Gondwana University, Gadchiroli

Syllabus

for

Master of Science (M. Sc.) Electronics

Based on NEP – 2020

(With effect from 2023-24)

Board of Studies in Electronics

Faulty: Science and Technology

General Guidelines

1. The duration of M.Sc. (Electronics) the course shall be of two academic years consisting of Four semesters with university examinations at the end of each semester namely:
    a. M.Sc. (Electronics) Part I: Semester I & Semester II Examination
    b. M.Sc. (Electronics) Part II: Semester III & Semester IV Examination
2. The examination specified in the preceding paragraph shall be held semester-wise at such places and such dates as may be appointed by the university.
3. Subject to their compliance with the provisions of this Direction and of other directions / ordinances in force from time to time, the candidate who has prosecuted a regular course of study for not less than one academic year prior to the examination shall be eligible for admission to examination.
4. **Eligibility: - For M.Sc. (Electronics) -I**

    Candidates who have passed Bachelor of Science B.Sc. degree in Electronics or Physics as one of the subject / Bachelor of Computer Application BCA/ Bachelor of Computer Science (BCS)/ Bachelor of Science in Information Technology/ Bachelor of Engineering degree in Electronics as one of the subject.

5. The fees for the examination shall be as prescribed by the university from time to time.
6. The scope of the subject of M.Sc. (Electronics) shall be as indicated in the respective syllabi in force from time to time.
7. The medium of instruction shall be English.
8. The theory papers and practicals in which an examinee is to be examined, the maximum marks prescribed for each paper and practical, and the minimum passing mark which the examinee must obtain to pass in the subject and the examination is prescribed in the Later part**.**
9. In the Fourth semester, there will be one Major project based on Electronics topics. Students need to develop one Project/ materials on the latest technology as prescribed by the department.
10. **Absorption Scheme from other Universities to Gondwana University**
11. A No objection certificate from Previous College and/or from a previous university is required along with the following satisfaction of criteria,

Admission to 3rd Semester if student cleared 1st year of M.Sc. (ELECTRONICS).

Scheme

M.Sc. – I Electronics – Semester-I

(2 Year P.G. Honors)

Subject	Course/ PaperCode	PaperName	Teaching Scheme Hrs/Week			Credits Assigned				%ofAssessment			
			Theory	Prac.	Tut.	Theory	Prac.	Tut.	Total	IA	UE	Total	Min. Passing Marks
Core (DSC)	PSCELT101	DSC 1 Semiconductor Devices and Electronic Circuits	4	-	-	3	-	-	3	20	80	100	40
	PSCELT102	DSC 2 Analog and Digital System	4	-	-	3	-	-	3	20	80	100	40
	PSCELT103	DSC 3 Advanced Microprocessors	4	-	-	3	-	-	3	20	80	100	40
Elective (DSE) (Student Shall select any one from the elective group)	PSCELT104	DSE1 Virtual Instrumentation	4	-	-	3	-	-	3	20	80	100	40
	PSCELT104	DSE 2 Embedded Systems and Applications											
	PSCELT104	DSE 3 Communication Techniques and Networking											
Research Methodology (RM)	PSCELT105	Research Methodology & Publication Ethics	4	-	-	3		-	3	20	80	100	40
Lab Course- I	PSCELP101	Lab Course I (Semiconductor devices & Digital System)	-	4	-	-	2	-	2	25	75	100	50
Lab Course - II	PSCELP102	Lab Course II (Microprocessor& Virtual system)	-	4	-	-	2	-	2	25	75	100	50
Ability Enhancement	PSCELS101	**Seminar**	-	1	-	-	1	-	1	50	-	50	20
Total			**20**	**9**	**-**	**15**	**5**	**-**	**20**	**200**	**550**	**750**	**320**

Scheme

M.Sc. – I Electronics – Semester-II

(2 Year P.G. Honors)

Subject	Course/ PaperCode	PaperName	Teaching Scheme Hrs/Week			Credits Assigned				%ofAssessment			
			Theory	Prac.	Tut.	Theory	Prac.	Tut.	Total	IA	UE	Total	Min. Passing Marks
Core (DSC)	PSCELT201	DSC 4 Computer Organization and Interfacing	4	-	-	3	-	-	3	20	80	100	40
	PSCELT202	DSC 5 Microwave and Optical Communication	4	-	-	3	-	-	3	20	80	100	40
	PSCELT203	DSC 6 Fuzzy Logic and Artificial Neural Networks	4	-	-	3	-	-	3	20	80	100	40
Elective (DSE) (Student Shall select any one from the elective group)	PSCELT204	DSE4 Internet of Things	4	-	-	3	-	-	3	20	80	100	40
	PSCELT204	DSE 5 Digital signal Processing											
	PSCELT204	DSE 6 Digital Image Processing											
OJT/FP	PSCELOJT201	On-the-Job Training/Internship/ Field Project	4	-	-	3		-	3	20	80	100	40
Lab Course - III	PSCELP201	Lab Course III (Interfacing and Optical Communication)	-	4	-	-	2	-	2	25	75	100	50
Lab Course- IV	PSCELP202	Lab Course IV (IoT and Digital Signal Processing))	-	4	-	-	2	-	2	25	75	100	50
Ability Enhancement	PSCELS201	**Seminar**	-	1	-	-	1	-	1	50	-	50	20
Total			**20**	**9**	**-**	**15**	**5**	**-**	**20**	**200**	**550**	**750**	**320**

