publishers.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
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Minor Tests
The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test
There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:
Part (a) Objective/ short answer type of 03 marks each
Part (b) Long answer type of 09 marks each
The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC114

Course No: PSELTC114 (Core Course)
Title: ***Computational Techniques in Electronics***
Credits: 4
Minor-I & Minor-II: 40 (20+20)
Validity: 2022, 2023, and 2024 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks
Contact Hours: 60

Course Objectives:

The course is intended to aware the students about various computational techniques used to model physical and electronic systems. The course also provides in-depth coverage to MATLAB and its applications.

Course Outcomes: At the end of the course, students would be able to:

- Learn complex variable functions, integral theorems and infinite series.
- Solve Legendre and Bessel differential equations along with their recurrence relations.
- Obtain the numerical solutions of non-linear equations using Bisection, Newton-Raphson and Secant methods.
- Obtain the numerical solutions of linear equations using Gauss elimination, Gauss Jordan method, Gauss-Seidal and Jacobi iteration methods.
- Obtain the numerical solutions of differential equations using Euler's and Runga-Kutta method.
- Learn general purpose commands, operations and matrix manipulations in MATLAB.
- Solve linear equations, differential equations, finding eigen values and plotting 2D & 3D plots using MATLAB.

UNIT I *Complex variables and Differential Equations*

Review of complex algebra; functions of a complex variable; Cauchy- Riemann equations; Cauchy integral theorem; Cauchy integral formula, Taylor's and Laurent's series; Cauchy residual theorem; Series solution of Differential Equations: Lengendres differential equation; generating function of Lengendres differential equation Pn(x); recurrence relation for Lengendres differential equation Pn(x).

UNIT II *Numerical Methods*

Solution of non linear equations: Bisection, Newton-Raphson and Secant method; Solution of system of linear equations: Gauss elimination, Gauss Jordan method; Gauss-Seidal iteration method, Jacobi iteration, Matrix eigen value problems.

Interpolation: Lagrange and Newton's Forward and backward difference formulae; Numerical solutions of differential equations: Euler's method and Runga-Kutta method (IInd Order).

UNIT III *Basics of MATLAB*

Introduction to MATLAB, Matrices and Vectors: Input, Indexing, Matrix manipulations, Creating vectors; Matrics and Array operations: Arithmatic operations, relational operations, logical operations, elementary math functions, matrix functions, character strings, Vectorization, plotting simple graphs,

Script and functions: script and function files, executing the function, sub-function, compiled functions; Global variables; Loops branches and control flow, interactive input, recursion.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC114

Unit IV *Applications of MATLAB*

Linear Algebra: Solving linear system, Gaussian elimination, Finding eigen values and eigen vectors; Curve fitting and interpolation; Numerical integration; Ordinary differential equations, Non linear algebraic equations,
Graphics: Basic 2D plots, 3D plots, saving and printing graphs.

References:

1. John Methew, **Numerical methods for mathematics science and engineering,** Prentice-Hall of India, New Delhi.
2. V. Rajaraman, **Computer oriented numerical methods,** Prentice-Hall of India, New Delhi.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, **Numerical Methods: Problems and Solutions,** New Age International, New Delhi.
4. Louis A. Pipes and Lawrence R. Harvill, **Applied mathematics for engineers and physicists,** McGraw Hill Book company, New Delhi.
5. P. B. Patil and U. B. Verma, **Numerical computational methods,** Narosa Publishing House, New Delhi.
6. B.S. Grewal, **Higher Engineering Mathematics.**
7. S. R. Otto and J. P. Denier, **An introduction to programming and numerical methods in Matlab,** Springer, USA.
8. Rudra Pratap, **Getting Started with MATLAB 7,** Oxford University Press, New Delhi.
9. Andrew Knight, **Basics of MATLAB and Beyond,** CRC Press.
10. William J Palm, **A concise introduction to MATLAB,** McGraw Hill Edition.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

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Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

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Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC115

Course No: PSELPC115 (Core Course)
Title: ***Lab course on Network Analysis***
Semester Exam: 25
Validity: 2022, 2023, and 2024 December Exams

Max. Marks: 50
Duration of Examination: 3 Hrs
Sessional Assessment: 25

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. To verify Thevenin and Norton theorems.
2. To verify superposition theorems.
3. To verify maximum power transfer theorem.
4. To find the network parameters of two port network.
5. To analyse simple resistive circuits using PSpice.
6. To analyse a resistive circuit to obtain dc operating point, small signal transfer function and dc sweep.
7. To find the Thevenin equivalent circuit using transfer function analysis.
8. To obtain the transient response of an RL circuit using PSpice.
9. To obtain the transient response of an RC circuit using PSpice.
10. To obtain the transient response of an RLC circuit using PSpice.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC116

Course No: PSELPC116 (Core Course)
Title: Lab course on Digital System Design
Semester Exam: 25
Sessional Assessment: 25
Validity: 2022, 2023 and 2024 December Exams

Max. Marks: 50
Duration of Examination: 3 Hrs
Credits: 02

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Design of adder and subtractor circuits
2. Design of multiplexer and demultiplexers
3. Design of Encoders
4. Design of Decoders
5. Design of Registers
6. Design of counters
7. Programming of memory units
8. Digital circuit design by using PLDs
9. Design of digital circuits using FPGA
10. VHDL programming

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELPC117

Course No: PSELPC117 (Core Course)
Title: Lab course on Electronic Material & Semiconductor Devices
Semester Exam: 25
Sessional Assessment: 25
Validity: 2022, 2023 and 2024 December Exams

Max. Marks: 50
Duration of Examination: 3 Hrs

Credits: 02

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Calculation of barrier height and ideality factor at room temperature (for Si and GaAs devices) from the *I-V* characteristics of the PN junction diode.
2. Calculation of diode parameters at varying frequency from the *C-V* characteristics.
3. Calculation of semiconductor conductivity type and carrier concentration using Hall Effect.
4. Calculation of semiconductor resistivity and band gap using Four-Probe method.
5. Calculation of carrier mobility and drift velocity using an experimental setup.
6. BJT characteristics.
7. FET & MOSFET characteristics
8. V I characteristics of Tunnel diode
9. V I characteristics of LED.
10. V I characteristics of photodiode.
11. V I characteristics of LDR.
12. V I characteristics of Solar cell.

M. Sc. Electronics
1st Semester (CBCS)
(for the examinations to be held in the years 2022, 2023 and 2024)
Course No: PSELTC118

Course No: PSELPC118 (Core Course)
Title: ***Lab course on Computational Techniques in Electronics***
Semester Exam: 25
Sessional Assessment: 25
Validity: 2022, 2023 and 2024 December Exams

Max. Marks: 50
Duration of Examination: 3 Hrs

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department. The Department will use open source software for the MATLAB based experiments.

