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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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:

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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: 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:

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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**	