Scheme

M.Sc. – II Electronics – Semester-III

(2 Year P.G. Honors)

Subject	Course/ PaperCode	PaperName	Teaching Scheme Hrs/Week			Credits Assigned				%ofAssessment			
			Theory	Prac.	Tut.	Theory	Prac.	Tut.	Total	IA	UE	Total	Min. Passing Marks
Core (DSC)	PSCELT301	DSC 7 Electromagnetic Fields and Antennas	4	-	-	3	-	-	3	20	80	100	40
	PSCELT302	DSC 8 Digital Communication	4	-	-	3	-	-	3	20	80	100	40
	PSCELT303	DSC 9 Mobile and Satellite Communication	4	-	-	3	-	-	3	20	80	100	40
Elective (DSE) (Student Shall select any one from the elective group)	PSCELT304	DSE7 Optoelectronics and optical fiber communication	4	-	-	3	-	-	3	20	80	100	40
	PSCELT304	DSE 8 IC Technologyand VLSI Design											
	PSCELT304	DSE 9 CMOS System Design											
Research Project **(RP)**	PSCELRP301	Research Project	4	-	-	3		-	3	20	80	100	40
Lab Course - V	PSCELP305	Lab Course V (Antenna and Digital and Communication)	-	4	-	-	2	-	2	25	75	100	50
Lab Course - VI	PSCELP306	Lab Course VI (CMOS Design and Optoelectronics)	-	4	-	-	2	-	2	25	75	100	50
Ability Enhancement	PSCELS303	**Seminar**	-	1	-	-	1	-	1	50	-	50	20
Total			**20**	**9**	**-**	**15**	**5**	**-**	**20**	**200**	**550**	**750**	**320**

Scheme

M.Sc. – II Electronics – Semester-IV

(2 Year P.G. Honors)

Subject	Course/ PaperCode	PaperName	Teaching Scheme Hrs/Week			Credits Assigned				%ofAssessment			
			Theory	Prac.	Tut.	Theory	Prac.	Tut.	Total	IA	UE	Total	Min. Passing Marks
Core (DSC)	PSCELT401	DSC 10 Mechatronics	4	-	-	3	-	-	3	20	80	100	40
	PSCELT402	DSC 11 Network Analysis and Synthesis	4	-	-	3	-	-	3	20	80	100	40
	PSCELT403	DSC 12 Analog Circuit Design	4	-	-	3	-	-	3	20	80	100	40
Elective (DSE) (Student Shall select any one from the elective group)	PSCELT404	DSE10 Fabrication and Characterization Techniques for Electronics Devices	4	-	-	3	-	-	3	20	80	100	40
	PSCELT404	DSE 11 Technologies in Smart City											
	PSCELT404	DSE 12 Electronic Commerce											
Research Project **(RP)**	PSCELRP401	Research Project	4	-	-	3		-	3	20	80	100	40
Lab Course- VII	PSCELP407	Lab Course VII (Mechatronics & Network analysis)	-	4	-	-	2	-	2	25	75	100	50
Lab Course- VIII	PSCELP408	Lab Course VIII Analog Circuit Design and E-Commerce	-	4	-	-	2	-	2	25	75	100	50
Ability Enhancement	PSCELS303	**Seminar**	-	1	-	-	1	-	1	50	-	50	20
Total			**20**	**9**	**-**	**15**	**5**	**-**	**20**	**200**	**550**	**750**	**320**

Abbreviation

- **Core:** Major theory papers in the concerned subject.
  - From Elective Courses students need to select only one paper.
- **IA** (Internal Assessment): It will be evaluated by Internal Examiner appointed by the college in consultation with the University. (Refer Appendix A)
- **UE** (University Examination): It will be evaluated by External Examiner appointed by the university. (Refer Appendix B)
- **For Paper Pattern refer Appendix C**

- **In Course/PaperCode**
  - P: Represent Post Graduate.
  - SC: Represent SCIENCE
  - EL: Represent the subject ELECTRONICS
  - T Represent Theory, P Represent Practical and S Represent Seminar
  - Last Three numbers: Represent Semester and paper No. e.g. 101 represent First semester first paper

Appendix A

Internal Assessment

1. The internal assessment marks shall be awarded by the concerned approved teacher by the university.
2. The internal assessment marks shall be sent to the University after the Assessment in the prescribed format and direction by the University.
3. General guidelines for Internal Assessment are:
   a) The internal assessment marks assigned to each theory paper on the basics of the performance in any two assignments (each of 10 marks) as described below selected by the concerned teacher.
      1. Class Test / Sessional Examination
      2. Certification from IIT Spoken Tutorial / Swayam / NPTEL / PARAKH etc.
      3. Application Oriented case study/ Project
      4. Online Test
      5. Theory Assignments
      6. Programming Assignments
      7. Study tour
      8. Industrial visits
      9. Visit educational institutions and research organizations, do fieldwork, Conference, etc.
      10. Group discussions
      11. Conference/ Webinar
      12. Seminar Presentation
      13. Publishing Research Paper
      14. Review of Research Papers

15. Participation in Departmental Activities

b) There shall be no separate/extra allotment of workload to the concerned teacher related to the above assignments. He/ She shall conduct the internal assessment activity during the regular teaching days/periods as a part of the regular teaching activity.
c) The concerned teacher/department/college shall have to keep a record of all the above activities until six months after the declaration of the results of that semester.
d) At the beginning of each semester, every teacher/department/college shall inform his / her students unambiguously of the method he/she proposes to adopt and the scheme of marking for internal assessment. (Prescribed in the syllabus of respective Subjects)
e) A teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD.