List of Experiments

1. Creating and working with array of numbers using MATLAB.
2. Creating and saving simple plots using MATLAB.
3. To find the determinant of a matrix using MATLAB.
4. To find the eigen values and eigen vectors using MATLAB.
5. To find the solution of first order linear ordinary differential equations using MATLAB.
6. To find the solution of second order non-linear ordinary differential equations using MATLAB.
7. To solve linear system of equations using Gauss Elimination method using MATLAB.
8. To find the roots of a polynomial using MATLAB.
9. Saving and printing 2D plots using MATLAB.
10. Saving and printing 3D plots using MATLAB.

REVISED SYBALLABI in the subject of Electronics of Master Degree Programme **M. Sc. (Electronics)** for semester 2 under **Choice Based Credit System** for the examinations to be held in the years mentioned below:

Semester-II: Validity May 2023, 2024 and 2025			
Course Title		**Course Code**	**Credits**
1. Antennas & Microwave Devices	(4 Credits)	**PSELTC211**	**24**
2. Advanced Analog Circuit Design	(4 Credits)	**PSELTC212**	
3. Embedded Systems Programming	(4 Credits)	**PSELTC213**	
4. Advance Microprocessors and Microcontroller	(4 Credits)	**PSELTC214**	
5. Lab course on Antenna & Microwave Devices	(2 Credits)	**PSELPC215**	
6. Lab course on Analog Circuit Design	(2 Credits)	**PSELPC216**	
7. Lab course on Embedded Systems Programming	(2 Credits)	**PSELPC217**	
8. Lab course on Microprocessors and Microcontrollers	(2 Credits)	**PSELPC218**	

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC211

Course Code: PSELTC211
Title: *Antennas & Microwave Devices* (AMD)
Credits: 4
Validity: 2023, 2024, and 2025 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 marks
Minor-I & Minor-II: 40 (20+20)

Course Objectives:

To equip the students with the principles of transmission, transmission media and microwave devices.

Course Outcomes: At the end of the course the students should be able to

- Understand Maxwell's equations and wave propagation through different media.
- Describe the principles of transmission lines and waveguides.
- Understand the radiation through different antennas.
- Understand the basic principles of microwave devices.

UNIT I. ***Maxwell's Equations***

Introduction; Maxwell's equations in point and integral forms; Magnetic potentials; Retarded potentials; Wave propagation in lossy dielectrics; Plane waves in lossless dielectrics, free space and good conductors; Skin effect; Power and Poynting vector.

UNIT II. ***Transmission Lines and Wave Guides***

Transmission line parameters; Transmission line equations; Characteristics impedance; Input impedance, Reflection coefficient, Standing wave ratio and Power; Smith chart: properties and applications; Applications of transmission lines.

Rectangular waveguides; Transverse electric and magnetic modes; Wave propagation in the guide; Power transmission and attenuation.

UNIT III. ***Antennas***

Radiation mechanism; Hertzian dipole; Radiation resistance; Half wave dipole and Quarter wave monopole antenna; Folded dipole; Antenna characteristics: Antenna patterns; Radiation intensity, Directive gain, Directivity and Power gain; Effective aperture; Antenna arrays: Broadside and Endfire arrays; Pattern multiplication; Effective area and Friis equation; Yagi-Uda Antenna; Helical antenna; Frequency independent antennas; Reflector and lens antennas; Horn antennas; Microstrip antenna.

UNIT IV. ***Microwave Devices***

Introduction: Microwave frequencies, Conventional vacuum tubes: Lead inductance and interelectrode capacitance effects, Transient angle effects limitation; Klystron: Reentrant cavities, Velocity modulation, Bunching process, output power and beam loading; Multicavity klystron amplifiers: Beam current density, output current and output power of two cavity klystron; Reflex klystron: Velocity modulation, power output and efficiency; Helix traveling wave tubes: Slow wave structures, Amplification process; Magnetron oscillator, Forward wave crossed field amplifier, Backward wave cross field amplifier and oscillator; Microwave tunnel diode ; GUNN diode; IMPATT Diode.

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M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC211

References

1. William Hayt, Engineering Electromagnetics.
2. George Kennedy, Electronic Communication systems.
3. John D Kraus, Electromagnetics.
4. Whealer, Microwave Principles.
5. Samuel Y Liao, Microwave Devices & Circuits: Prentice-Hall of India Private Limited, New Delhi.
6. Elements of Electromagnetics, Matthew N.O. Sadiku, Oxford University Press, New Delhi.
7. Microwave Engineering, R.S. Rao, PHI Learning Private Limited, New Delhi.
8. Microwaves, M.L. Sisodia, Vijay Laxmi Gupta, New Age International Publishers, New Delhi.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 06 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 04 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC212

Course code: PSELTC212
Title: *Advanced Analog Circuit Design* (AACD)
Credits: 4
Validity: 2023, 2024 and 2025 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks
Minor I & Minor II: 40 Marks

Course Objectives:
To equip the students with the principles of CMOS circuits and Operational amplifiers and Active filters.

Course Outcomes: At the end of the course the students should be able to

- Understand Modelling of CMOS devices and operation of basic circuits.
- Describe the different topologies of CMOS amplifiers.
- Understand the different configurations and applications of operational amplifiers.
- Understand the basic principles of Active filters.

UNIT I. *CMOS Modelling and Circuits*

Simple MOS large and small signal models; Subthreshold MOS model
Analog CMOS Subcircuits: MOS Switch, MOS Diode/Active Resistor; Current Sink and sources, Cascode Stage: Cascode as current source and amplifier, Current mirror: Basic structure, Non-ideal effects, Wilson current mirror and its modification, Problems

UNIT II. *CMOS Amplifiers*

MOS amplifier topologies; Biasing; Realization of current sources; Common source stage: CS core, CS stage with current source load, CS stage with diode connected load, CS stage with degeneration; CS core with biasing; Common gate stage: CG stage with biasing; Source follower: Source follower core, source follower with biasing; Differential amplifier: Large signal and small signal analysis; Cascode differential amplifier, Differential pair with active load, Frequency response of amplifiers, Bode rules, Millers theorem; High frequency model of MOSFET and transient frequency, Problems.

UNIT III. *Operational Amplifiers*

General considerations, Op-amp based circuits: Non-inverting amplifier, inverting amplifier, Integrator, Differentiator, Voltage adder, Precision Rectifiers; Logarithmic Amplifiers; Square root amplifier; Op-amp non-idealities: DC offsets, input bias current, speed limitations, finite input and output impedance; Differential and Instrumentation amplifier, Comparators; Schmitt Trigger; Clippers; Clampers; Peak Detector; Sample and Hold circuit.

UNIT IV. *Active Filters*

Filters: Characteristics, Classification, Transfer function & Sensitivity function; First order and Second order filters; RLC Realizations; Active Filters: Sallen and Key filter, Integrator based biquads, Biquads using simulated inductors; Approximation of Filter response: Butterworth response, Chebyshev response.

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M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC212

References:

1. A.S. Sedra, K.C Smith, Microelectronic Circuits, Oxford International Student Edition.
2. P.E. Allen, D.R. Holberg, CMOS Analog Circuit Design, Oxford University Press.
3. B. Razavi, Fundamentals of Microelectronics, Wiley India private Ltd.
4. Millman and Grabel, Microelectronics, Tata McGraw-Hill, New Delhi.
5. Mark N. Horenstein, Microelectronic circuits and devices, Prentice-Hall of India, New Delhi.
6. J. Michael Jacob, Applications and design with Analog Integrated Circuits, Prentice-Hall of India Pvt. Ltd., New Delhi.
7. Ramakant A. Gayakwad, Op-amps & linear integrated circuits, Prentice-Hall of India Pvt. Ltd., New Delhi.
8. James M. Fiore, Op Amps and Linear Integrated Circuits, Jaico Publishing House, Mumbai.
9. Sergio Franco, Design with Op Amp and Analog Integrated Circuits, WCB McGraw-Hill, New York.
10. Sidney Soclof, Applications of analog integrated circuits, Prentice-Hall of India Pvt. Ltd., New Delhi.
11. A.G. Bolton & L.C. Jain, Switched capacitor circuits, BPB Publications, New Delhi.
12. D. Roy Choudhary & S. B. Jain, Linear Integrated Circuits, New Age International Publishers, New Delhi.
13. R Schaumann & M. E. Valkenburg, Design of Analog Filters, Oxford University Press.

Scheme of Evaluation:

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Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC213

Course No: PSELTC213 (Core course)
Title: ***Embedded Systems Programming***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2023, 2024, and 2025 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objectives:

To equip the students with skills of problem solving in embedded systems and Python.

Course Outcomes: At the end of the course the students should be able to

- Learn Problem solving strategies and data structures.
- Develop programming skills for embedded systems.
- Learn basic elements of python programming
- Implement object oriented programming in python.
- Evaluate network functions and determine network stability.

UNIT I. ***Problem Solving Strategies Data structures***

Problem Analysis; Algorithms: Complexity, time space trade off ; Flow charts; Overview of programming Languages; Data structures; Data structure operations; Arrays: Linear arrays, representation, traversing, inserting and deleting; Sorting: Bubble sort, selection sort insertion sort, merge sort; searching: Linear and binary; Linked List: representation, traversing, inserting and deleting; Stacks: Array representation of stack; Arithmetic expressions, Quick sort, Queues; Trees: Binary trees, representing binary trees in memory, traversing binary tree.

UNIT II. ***Embedded C***

Introduction: Embedded Systems, Processor for embedded systems, programming language; Example of embedded program; compiling, linking and locating; Reading switches: basic techniques for reading from port pins, examples; Adding structure to code: OOPs with C, Project and port header; Meeting real time constraints: creating hardware delays; Variables in embedded C ; Logical and bit wise operations; Introduction to Rasberry Pie.

UNIT III. ***Basics of Python*:**

Python Overview; Getting started with Python; Python Identifiers; Reserved Keywords; Variables; Standard Data Types: Numeric, String, List, Tuple, Dictionary, Boolean, Sets; Operators: Arithmetic, Comparison, Assignment, Logical, Bitwise, Membership, Identity; Statement and Expressions; Strings Operations; Boolean Expressions; Control Statements: for loop, while loop, if elif else statements; Input from Keyboard; Functions: Built-in Function, Composition of functions, user defined Functions, Parameters and Arguments, Function Calls, The return Statement, Python Recursive Functions; The Anonymous Functions.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC213

UNIT IV. ***Object Oriented Programming with Python***

Overview of Object-Oriented Programming); Classes: Defining classes, creating objects, methods; objects as arguments; objects as return values; Built-in Class Attributes; Inheritance: Types, Multiple and multilevel inheritance; Method Overriding; Operator overloading; Data Encapsulation; Data Hiding.

References:

1. E.Balagyrusamy, Introduction to computing and Problem Solving Using Python, McGraw-Hill, New Delhi.
2. S. Lipschutz, Theory and problems of Data structures, Schaum outline series in computers, McGraw-Hill, New Delhi.
3. Michael J. Pont, Embedded C, Pearson, Education.
4. Rance D. Necaise, Data structures and algorithms Using Python, Wiley, New Delhi.
5. Ashok Namdev Kamthane, Problem Solving Using Python, McGraw-Hill, New Delhi.
6. Anurag Gupta and G P Biswas, Python programming, McGraw-Hill, New Delhi.
7. Sheetal Taneja and Naveen Kumar, Python programming, Pearson, New Delhi.
8. Robert Sedgewick, Kevin Wayne and Robert Dondero, Introduction to Programming Python, Pearson, New Delhi.
9. Y.Daniel Liang, Introduction to Programming Python, Pearson, New Delhi.

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Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC214

Course No: PSELTC214 (Core Course) Duration of Examination: 3 Hrs
Title: Advance Microprocessors and Microcontroller (AMM) Max. Marks: 100
Credits: 4 Major Test: 60 marks
Minor-I & Minor-II: 40 (20+20)
Validity: 2023, 2024 and 2025 May Exams

Course objectives:

The key objective of this course is to develop an understanding of the operations of various microprocessors and microcontrollers; assembly language programming and interfacing techniques.

Course Outcomes: At the end of the course students should be able

- To understand the system design based on 8086 microprocessor.
- To understand the programming and interfacing techniques of 8086 microprocessor.
- To analyze the basic concepts and programming of 8051 microcontroller.
- To understand the basics of AVR microcontroller.

UNIT I *16-bit microprocessors*

8086 internal architecture, memory organization; 8086 basic configurations: minimum mode, maximum mode; internal architecture and interfacing of 8284 clock generator & 8288 bus controller with 8086; system bus timings for minimum and maximum modes; 8086 Interrupts, introduction to advance 8086 architecture; concepts of multicore processors.

UNIT II *Programming and Interfacing of 8086*

8086 addressing modes, Instruction formats; special one-bit indicators; instruction set: data transfer instructions, arithmetic instructions: binary, packed and unpacked arithmetic; branch instructions: conditional and unconditional, loop instructions, flag manipulation instructions, shift and rotate instructions, byte and string instructions; interfacing memories: I/O mapped I/O and memory mapped I/O; 8086 memory interface; I/O operations: programmed I/O and interrupt driven I/O, assembly language programs.

UNIT III *8051 Microcontroller and Programming*

8051 internal architecture: special function registers, flags, and PSW; internal RAM; stack and stack pointer, I/O ports; external memory; 8051 interrupts; counters and timers; serial data input/output; instruction set: logical operations-byte and bit level logical operations, rotate and swap operations; arithmetic operations: flags, multiplication and division, decimal arithmetic; Jump and call instructions: calls and subroutines, interrupts and returns; programming examples.

UNIT IV AVR Microcontroller

AVR architecture and assembly language programming: general purpose resisters, AVR data memory, AVR status register, AVR data format and directives, introduction to AVR assembly language programming, program counter and program ROM space in AVR, RISC architecture in AVR, introduction to PIC.