Appendix B

Seminar and Practical Marks Distribution

Seminar

In the Seminar, the student will have to deliver a seminar on any topic relevant to the syllabus/subject encompassing the recent trends and development in that field/subject. The topic of the seminar will be decided at the beginning of each semester in consultation with the supervising teachers. The student has to deliver the seminar which will be followed by a discussion.

The students should submit the seminar report typed and properly bound in one copy to the head of the department along with a soft copy on CD. The said shall be evaluated by the concerned supervisor/head of the department. The concerned teacher/department/college shall have to keep the record of Seminar Reports until six months after the declaration of the results of that semester.

Marks Distribution: A seminar mark will be allocated by Internal Examiner as per the following format

Sr. No.	Particulars	Total Marks (50)	Min. Marks or Passing (40%)
a.	Seminar Report & Documentation	30	12
b.	Seminar Presentation	20	08
Total		50	20

- **Practical Assessment:**
  Time: Minimum 6 Hours for conducting the practical examination subject to the condition of the availability of experimental setup and electricity.

Instructions for Lab Course:

1. Students should perform at least 6 Prcaticals from each section.
2. Students should perform at least 6 practicals from selected elective course.
3. Students should maintain the record/ journal for each lab course separately.

Distribution of Marks for each Lab Course:

For University Assessment: A practical mark will be allocated by the Internal & External Examiner as per the following format

Sr No.	Items	Max marks
1	Experiment 1 from section A	25
2	Experiment 1from section B	25
3	Viva-voce	10
4	Record / journal	15
Total		**75**

]

For College Assessment:

Sr No.	Items	Max marks
1	Attendance in practical	10
2	Practical Performance	10
3	Design of Circuit	5
	Total	**25**

Note: In a day examiner can conduct a maximum of two Practical Examinations of different classes/courses but not of the same class/course.

Appendix C

The Pattern of the Question Paper

General Rules and Regulations regarding a pattern of question papers for the semester-end examinations as given below:

1. There will be four units in each paper.
2. The maximum marks of each theory paper will be 80.
3. The question paper will consist of five questions, each of 16 marks.
4. Four questions will be based on four units with internal choice.
5. The fifth question will be compulsory with questions from each of the four units having equal weightage and there will be no internal choice.

M.Sc. (Electronics)

Year : [I/II] **Semester : [I/II/III/IV]**

Paper Code : **Paper : Name of Paper**

Time: 3 Hours] **[Max. Marks: 80**

Note 1) All questions are compulsory and carry equal marks.

2) Draw a Neat and Labeled diagram and use supporting data wherever necessary.
3) Avoid vague answers and write specific points/answers related questions.

Q1 EITHER (From Unit1)

a) 8
b) 8

OR

c) 8
d) 8

Q2 EITHER (From Unit2)

a) 8
b) 8

OR

c) 8
d) 8

Q3 EITHER (From Unit3)

a) 8
b) 8

OR

c) 8
d) 8

Q4 EITHER (From Unit4)

a) 8
b) 8

OR

c) 8
d) 8

Q5 Solve all questions

a) (From Unit 1) 4

b) (From Unit 2) 4

c) (From Unit 3) 4

d) (From Unit 4) 4

M. Sc. SEMESTER I
(2 Year P. G. Honors)

DSC1 Major (Credits: 03)
Paper – I (PSCELT101)
SEMICONDUCTOR DEVICES AND ELECTRONIC CIRCUITS

Course Outcomes:

On successful completion of this course, student should be able to

1. Learn action of bipolar junction transistors and analysis of transistor amplifier.
2. Learn multistage amplifiers at high frequency.
3. Understand the concept of power amplifier and its various types.
4. Design and study various types of oscillator circuits.

UNIT-I: Bipolar Junction Transistors: Transistor action, configurations and characteristics, current gains, h-parameters and analysis of transistor amplifier using h-parameter, inter conversions in different configuration, thermal instability and bias stabilization, cascaded transistors.

UNIT-II: Multistage Amplifiers: BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.

UNIT-III: Power Amplifiers: Classification of amplifiers, transformer coupled class- A power amplifier, efficiency and crossover distortion, class- B push pull amplifier, single tuned and double tuned amplifier. Classification of feedback amplifiers, effect of negative feedback, stability and response of feedback amplifiers.

UNIT-IV: Oscillators: General theory of operation, Phase Shift, Wien's Bridge, Hartley, Colpitts and Crystal Oscillators.