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M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC214

References:

1. Yu Cheng Liu, Glenn A. Gibson, Microcomputer systems: The 8086/8088 family architecture, programming and design, Prentice Hall of India, New Delhi.
2. Douglas V. Hall, Microprocessors and interfacing, Tata McGraw-Hill Company Limited, New Delhi.
3. Bhupinder Singh Chabra, The Intel 8086/8088 microprocessor architecture programming design and interfacing, Dhanpat Rai Publishing Company Limited, New Delhi.
4. Ramesh S. Gaonkar, Microprocessor architecture, programming and application with 8085/8080A, Wiley Eastern Limited, New York.
5. Kenneth J. Ayala, The 8051 Microcontroller architecture, programming, and applications, Penram International Publishing, India.
6. Barry B. Brey, The Intel Microprocessors 8086/8088, 80186,80286, 80386 and 80486 Architecture, programming and interfacing, Prentice Hall of India, New Delhi.
7. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, S.K. Shah, Microprocessors and Interfacing 8086, 8051, 8096 and advanced processors, Oxford university press.
8. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, "The AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education Publishing Pvt. Ltd.
9. Myke Predko, "Programming and customizing the PIC Microcontroller", McGraw Hill Publishing, India.

Scheme of Evaluation:

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Minor Tests
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Part (b) Long answer type of 09 marks each
The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC215

Course No: PSELPC215 (Core Course)
Title: ***Lab course on Antenna & Microwave Devices***
Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 May Exams

Max. Marks: 50
Duration of Examination: 3 Hrs
Credits: 02

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Study of simple Dipole antenna.
2. Study of variation in radiation strength at a given distance from antenna.
3. Study of Folded half wave dipole antenna.
4. Study of Yagi-Uda three element folded antenna.
5. Study of V-I characteristics of GUNN Diode.
6. Study of V-I characteristics of Tunnel Diode.
7. To determine the standing wave ratio and reflection coefficient.
8. Measurement of dielectric constant.
9. Characteristics of Klystron tube.
10. To measure an unknown impedance with Smith Chart.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC216

Course No: PSELPC216 (Core Course) Max. Marks: 50
Title: ***Lab course on Advanced Analog Circuit Design*** Duration of Examination: 3 Hrs
Semester Exam: 25 Credits: 02
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 May Exams

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Design and simulation of current mirrors using PSpice.
2. Design and simulation of CMOS Amplifiers using PSpice.
3. Design and verification of operational amplifier based inverting amplifier.
4. Design and verification of operational amplifier based non-inverting amplifier.
5. Design and verification of differential and instrumentation amplifier.
6. Design and verification of adder and subtractor.
7. Design and verification Integrator and differentiator.
8. Design and verification of first order active low pass and high pass filters.
9. Design and verification of second order active low pass and high pass filters.
10. Design and verification of switched capacitor filters.

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC217

Course No: PSELPC217 (Core Course) Max. Marks: 50
Title: ***Lab course on Embedded System Programming*** Duration of Examination: 3 Hrs
Credits: 2 Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024, and 2025 May Exams

Each student has to perform a total of six experiments by selecting at least one from each set. The teacher in-charge may add or delete experiments as per the availability of the equipments and need of the course with the authorization of the Head of the Department.

List of Experiments

Set I: Simple programs using Python

Set II: Implementing object oriented programming concepts using python

Set III: Implementing Data structures using Python

Set IV: Embedded system Programming

M. Sc. Electronics
2nd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC218

Course No: PSELPC218 (Core Course) Max. Marks: 50
Title: ***Lab course on*** **Microprocessors and Microcontrollers** Duration of Examination: 3 Hrs
Credits: 2 Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 May Exams

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipments and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Simple programs with 8086.
2. Implementation of bubble sorting.
3. Implementation of searching with 8086.
4. Interfacing with 8086 (Logic Controller).
5. Interfacing with 8086 (Traffic Light Controller).
6. Interfacing using A/D Converter.
7. Assembly language programming using 8051.
8. Assembly language programming using AVR microprocessors.

REVISED SYBALLABI in the subject of Electronics of Master Degree Programme **M. Sc. (Electronics)** for semester 3 under **Choice Based Credit System** for the examinations to be held in the years mentioned below:

Semester-III: Validity December 2023, 2024 and 2025			
	Course Title	**Course Code**	**Credits**
1.	Digital Signal Processing (4 Credits)	**PSELTE311**	**24**
2.	Electronic Communication Systems (4 Credits)	**PSELTE312**	
3.	Industrial Electronics and Control systems (4 Credits)	**PSELTE313**	
4.	Electronic Measurements and Domestic Appliances (Open) (4 Credits)	**PSELTO314**	
5.	Lab course on Digital Signal Processing (2 Credits)	**PSELPC315**	
6.	Lab course on Electronic Communication Systems (2 Credits)	**PSELPC316**	
7.	Lab course on Industrial Electronics and Control systems (2 Credits)	**PSELPC317**	
8.	Industrial Training (2 Credits)	**PSELIC318**	

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTE311

Course No: PSELTE311 (Elective course)
Title: ***Digital Signal Processing***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2023, 2024, and 2025 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objectives:
Understanding of basic principles of digital signal processing and DSP processors based implementation of industrial systems.

Course Outcomes:
At the end of the course the students should be able to

- Understand the principles of DSP
- Understand the working of DSP processors
- Understand discrete transforms and their applications
- Design DSP processors based systems

UNIT I. *Introduction*:
Advantages of digital over analog signal processing; discrete time signals as array of values; standard discrete time signals; classification of discrete time signals; discrete time systems; classifications of discrete time systems; linear time invariant systems; difference equations; correlation.

UNIT II. *Discrete transforms:*
DFT, IDFT, and their properties; Radix-2 DIT FFT algorithm; Radix-2 DIF FFT algorithm; circular convolution; Z transform; properties of Z transform; inverse Z transform; system function and pole zero plots from Z transform; causality and stability in terms of Z transform; linear convolution using Z transform; relationship between Fourier transform and Z transform; Goertzel algorithm; chirp-Z transform.

UNIT III. *Filter design:*
Comparison of analog and digital filters; examples of FIR and IIR filters; ideal filter characteristics; realization of ideal filters; IIR filter design by approximation of derivatives; IIR filter design by impulse invariance; inherent stability of FIR filters; symmetric and antisymmetric FIR filters; linear phase in FIR filters; FIR filter design using windowing; FIR filter design using frequency sampling; FIR differentiators; design of Hilbert transformers; filter design using pole-zero placement.

UNIT IV. *DSP processors and applications:*
Architecture of TMS32OC54xx; on-chip peripherals; interrupts of TMS32OC54XX; data addressing modes of TMS32OC54xx; memory space of TMS32OC54xx processors; basic instructions and programming; serial interface; external bus interfacing signals; memory interface; parallel I/O interface; programmed I/O; DMA; CODEC interface circuit.