References:

1. Electronic Devices & Circuits: Mottershed

2. Electronic Devices & Circuits: Milliman and Halkias

3. Solid state Electronic devices: B. G. Streetman

4. Functional Electronics: Ramnan

DSC 2 Major (Credits: 03)
Paper – II (PSCELT102)
ANALOG AND DIGITAL SYSTEM

Course Outcomes:

On successful completion of this subject, student should be able to

5. Learn to design analog and digital systems, from specifications and simulation to construction and debugging.
6. Learn techniques and tools for programmable logic design.
7. Understand the limitations and difficulties in modern analog and digital design aspects, including wiring constraints, high-speed etc.
8. Design, construct, test and debug a moderate-scale digitalcircuits.
9. Be familiar with the state-of-the-art system on chip (SoC) design methods using FPGAs and ASIC design chips.

Unit I: Analog System Design

Design and analysis of BJT/FET differential and multistage amplifiers, current sources, current mirrors, and active loads, small signal circuit analysis

Unit II: Amplifiers and their applications

Operational Amplifiers (OPAMP) characteristics and Applications: Integrator, Differentiator, Wave-shaping circuits, Active filters, Oscillators, Schmitt trigger circuit, Non-sinusoidal oscillators and timing circuits. Design and analysis of Signal conditioning circuits, Current to voltage, voltage to current, voltage to frequency, frequency to voltage converters, Phase Locked loop and its application circuits.

Unit III: Combinational and Sequential circuits:

Combinational circuits: Simplification of logic functions using K-maps, multiplexer, DEMUX, decoders, encoders, 4x4 keyboard encoder

Sequential circuits: State diagrams, characteristic equations of different flip-flops, conversion from one type to another type of flip flops. Finite state machines (FSM), Mealy and Moore models, State assignments, design of counters with lockout prevention; asynchronous sequential circuits, ripple counters, detection and removal of races and hazards.

Unit IV: Digital System Design:

Digital System design concepts, approaches; Implementation of systems like ALU, Stopwatch,

Control Unit design, Applications of FSM like shift registers, ring counter, sequence detector, sequence generator, Stepper control. Programmable logic devices: ROM, PLA, PAL, CPLD,FPGA etc.

Books:

1. Electronic circuit analysis and design: D. A. Neaman, McGraw Hill
2. Integrated Electronics: J. Millman, C. Halkias, C. Parekh, McGraw Hill
3. Digital Design: Morris Mano, Prentice Hall India, New Delhi
4. Digital System Design using VHDL: Charles H. Roth, Jaico Publishers, New Delhi
5. Fundamentals of Digital Logic with VHDL Design: Stephen Brown, TMH, New Delhi

References:

1. Modern Digital Electronics: R. P. Jain, Tata McGraw Hill, New Delhi
2. VHDL: Douglas Perry, Tata McGraw Hill, New Delhi
3. VHDL Primer: J. Bhaskar, Pearson Education, New Delhi

DSC 3Major (Credits: 03)
Paper – III (PSCELT103)
Advanced Microprocessors

Course Outcomes:
On successful completion of this subject, student should be able to

1. Learn16 bit microprocessors and their instruction sets.
2. Learn assembly language programming of 16 bit microprocessors.
3. Understand the various interfacing devices.
4. Learn 80x86 processors, MMX and SIMD technology with their instruction sets.

Unit-I: Microprocessor Architecture

Introduction to 16-bit microprocessors, 8086/8088 CPU architecture, memory segmentation, physical address generation, addressing modes, Instruction set: data transfer, arithmetic, logical, string manipulation, control transfer, unconditional branch, conditional branch, flag, processor control, 8087 coprocessor, data formats.

Unit-II: Assembly Language Programming

Assembler organization, assembler directives and operators, Assembly language programs, MASM and DEBUG utility, stack structure, PUSH and POP instructions, subroutine, procedure and macros, timing and delays.

Unit-III: Interfacing of Peripherals

Programmable peripheral interface 8255, internal architecture, control word register, operating modes; Timer/counter 8253/8254: functional block diagram, control word register, modes of operation, timing diagrams; keyboard interface/display controller 8279: internal architecture, 8279 commands, operating modes; programmable interrupt controller 8259A: architectural block diagram, command words.

Unit-IV: Architectures of 80x86 processors

Protected mode memory addressing, protected virtual addressing mode (PVAM), architecture, special features and overview of 80286, 80386 and 80486, Pentium Pro processors, superscalar architecture, MMX (Multimedia Extension) and SIMD (Single Instruction Multiple Data) technology.

Practicals: Atleast 10 experiments based on Assembly Language Programming on μp 8086/8088 and Peripherals (8255, 8253 and 8279).

Books:

1. Advanced Microprocessors & Peripherals: A. K. Ray & Bhurchandi, TMH, New Delhi

2. Microprocessor based Systems: N. G. Palan, Tech-Max Publication, Pune

3. Assembly Language Programming: Peter Abel, PHI, New Delhi

4. 8086/8088 Family: Design, Programming and Interfacing: John Uffenbeck, Pearson Education

5. Intel Microprocessors 8086, 80286, 80386, 80486, Pentium Pro Programming and Interfacing: Barry and Brey, PHI, New Delhi

References:

1. Modern Digital Electronics: R. P. Jain, TMH, New Delhi

2. The 80x86 Family: Design, Programming and Interfacing: John Uffenbeck, Pearson Education

DSE1Major Elective-I (Credits: 03)
Paper – IV(PSCELT104)
Virtual Instrumentation

Course outcome:
After the successful completion of the course the students will be able to:
1. demonstrate the working of LabVIEW.
2. explain the various types of structures used in LabVIEW.
3. analyze and design different type of programs based on data acquisition.
4. demonstrate the use of LabVIEW for signal processing, image processing etc.

Unit-I: Virtual Instrument (VI)
Definition of VI, architecture of VI, development of Lab VIEW, graphical programming, advantages of Lab VIEW, palettes, sub VI, express VI, data flow program, modular programming

Unit-II: VI Programming Techniques
For and WHILE loops, feedback nodes, local and global variables, arrays, array functions, polymorphism, cluster operations, conversion between arrays and clusters, case and sequence structures, formula nodes, strings and file I/o, charts and graphs

Unit-III: Instrument Control
Instrument I/O Assistant, VISA, instrument drivers, serial port communications with GPIB, RS-232, USB, firewire, ethernet and IEEE-1394 controllers,

Unit-IV: Processing and Analysis tool kits
Control design and simulation tools, PID control, digital filter design and modulation tool kits, simulation of ECG signal, motion control systems, prototyping with Motion Assistant.

Books:
1. Virtual Instrumentation using Lab VIEW:Jovitha Jerome, PHI Learning Pvt. Ltd., New Delhi
2. Virtual Instrumentation using Lab VIEW: Sanjay Gupta and Joseph John, TMH, New Delhi

References:
1. Lab VIEW for Everyone:Jeffrey Travis and Jim Kring, Pearson Education, New Delhi
2. NI Lab VIEW user manual

DSE-2 Major Elective-II (Credit:03)
Paper IV(PSCELT104)
Embedded Systems and Applications

Course outcome:

After the successful completion of the course the students will be able to:

1. Acquire a basic knowledge about fundamentals of microcontrollers.
2. Acquire a basic knowledge about programming and system control to perform a specific task.
3. Acquire knowledge about devices and buses used in embedded networking Develop programming skills in embedded systems for various applications.
4. Acquire knowledge about basic concepts of circuit emulators.
5. Acquire knowledge aboutProgrammable Logic Controller.

Unit-I: Microcontrollers

Introduction to embedded systems, classifications, processor in the system, microcontroller, introduction: 8051 architecture, features of 8051, basic assembly language programming concepts, instruction set, data transfer, logical operations, arithmetic operations, jump/call instructions, interrupt handler, addressing modes, an 8051 microcontroller design & testing

Unit-II: Interfacing

Interfacing of Keyboard, displays, ADC/DAC, stepper motor, dc motor; serial communication with PC using RS232, Serial Peripheral Interface (SPI), Inter-Integrated Circuit (I2C), serial communication with other microcontrollers/devices using I2C, SPI, RS232 and USB

Unit-III: Other Microcontrollers

Introduction to 16-bit micro-controllers, ATMEGA, PIC and ARM processors: General architecture and their limitations, clocking unit, Real Time Clock and Timers, Reset Circuitry and Watchdog Timer; development tools: ATMEL assembler and simulator, ATMEL AVR studio; robotic control applications

Unit-IV: Programmable Logic Controller

Basic functions of PLC, advantages over microcontroller, basic architecture, register basics, timer functions, counter function, ladder diagram, overview of PLC systems, I/O modules, power supplies, isolators, programming PLC.

Books:

1. Embedded Systems: Architecture, programming and Design: Raj Kamal, TMH New Delhi.
2. The 8051 microcontroller: Kenneth Ayala, Thomson Delmar Learning, New Delhi.
3. 8051 Microcontroller: Mazidi & Mazidi, Penram Publishers, New Delhi.
4. Programmable Logic Controllers- Principles & Applications: John W. Webb & Ronald A. Reis, Prentice Hall Inc. New Jersey
5. Datasheet and user manuals of AVR, PIC, ARM microcontrollers

References:

1. Programming & Customizing the 8051 Microcontroller: MykePredko, TMH, New Delhi
2. Robotic Engineering: Richard D. Klafter, Thomas A. Chmielewski, Michael Negin TMH, New Delhi
3. Embedded System Design: F. Vahid& T. Gargivis, John Wiley and Sons

DSE-3 Major Elective-III (Credit:3)
Paper IV(PSCELT104)
Communication Techniques and Networking

Course outcome:

After the successful completion of the course the students will be able to:

1. Describe basic components of Digital Communication Systems.
2. Compare different error detecting and error correction codes like block codes, cyclic codes and convolution codes.
3. Design optimum receiver for Digital Modulation techniques.
4. Build an understanding of the fundamental concepts of computer networking.
5. Identify the different types of network topologies and protocols

UNIT I: Classification of signals, Correlation, Auto correlation and Cross-correlation function, Convolution. Probability and events, Random signals, Random variable and Random Process, Statistical averages and moments, Probability density function and Power spectral density, Gaussian distribution. Noise, Noise Calculation, Noise Temperature, Noise figure

UNIT II: amplitude modulation system, maximum allowable modulation, square law demodulator, spectrum of amplitude modulation system, balanced modulators, SSB,VSB and CSS modulation system, angle modulation, phase and frequency modulation and relation, spectrum of FM system, Armstrong Frequency modulation system, frequency demodulators

UNIT III: analog to digital conversion, sampling theorem (low pass and High pass Signals), PAM, Quantization of signals, quantization error, PCM, Differential PCM, Delta Modulation, ASK, PSK, FSK, Time division Multiplexing, Frequency division Multiplexing

Unit IV: Introduction to data communication, layered network architecture (OSI and TCP/IP), Public Telephone Network, Cellular Telephone system, data communication codes, error detection and error control, Modems, LAN topologies, Division Multiplexing (WDM) and its network implementation.