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M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTE311

Note for examiner:
The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
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Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests
The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test
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References:

1. J. S. Chitode, Digital signal processing, Technical Publications, Pune.
2. Johnny R. Johnson, Introduction to digital signal processing, Prentice-Hall of India Private Limited, New Delhi.
3. Richard G. Lyons, Understanding digital signal processing, Pearson education Asia, India.
4. Alan V. Oppenheim, Discrete signal processing, Prentice-Hall of India Private Limited.
5. Sanjit K. Mitra, Digital signal processing: a computer based approach, Tata McGraw-Hill.
6. Avatar Singh and S. Srinivasan, Digital signal processing, Thomson Learning, 2004.
7. E. C. Ifeachor, B. W. Jervis, Digital signal processing: A practical approach, Pearson Education.
8. B. Venkataramani and M. Bhaskar, Digital Signal Processors, TMH, 2002.
9. Peter Pirsch, Architectures for digital signal processing, John Weily, 2007

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC312

Course Code: PSELTE312 (Elective Course)
Title: *Electronic Communication Systems* (ECS)
Credits: 4
Minor-I & Minor-II: 40
Validity: 2023, 2024 and 2025 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60

Course Objectives:

To equip the students with the principles of Electronic Communication Systems.

Course Outcomes: At the end of the course the students should be able to

- Understand different signals and operations performed on them.
- Describe the different techniques of analog modulation and demodulation.
- Understand the different techniques of digital modulation and demodulation.
- Understand information theory and coding techniques.

UNIT I ***Signals and Systems***

Signals: Classification, Singularity functions: Step, Impulse & Ramp, Signal operations: Shifting, Inversion and Scaling, Fourier transform and its properties; FT of periodic signals; Convolution; Energy and Power signals, Parseval's theorem for energy and power signals, Energy and power spectral densities, Correlation and Autocorrelation, Random variables: Discrete, continuous & their probability density functions.

UNIT II ***Analog Modulation***

AM and its spectrum, generation by square law modulation; AM demodulation by square law demodulator and envelope detector; DSBSC: Spectrum, Generation (Balanced modulator) Detection (Synchronous detection); SSB modulation; Generation by frequency discriminator & phase discriminator methods and Synchronous detection; VSB: Generation, Detection.

Angle modulation: Phase and FM; NBFM; WBFM; Generation of FM by Direct and Indirect method, FM discriminator.

UNIT III ***Digital Modulation***

Sampling Theorem, Natural and Flat-top sampling; PAM & PTM, PCM: Quantization and BW; Companding; Differential PCM; Delta modulation; Adaptive delta modulation; Shift keying: ASK, FSK, PSK, and QPSK with generation and reception.

UNIT IV ***Information Theory***

Information measure; Average information (Entropy); Information rate; Discrete memory less channel, Channel types; Joint and Conditional entropy; Mutual information; Channel capacity; Shannon's Theorem; Shannon-Hartley Theorem; Trade-off between S/N and BW; Coding: Source coding, Entropy coding & Channel coding.

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M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC312

References:

1. **Principles of Communication Systems**, H. Taub, D.L. Schilling and G. Saha, Tata McGraw-Hill.
2. **Modern Digital and analog Communication Systems**, B.P. Lathi, Oxford University Press.
3. **Communication Systems**, Simon Haykin, John Wiley and Sons.
4. **Theory and Problems of Analog and Digital Communications**, Hwei P. Hsu, Schaum's Outline Series, McGraw-Hill.
5. **Communication Systems**, R.P. Singh and S.D. Sapre, Tata McGraw-Hill.
6. **An Introduction to the Principles of Communication Theory**, J.C. Hencock, Tata McGraw-Hill.
7. **Communication Systems,** A.B. Carlson, P.B. Crilly and J.C. Rutledge, McGraw-Hill.
8. **Information, modulation, and noise,** Schwartz, McGraw-Hill.
9. **Principles of Electronic Communication**, P.K. Ghosh, Universities Press.

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The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTE313

Course No: PSELTE313 (Elective Course)
Title: Industrial Electronics and Control systems (IEC)
Credits: 4
Minor-I & Minor-II: 40 (20+20)
Validity: 2023, 2024 and 2025 December Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 marks

Course objectives:

To impart knowledge on various power semiconductor devices, SMPS, converters, inverters along with their applications. It further aims to provide the basic concepts of control systems.

Course Outcomes: At the end of the course students should be able

- To understand various power semiconductor devices such as P-MOSFET, SCR, DIAC, TRIAC, GTO etc.
- To understand the basic principle of phase control, cycloconverter, buck converters, boost converters etc.
- To describe PWM inverters, HVDC system, static circuit breakers etc.
- To use standard test signals to identify performance characteristics of 1st and 2nd order systems.
- To apply Root locus, Nyquist and Bode plot stability criterion.

UNIT I Power Semiconductor Devices

Power diode: basic structure, characteristics and types; Power transistor: steady-state characteristics and switching characteristics; power MOSFET: P-MOSFET characteristics and applications, comparison of P-MOSFET with BJT; IGBT: basic structure, equivalent circuit, working, latch-up, characteristics, applications and comparison with MOSFET; Thyristors: characteristics, thyristor turn-on methods, two-transistor model of thyristor, thyristor protection, series and parallel operation of thyristors, introduction to PUT, SUS, SCS, DIAC, TRIAC and GTO.

UNIT II Converters

Phase controlled rectifiers: principle of phase control, single phase half-wave circuit with RL load, single phase half-wave circuit with RL load and free-wheeling diode; single phase full-wave converters: mid-point and bridge converters; choppers: principle of chopper operation, step up choppers, types of choppers (A, B, C and D); Buck converters, Boost converters, Derived converters.

UNIT III SMPS and Inverters

Switched mode power supply (SMPS): flyback, push-pull, half-bridge and full bridge converters; uninterrupted power supplies (UPS); inverters: single phase bridge inverters, voltage control in single phase inverter, pulse width modulated (PWM) inverters, principle of cycloconverter operation; high voltage DC transmission (HVDC): types of HVDC link, bipolar HVDC system, control of HVDC converters; static switches: single phase AC switches and DC switches; static circuit breakers: ac and dc circuit breakers.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTE313

UNIT IV Control systems

Open loop and closed loop system; transfer function, block diagram algebra: reduction of block diagram; signal flow graph: Mason's gain formula; control actions: proportional, derivative, integral and PID control. Standard test signals, time response of 1st and 2nd order systems; time response specifications: rise time, peak time, peak overshoot, settling time; concept of steady state errors and error constant; Routh and Hurwitz stability criterion; relative stability analysis; root locus technique: concepts and construction of root loci; Bode plot and Nyquist stability criterion.

References:

1. I. J. Nagrath, M. Gopal, Control Systems Engineering, New age International publishers.
2. B. S. Manke, Linear Control Systems, Khanna Publishers.
3. Kuo, Automatic control systems, Prentice-Hall of India, New Delhi.
4. P. S. Bimbhra, Power Electronics, Khanna Publishers.
5. S. K. Bhatacharya and S. Chatterjee, Industrial electronics and controls, Tata McGraw Hill, New Delhi.
6. Mohammad H. Rashid, Power electronics circuits, devices, and applications, Prentice-Hall of India, New Delhi.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 06 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 04 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTO314

Course No: PSELTO314 (Open Course)
Title: ***Electronic Measurements and Domestic Appliances***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2023, 2024, and 2025 Dec Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objectives:
To introduce to the students the operation of various electronic instruments which are used to measure the electronic parameters.