Reference Books:

1.Electronics Communication Systems: Fundamental through advanced By Wayne Tomasi, Pearson Education Asia.
2. Elements of engineering electromagnetic by Narayaaa Rao, PHI
3. Mobile communication Engineering- W.Y.C. Lee, McGraw Hill.
4. Mobile Cellular Telecommunication: Analog and Digital Systems, William C.Y. Lee, Mc Graw Hill.
5. Communication principles by Toub Shilling 6. Data Communication and Networks by Wayne Tomasi, Pearson Education Asia.

Paper VI ((PSCELT106)
Research Methodology (Credit:03)

Learning / Course Objectives:

At the end of this course a candidate will be able to

1. Understand the psychology of research which includes different perspectives and necessity of research.
2. Apply the research knowledge to formulate a suitable problem statement by adopting different research methods and models.
3. Analyze the research outcome by using suitable statistical tool.
4. Write or present a scientific report and research proposal by adopting copyright based ethical values.

Unit-I:Introduction to Research : Definition- Scientific Research- Meaning and importance of Research, Types of Research, Selection and formulation of Research Problem, Research Design Motivation and objectives, Defining and formulating the research problem, Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Literature review, Primary and secondary sources, reviews, treatise, monographs-patents, web as a source, searching the web, Critical literature review, Identifying gap areas from literature review, Research methods vs Methodology

Unit-II:**Methods of Research:**Traditional Methods, Historical, Institutional, Legal, Philosophical, Comparative, Ethical methods, Modern Methods, Survey of Literature, Sampling method, Questionnaire, Schedule etc, Interview method and Focus Group discussion, Observation Method, Case Study method, Content analysis, Delphi method, Statistical Method, Experimental method, Brainstorming Techniques, Rating Scale, Ethnographic methods, Documentation methods.

Unit-III:Research Design: Basic Principles- Need of research design, Features of good design important concepts relating to research design, Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. The nature of research design, formulation of research design, classification of research designs: Descriptive, experimental, exploratory, diagnostic, correlative, action and evaluation, developing a research plan; determining experimental and sample designs, Pilot Study.

Unit-IV:Report Writing: Structure and components of scientific reports, types of report, Significance, Different steps in the preparation, layout, structure and language of typical reports, illustrations and tables, bibliography, Webliography, referencing, perfecto pages, prefectural quotation, different report writing manuals, Appendices, plagiarism.

Publication Ethics: Publication ethics: definition, introduction, and importance. Best practices/standards-setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Predatory publishers and journals

Suggested References:

1. An introduction to Research Methodology; Garg B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers.
2. Research Methodology: Methods and Techniques,Kothari C.R., 1990. New Age International.
3. Research Methodology; Sinha S.C. and Dhiman, A.K., 2002. Ess Publications. 2 volumes.
4. Research Methods: the concise knowledge base; Trochim W.M.K., 2005. Atomic Dog

Publishing. 270p.
5. Research Methodology; Panneerselvam R., PHI, Learning Pvt. Ltd., New Delhi – 2009
6. Research Methodology: Concepts and cases, Chawala D. and N. Sondhi; Vikas Publishing House Pvt. Ltd.

Additional Suggestion:

1. Research Methods: A Process of Inquiry Anthony, M., Graziano, A.M. and Raulin, M.L., 2009., Allyn and Bacon.
2. Proposal Writing; Coley, S.M. and Scheinberg, C. A., 1990, Sage Publications.
3. Marathi Reference books related to the paper.

Lab Course I (Credit: 02)

Semiconductor Devices and Digital Circuits(PSCELP101)

Section A

1. Study of BJT amplifier
2. Study of RC coupled Amplifier
3. Study of Transformer coupled amplifier
4. Study of Class- A Push pull Amplifier
5. Study of Class- B Push pull Amplifier
6. Study of Phase Shift Oscillators
7. Study of Wien's Bridge Oscillators.
8. Study of Hartley, Colpitts and Crystal Oscillators

Section B

1. Design and Study of Active filter using OPAMP.
2. Design and Study of Schmitt trigger using OPAMP
3. Design and Study of Phase Locked Loop using OPAMP
4. Design and Study of MUX and DEMUX
5. Design and Study of Encoder and Decoder
6. Design and Study of Sequence generator
7. Design and Study of Ring Counter
8. Design and Study of PLA

Lab Course II (Credit: 02)

Microprocessor & Virtual System(PSCELP102)

Section A

1. Assembly Language Programming (microprocessor 8086/8088) on data transfer group instructions
2. Assembly Language Programming (microprocessor 8086/8088) on arithmetic group instructions
3. Assembly Language Programming (microprocessor 8086/8088) on Logical group instructions
4. Assembly Language Programming (microprocessor 8086/8088) on unconditional branch, conditional branch instructions
5. Interfacing of 8255
6. Interfacing of 8253
7. Interfacing of 8279
8. Interfacing of 8259