Course Outcomes: At the end of the course the students should be able to

- Understand operation of different instruments.
- Describe different terminology related to measurements.
- Understand the principles of various types of transducers and sensors.
- Identify the various parameters that are measurable in electronic instrumentation.
- Employ appropriate instruments to measure given sets of parameters.

UNIT I. INTRODUCTION

Measurement; classification of transducers; errors in measurement; calibration and standards; standard test signals; periodic and periodic signals; modulated signals; sampled data; measurement of current; measurement of voltage; measurement of resistance; measurement of impedance; electronic amplifiers; measurement of phase angle; frequency and time interval measurement.

UNIT II. TRANSDUCERS

Basics of temperature measurement; pressure measurement; force measurement; torque measurement; density measurement; liquid level measurement; viscosity measurement; flow measurement; displacement to pressure transducer; resistive transducers; inductive transducers; capacitive transducers; Hall effect transducers; electromechanical transducers: tachometers and electromagnetic flow meters; photoelectric transducers: Photoconductive, photovoltaic and photo emissive, feedback fundamentals; inverse transducers.

UNIT III. ADVANCED INSTRUMENTATION SYSTEMS

Semiconductor sensors; smart sensors; micro sensors; IR radiation sensors; ultrasonic sensors; fibre optic sensors; chemical sensors; bio sensors; thermometry and thermography; nano instrumentation; environmental pollution monitoring; process control instrumentation in pharmaceutical; textile; food processing; aerospace; nuclear; bioprocess industries; field instrumentation.

UNIT IV. DOMESTIC APPLIANCES

Commercial Television: LED, LCD, Plasma, Curved (Comparison among them and their size); Block Diagram, Operating Principle, Precautions and Preventive Maintenance: Microwave Ovens, washing machines, refrigerator, rice cooker, electric iron, air conditioner, MODEM (Broadband), LED Bulbs, domestic motor pumps.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTO314

References:

1. D.V.S. Murthy, Transducers and Instrumentation, Prentice Hall, New Delhi.
2. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, **Instrumental Analysis**, CENGAGE Learning, Indian Edition.
3. A. K. Sawhney, **A Course in Electrical and Electronic Measurements and Instrumentation,** Dhanpat Rai & Co.
4. Albert D. Helfrick and William D. Cooper, **Modern Electronic Instrumentation and measurement techniques,** Prentice Hall.
5. Shashi Bhushan Sinha, **Handbook of Repair and Maintenance of Domestic Electronics Appliances handbook**, BPB Publications

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 06 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 04 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC315

Course No: PSELPC315 (Core Course)
Title: ***Lab course on Digital Signal Processing***
Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 December Exams

Max. Marks: 50
Duration of Examination: 3 Hrs

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. To generate a sinusoidal signal in MATLAB.
2. To implement a FIR filter in MATLAB.
3. To implement an IIR filter in MATLAB.
4. To implement DFT in MATLAB.
5. To record and process speech using data acquisition system.
6. To understand and process ECG signal.
7. To implement a filter on DSP kit.
8. To record and process heart sounds.
9. To acquire and process a noisy image using MATLAB.
10. To enhance a stored image using histogram based analysis.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELTC316

Course No: PSELPC316 (Core Course)
Title: ***Lab course on Electronic Communication Systems***
Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 December Exams

Max. Marks: 50
Duration of Exam.: 3 Hrs

Each student has to perform a total of six experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course with the authorization of the Head of the Department.

List of Experiments

1. Study of Amplitude modulation.
2. Study of Amplitude demodulation.
3. Study of frequency modulation.
4. Study of frequency demodulation.
5. Study of Pulse modulation.
6. Study of Pulse demodulation.
7. Study of delta modulation & demodulation.
8. Study of adaptive delta modulation & demodulation.
9. Calculation of noise figure.
10. Study of FSK/PSK system.

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELPC317

Course No: PSELPC317 (Core Course) Max. Marks: 50
Title: ***Lab course on Industrial Electronics and Control systems*** Duration of Examination: 3 Hrs
Credits: 2 Semester Exam: 25
Sessional Assessment: 25
Validity: 2023, 2024 and 2025 December Exams

Each student has to perform a total of six experiments by selecting at least one from each set. The teacher in-charge may add or delete experiments as per the availability of the equipments and need of the course with the authorization of the Head of the Department.

List of Experiments

Set I: Thyristor characteristics

Set II: Thyristor applications

Set III: Converters

Set IV: Inverters

Set V: SMPS and UPS

Set VI: Some experiments on control systems

References:

1. J.B. Gupta, A course in electrical power, S. K. Kataria and Sons, New Delhi.
2. S. K. Bhatacharya and S. Chatterjee, Industrial electronics and controls, Tata McGraw Hill, New Delhi.
3. Mohammad H. Rashid, Power electronics circuits, devices, and applications, Prentice-Hall of India, New Delhi.
4. P. S. Bimbhra, Power Electronics, Khanna Publishers.
5. B. S. Manke, Linear Control Systems, Khanna Publishers

M. Sc. Electronics
3rd Semester (CBCS)
(for the examinations to be held in the years 2023, 2024 and 2025)
Course No: PSELIC318

Course No: PSELIC318 (Core Course) Max. Marks: 50
Title: **Industrial Training** Credits: 2
Validity: 2023, 2024 and 2025 December Exams

The internal assessment shall be as per the following details:

Training report: 25 marks **Seminar based on the industrial training:** 25 mark

Course Objectives

This course aims at building the students for taking up industrial problems and incorporates better practical skills in them, so that they can have better exposure in the relevant field and have interaction with the industries.

Scheme

The students are required to undertake an industrial training under the supervision of a faculty member from the department. The industrial training is to be undertaken by each student at an institute/industry of repute for duration of 4 to 6 weeks during the summer vacations falling between 2nd and 3rd semester. The certificate of the successful completion of industrial training of the required duration shall be submitted to the department by the candidate along with the training report. The candidates will be required to present seminar based on the work done during the training period.

The industrial training can be organized by multiple ways including

1) In house summer school during vacations
2) Industrial tours during summer/winter vacations
3) Condensed outside trainings in industries such as medium scale and micro industries (MSME) and research institutions.

REVISED SYLLABI in the subject of Electronics of Master Degree Programme **M. Sc. (Electronics)** for semester 4 under **Choice Based Credit System** for the examinations to be held in the years mentioned below:

Semester-IV: Validity May 2024, 2025 and 2026			
Course Title		**Course Code**	**Credits**
1. Smart Sensors and Instrumentation Systems	(4 Credits)	**PSELTE411**	**24**
2. Data Communication	(4 Credits)	**PSELTE412**	
3. Device Fabrication and Characterization Techniques	(4 Credits)	**PSELTE413**	
4. Electronic Communication (Open Course)	(4 Credits)	**PSELTO414**	
5. Seminar	(2 Credits)	**PSELSC415**	
6. Project Work	(6 Credits)	**PSELPC416**	

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 411

Course No: PSELTE411 (Elective course)
Title: ***Smart Sensors and Instrumentation Systems***
Credits: 4
Minor I & Minor II: 40 Marks
Validity: 2024, 2025, and 2026 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 Marks

Course Objectives:
Understanding of basic principles of advanced instrumentation used for biomedical, agriculture, and IoT based applications.