Section B

1. Data acquisition using virtual instrumentation from temperature transducer
2. Data acquisition using virtual instrumentation from pressure transducer
3. Stepper motor control using virtual instrument
4. Creation of CRO using virtual instrument
5. Design of digital multi-meter using virtual instrument
6. Design of variable function generator using virtual instrument
7. Creation of digital temperature controller using virtual instrument
8. Machine vision concepts using virtual instrument

M. Sc. SEMESTER II
(2 Year P. G. Honors)

DSC 4 Major (Credits: 03)
Paper – I (PSCELT201)
Computer Organization and Interfacing

Course Outcomes:

At the end of the course student will be able to

1. Identify functional units and illustrate register transfer operations.
2. Explain the internal organization of the computer and its instructions.
3. Make use of fixed and floating point algorithms and analyze micro program instructions.
4. Summarize the memory organization and pipelining concepts.
5. Illustrate data transfer between central computer and I/O devices.

Unit-I: Computer Organization

A functional view of the computer, Pentium and power PC evolution, computer function and inter-connection, PCI bus, cache/main memory structures, DMA module, the external interface: fire wire and infiniband.

Unit-II: Reduced Instruction Set Computers

Pipelining concepts, RISC architecture, comparison of complex instruction set computers (CISC) and RISC, RISC pipelining, organization of pipelining, overview of super-scalar and super-pipelined organizations

Unit-III: Data Acquisition Systems (DAQ)

Basic components of the DAQ system, functional block diagram of PC bus based DAQ system, data acquisition configurations, parallel port data acquisition; GPIB (IEEE-488), UART, USB interface; networked data acquisition

Unit-IV: Hardware Organization and PC interfacing

Expansion buses and I/O ports: ISA, EISA, PCI, USB port; Peripherals: Monitors, printers of different types; BIOS services; 8-bit ISA bus signals and their functions, timing diagrams of ISA bus cycles, interfacing to 8-bit ISA bus, interrupt handling, using DMA channels, limitation of 8-bit ISA bus; features of PCI bus, PCI system, standard parallel port (SPP), centronics, interfacing to parallel port and serial ports.

References:

1. Computer Organization and Architecture: William Stallings, Pearson Education, New Delhi

2. PC based Instrumentation: Concepts and Practice: N. Mathivanan, PHI, New Delhi

DSC 5 Major (Credits: 03)
Paper – II (PSCELT202)
Microwave and Optical Communication

Course Outcomes:

At the end of the course the student will be able to

1. Verify characteristics of Reflex Klystron.
2. Analyze various parameters of Waveguide Components.
3. Estimate the power measurements of RF Components such as directional Couplers.
4. Demonstrate characteristics of various optical sources.
5. Study the optical fibers and its measurements.

Unit I: Microwave Generators and wave guides

Failure of vacuum tubes at high frequency, Two cavity klystron, reflex klystron oscillator, magnetron oscillator, TWT amplifier, backward wave oscillator, GaAs oscillator; Propagation of EM waves through wave guide, TE, TM and TEM waves.

Unit II: Microwave components and Measurements

Microwave components: scattering matrix, attenuators, Tees, directional couplers, circulators, isolators, phase shifters, cavity resonators, Microwave measurements: Measurement of VSWR, phase shift, frequency, power, attenuation, dielectric constants of liquids and solids, Q of cavity.

Unit III: Fiber optics

Principles of optical communication, single mode and multi modefibers, step index, graded index, ray model, multi path dispersion, material dispersion, optical fiber as wave guide, fiber sources and detectors.

Unit IV: Manufacture and Measurements of fibers

Optical fiber cable, fiber joints, splices, couplers and connectors, measurement in optical fibers, attenuation measurement, dispersion measurement, refractive index profile measurement, transmission links, optical transmitters and receivers.

Books:

1. Microwave devices and Circuits: Liao
2. Microwave Engineering: David Pozar
3. Electronics and Radio Engineering: Terman
4. Introduction to Microwave Theory and Measurement: A. L .Lance
5. Optical FiberCommunication : B. Keiser, McGraw Hills
6. Optical Communication Systems: J. Gower, Prentice Hall Publ.
7. Optical Fiber Systems: Kao (MGH)
8. Fiber Optic Communication: D. C. Agrawal, A. H. Wheeler Co., New Delhi

DSC 6 Major (Credits: 03)
Paper – III (PSCELT203)
Fuzzy Logic and Artificial Neural Network

Course Outcomes:

At the end of the course the student will be able to

1. Introduce students to the various neural network and fuzzy systems models.
2. Reveal different applications of these models to solve engineering and other problems.
3. Introduce the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control.
4. Discuss neural networks and fuzzy systems, architectures, algorithms and• applications,

Unit- I: Fuzzy sets and Membership functions

Fuzzy set operations, properties of fuzzy sets, fuzzy relations, features of the membership function, Lambda – cuts, De-Fuzzification methods.

Unit - II: Extension principle, Approximate reasoning, Representing set of rules, fuzzy rule-based systems. Graphical techniques of inference; Fuzzy classification, Fuzzy c-means clustering (FCM).