Course Outcomes:
At the end of the course the students should be able to

- Understand the important transduces and sensors
- Understand the working of biomedical instruments
- Apply electronic principles for agriculture development
- Sensors and networking principles to IoT based system design

UNIT I. *Basics transducers*:
Transducers: pressure transducers, temperature measurement, pulse sensors, techometers, displacement, flow, humidity, thickness, pH, position; medical measurement constraints; interfering and modifying inputs; compensation techniques; electrical activity of excitable cells; electrode-electrode interface; plolarization; electrode-skin interface and motion artifact.

UNIT II. *Biomedical Instrumentation*:
Introduction to ENG, EMG, ERG, EEG, MEG systems; electrocardiograph: functional diagram, problems, transient protection; interference reduction circuits; intracellular electrodes; evoked potential; fetal electrocardiography; blood pressure measurements; heart sounds; computer tomography; magnetic resonance imaging; apnoea detectors; foetal monitoring; physiological effects of electricity.

UNIT III *Agro and environmental instrumentation:*
Functional analysis of agriculture machines; thermodymic limits to engine performance; heat losses and power at the piston; mechanical losses and power at the flywheel; induction motors and their principle of operation; single phase and three phase induction motors; variable speed electric motors and their efficiency; mechatronics and system control; GPS and applications in agriculture; GIS and applications.

UNIT IV. *Internet of Things:*
Introduction to IoT; characteristics of IoT; applications of IoT; IoT reference model (Level-I, Level-II), interfacing concepts to embedded systems; RFID; LoRa; comparison of IoT protocols; RaspberryPi: introduction, learning model, operating systems, operating system setup, commands, programming with Python.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 411

Note for examiner:
The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests
The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test
There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts. Part (a): Objective/ short answer type of 03 marks each and Part (b): Long answer type of 09 marks each. The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

References:

1. John G. Webster, Medical instrumentation: application and design, John Wiley & Sons, Inc, New York.
2. R. S. Khandpur, Handbook of biomedical instrumentation, Tata McGraw-Hill Publishing Company Limited., New Delhi.
3. Ajit K Srivastava, Carroll E Goering, Roger P Rohrbach, Dennis R Buckmaster, Engineering principles of agriculture machines, ASAE publication
4. K. G. Srinivasa, G. M. Siddesh, R. Hanumantha Raju, Internet of things, Cengage.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 412

Course No: PSELTE412 (Elective Course)
Title: ***Data Communication***
Credits: 4
Minor I & Minor II: 40 (20+20)
Validity: 2024, 2025, and 2026 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60

Course Objectives:
To equip the students with the principles of Data Communication Systems.

Course Outcomes: At the end of the course the students should be able to

- Understand different Network topologies.
- Describe the principles of wireless and mobile communication.
- Understand the principle and techniques of optical communication.
- Describe the satellite communication techniques and Radar principle.

UNIT I ***Network Technologies***

Network hardware: Topologies, switching: circuit, packet and message, routers and routing, network OSI model, LAN, WAN, MAN, wireless network, GSM, short messaging in GSM, ARPANET, INTERNET; protocols: one bit sliding window, HDLC, ALOHA, CSMA, TCP/IP, UDP, ISDN.

UNIT II ***Wireless and Mobile communication***

Introduction: Overview, challenges in wireless networks, wireless network standards; Modern wireless communication systems: 2G, 3G & 4G.

Introduction to mobile communication, main methods of radio transmission, GSM standards for cellular telephony, Architecture of GSM, Cellular mobile radio systems, Structure & working of cell phone, Performance criteria for cellular phones, operation of cellular systems, Concept of frequency re-use, power control for cellular systems, Function of MTSO & interconnection.

UNIT III ***Optical communication***

Introduction to optical fibers, comparison of optical fiber with other interconnectors, attenuation in fibers, splices and connector optical fiber communication systems (analog and digital), opto-electronics Ics, Opto-coupler, OEIC-Transmitter/Receiver. Propagation in fibers, Step Index, Graded Index, Multipath dispersion, Material dispersion, combined effect.

UNIT IV ***Satellite communication and Radar***

Introduction: satellite frequency bands, satellite system; satellite orbits: inclined, polar and equatorial, geostationary satellite; satellite channel: electromagnetic field propagation, transmission path and path loss, saturation flux density, satellite link analysis; satellite earth station, satellite transponder.

Radar fundamental: block diagram, radar range equation, performance factor, detection of signal in noise; Doppler effect, MTI and pulse Doppler radar.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 412

References:

1. Andrew S. Tanenbaum, Computer networks, Prentice Hall of India Limited, New Delhi.
2. Kavesh Pahlavan, Principles of Wireless Networks, Pearson Education
3. Achyut S Godbole, Data Communication and Networks, Tata McGraw-Hill
4. Sudhir K. Pandey, Handbook of satellite communication, Authors Press, New Delhi.
5. Tri T. Ha, Digital satellite communications, McGraw-Hill Publishing Company, New York.
6. John Gowar, Optical communication systems, Prentice-Hall of India Limited, New Delhi.
7. Merrill I. Skolnik, Radar Communication Systems, Mc Graw Hill Education.
8. R.G. Hunsperger, Integrated Optics: Theory & Technology (3rd edition)
9. J. Wilson, J.F.B. Hawkes, Optoelectronics: An Introduction (2nd edition)
10. Goving P. Aggarwal, Fiber Optic Communication Systems
11. John M. Senior, Optical Fiber Communications – Principle & Practice
12. Theodore S Rappaport, Wireless communications, Pearson.
13. Jon W Mark and Weihua Zhuang, Wireless communications and Networking, PHI.
14. R.P. Singh and S.D. Sapre, Communication Systems, Tata McGraw-Hill.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 08 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 02 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt four questions from section A and one question from section B. All questions shall carry equal marks.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 413

Course No: PSELTE413 (Elective Course)
Title: ***Device Fabrication and Characterization Techniques***
Credits: 4
Minor-I & Minor-II: 40 (20+20)
Validity: 2024, 2025 and 2026 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60 marks

Course objective: This course is designed to provide a deep understanding of IC fabrication technology, various thin film deposition and characterization techniques.

Course outcome:

After learning the course, the students should be able:

1. To understand the basics of IC fabrication.
2. To understand the basics of lithography, etching, NEMS, MEMS etc.
3. To have knowledge of various thin film deposition and characterization techniques.

UNIT I **Fabrication principles**
Crystal growth techniques: czochralski method and float zone method; epitaxy: VPE and MBE; oxidation: thermal oxidation, kinetics of growth; diffusion: basic diffusion process, diffusion equation; ion implantation: range of implanted ions, ion distribution, ion stopping; Implantation damage, Annealing: conventional and rapid thermal annealing (RTA).

UNIT II **Lithography and etching**
Lithography: optical lithography, clean room, exposure tools, masks, photo resist, pattern transfer; x-ray lithography, e-beam; Etching: wet chemical etching and dry etching, reactive ion etching; Basics of MEMS & NEMS, Quantum well, Quantum wire, Quantum dots, Nanowire and Carbon nanotube.

UNIT III **Deposition techniques**
Thin film deposition techniques: Physical vapor deposition (PVD): sputtering, e-beam PVD; advantages of PVD, disadvantages of PVD; Chemical vapor deposition (CVD): Low-Pressure CVD (LPCVD), Plasma-Enhanced CVD (PECVD); advantages of CVD, disadvantages of CVD; Sol-Gel and spin coating techniques.

UNIT IV **Characterization techniques**
Thin-film characterization techniques: X-ray diffraction (XRD), optical microscopy, transmission electron microscopy (TEM), energy dispersive X-ray microanalysis (EDS), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM); Electrical characterization techniques: Electrical resistivity, Hall effect and magnetoresistance.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2021, 2022 and 2023)
Course No: PSELTE 413

References:

1. S. M. Sze, Semiconductor devices, Physics and technology, John Wiley & Sons.
2. S. M. Sze, VLSI Technology, McGraw-Hill International.
3. Sorab K. Gandhi, VLSI fabrication principles, John Wiley & Sons.
4. M.A. Shah, Tokeer Ahmad, Principles of NanoScience and Nanotechnology, Narosa Publishing House.
5. Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, John Wiley & Sons.
6. G. Cao, Nanostructures & Nanomaterials: Synthesis, Properties & Applications, Imperial College Press, 2004.
7. K. L. Chopra, Thin Film Phenomena, McGraw Hill.

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

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Major Test

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Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 414

Course No: PSELTO414 (Open Course)
Title: ***Electronic Communication***
Credits: 4
Minor-I & Minor-II: 40 (20+20)
Validity: 2024, 2025, and 2026 May Exams

Duration of Examination: 3 Hrs
Max. Marks: 100
Major Test: 60

Course Objectives:
To learn the fundamentals of basic communication system.

Course Outcomes: At the end of the course the students should be able to

- Understand different blocks in communication system and how noise affects communication using different parameters.
- Distinguish between different modulations schemes with their advantages, disadvantages and applications.
- To analyze basic digital communication systems.
- To compare optical fibres with the conventional system.
- To understand the various terminology, principles, devices, schemes, concepts, and different methodologies used in Satellite communication.

UNIT I. Introduction

Components of Electronic Communication system; Need of modulation; Bandwidth requirements; External Noise: Atmospheric, extraterrestrial and Industrial; Internal Noise: Thermal, Short and Transit Noise; Noise calculations: Addition of noise due to several sources, Addition of noise due to several amplifiers in cascade, Noise in a resistive circuit; Noise figure and its calculation, Noise figure from equivalent noise resistance, Noise temperature.

UNIT II. Modulation

Frequency spectrum of Amplitude Modulation, Mathematical representation of Amplitude Modulation, Modulation index, Power relations, Generation of AM (Square law modulator), Demodulation of AM (Envelope detector), Suppressed carrier AM, Single side band modulation, Frequency modulation, Mathematical representation of FM, Frequency spectrum of FM, Phase modulation, FM Modulator (Direct & Indirect methods), Phase Modulation

UNIT III. Communication

Digital communication: Pulse modulation, Pulse Amplitude Modulation, Pulse Time Modulation, Pulse Position Modulation, Pulse Code Modulation, PCM System, Fundamentals of data communication systems, Bandwidth requirements, ASK, FSK, PSK, DPSK. Optical Communication: Basics of optical communication, Advantages & disadvantages of optical fiber communication, Structure & Characteristics of optical fibres, Principle of optical guides, Attenuation in fibers, splices and connector.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELTE 414

UNIT IV. Applications

FM radio, Mobile Phone (cellular telephony and smart phones), ATM, Set top box for satellite TV, Introduction satellite frequency bands, satellite system; satellite orbits: inclined, polar and equatorial, geostationary satellite; multiple access format: Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access. Radar fundamental: block diagram

References:

1. Electronic Communication Systems, Kennedy & Davis, Tata McGraw-Hill.
2. Communication Systems, R.P. Singh and S.D. Sapre, Tata McGraw-Hill.
3. John Gowar, Optical communication systems, Prentice-Hall of India Limited, New Delhi.
4. R.G. Hunsperger, Integrated Optics : Theory & Technology
5. J. Wilson, J.F.B. Hawkes, Optoelectronics : An Introduction
6. John Gower, Optical Communication Systems
7. John M. Senior, Optical Fiber Communications – Principle & Practice

Scheme of Evaluation:

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (Theory)	Syllabus to be covered in examination	Time allotted for the examination	% Weightage (Marks)
Minor Test I (after 30 days)	Up to 25%	1 and half hour	20
Minor Test II (after 60 days)	Up to 50%	1 and half hour	20
Major Test I (after 90 days)	Up to 100%	03 hours	60

Minor Tests

The minor test would consist of two sections (A&B). Section A would consist of three short answer type questions (05 marks each) and section B would consist of two long answer type questions (10 marks each). Students are required to answer two questions from section A and one question from section B.

Major Test

There will be ten questions in all in the Major Test out of which 06 questions (as Section A) would be set out of the 50% of the Syllabus not covered in Minor Test 1 and Minor Test 2. The remaining 04 questions (as section B) would be set across the units from the entire syllabus. Each question shall comprise of two parts:

Part (a) Objective/ short answer type of 03 marks each

Part (b) Long answer type of 09 marks each

The candidates are required to attempt three questions from section A and two questions from section B. All questions shall carry equal marks.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELSC 415

Course No: PSELSC415 (Core Course) Max. Marks: 50
Title: **Seminar** Credits: 2
Semester Exam: 50
Validity: 2024, 2025 and 2026 May Exams

Course Objectives

This course aims at exposing the students to recent developments in the field of Electronics.

Scheme

The students are required to make a detailed presentation in the form of a seminar on any of the latest topics falling in the Electronics domain duly approved by the staff council under the supervision of a faculty member from the department. The seminar will be of one hour duration including questions and answer session.

M. Sc. Electronics
4th Semester (CBCS)
(for the examinations to be held in the years 2024, 2025 and 2026)
Course No: PSELPC 416

Course No: PSELPC416 (Core Course)
Title: **Project Work**
Semester Exam: 75

Max. Marks: 150
Credits: 6
Sessional Assessment: 75

Validity: 2024, 2025 and 2026 May Exams

The internal assessment marks shall be as per the following details:

Regularity/Attendance: 25 marks

Project report: 25 marks **Seminar based on the Project Work:** 25 marks

Course Objectives

This course aims at building the students for taking up relevant industrial problems as a major project so as to incorporate better practical skills in them.

Scheme

The students are required to undertake a major project on topics fall in the Electronics domain under the supervision of a faculty member from the department. The candidates are required to demonstrate the project undertaken by them in the form of a prototype and should be implemented using the hardware/software. The candidates will be further required to present a seminar based on the project work carried out by them.