Unit- III: Fundamental concepts of ANN

Model of an artificial neural network (ANN), Network architectures, feed forward networks, Learning processes, Delta learning rules for multi-perception layer, back propagation algorithm.

Unit- IV: Associative memories and self organizing networks:

Basic concepts and performance analysis of recurrent associative memory, bidirectional associative memory (BAM); the counter-propagation network (CPN), self-organising feature maps, Adoptive Resonance Theory (ART-I).

References:

1. Fuzzy Logic with Engineering Applications: Timothy J. Ross, McGraw Hill, Inc.

2. Neural Networks, A comprehensive Foundation: Simon Haykin, Pearson Education, Asia

Other Books:

1**.** Neural networks: Algorithms, applications & Programming Techniques: J.A. Freeman & D. M. Skapura, Pearson Education Asia

2. Artificial Neural Networks: K. Mehrotra, C. K. Mohan &Sanjay Ranka, Penram International
Publications, New Delhi

3. Introduction to Artificial Neural Systems: J. M. Zurada, Jaico Publishing House, New Delhi

4. Neural Network with MATLAB: Sivanandan

5. Fuzzy Logic with MATLAB: Sivanandan, Springer Verlag

6. Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence:Jyh-Shing Roger Jang, Chuen-Tsai Sun &EijiMizutani, Pearson Education, New Delhi

DSE4 Major Elective -I (Credits: 03)
Paper – IV (PSCELT204)
Internet of Things

Course Objectives:
To understand the basics and fundamentals of latest technology of Internet of Things (IoT)

Course Outcomes:
Students after successful completion of the course will be able to:

1. Understand the concepts of Internet of Things
2. Analyze basic protocols in wireless sensor network
3. Design IoT applications in different domain and be able to analyze their performance
4. Implement basic IoT applications on embedded platform

Unit I: Introduction to IoT & M2M:
Definition of IoT, characteristics of IoT, physical design of IoT, logical design of IoT, functional blocks of IoT, communication models & APIs, standards considerations, Machine to Machine communication, Difference between IoT and M2M protocol, Software defined Network.

Unit II: Network & Communication Aspects:
Wireless medium access issues, MAC protocol survey, survey routing protocols, sensor deployment& node discovery, data aggregation & dissemination. Design challenges, development challenges, security challenges, other challenges.

Unit III: IoT Protocols, Security and Web/ Cloud of Things
IoT protocols, protocol standardization for IoT, issues with IoT standardization, unified data standards, protocols- IEEE 802.15.4, BAC Net protocol, mod bus IoT Security: Vulnerabilities of IoT, security requirements, challenges for secure IoT, threat modelling, key elements of IoT security Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT.

Unit IV: Developing IoTs:
Introduction to different IoT tools, developing applications through IoT tools, developing sensor based application through embedded system platform, Implementing IoT concepts with python.

Books:
1.Internet of Things: A Hands-On Approach: Arshdeep Bahga,Vijay Madisetti, University Press, Mumbai
2. Fundamentals of Wireless Sensor Networks: Theory & Practice, WaltenegusDargie, Christian Poellabauer

DSE 5Major Elective-I (Credit:03)

Paper – IV (PSCELT204)

Digital signal Processing

Course Outcomes:

Students after successful completion of the course will be able to:

1. Recall the properties of different signal
2. Discover modulation techniques both in time and frequency domains.
3. Examine the conversion methods from analog system to digital system.
4. Compare all the types of coding.
5. Study the digital filter design.
6. Understand the DSP processor.

Unit I: Discrete-time Signals and Systems

Discrete time signals: types, operations, D-T system classification; linear time-invariant systems: convolution, linear constant-coefficient difference equations, correlation functions.

Unit II: Transform methods

Introduction to Fourier series and Fourier transform, properties of Fourier transform, discrete Fourier transform and its properties, inverse Fourier transform, twiddle factor, circular convolution, z-transform: definition, region of convergence (RoC), pole zero plot, the inverse z-transform and its methods.

Unit III: Digital Filter Design

FIR filter structures, IIR filter structures, IIR filter design: impulsive invariance method, bilinear transformation method and matched z-transform method, FIR filter design: Fourier series method, windowing technique, Kaiser window filter design method, frequency sampling method.

Unit IV: DSP Chips and Applications

Introduction to DSP processors, types of DSP processors and architecture, general purpose DSP processors; implementation of noise removal techniques, echo, chorus and flange effects introduced in music.

Books:

1. Digital Signal Processing: N. G. Palan (Tech Max Publications, Pune)

2. DSP Processor Fundamentals: Architectures and Features: Phil Lapsley, Jeff Bier, Amit Shoham& Edward A. Lee

3. Discrete Time Signal Processing: Allen V. Oppeheim& Ronal W. Schafer (PHI, New Delhi)

4. Introduction to Digital Signal Processing: Roman Kuc (MGH)

5. Digital Signal Processing- Principles, Algorithms and Applications: J. G. Proakis and D. G. Manolakis (PHI, New Delhi)

References:

1. Introduction to Digital Signal Processing: Johny R. Johnson (PHI, New Delhi)

2. Digital Signal Processing: Sanjit K. Mitra (TMH, New Delhi)

3. Signal Processing using MATLAB: C. Sidney Burrus, J. K. Mc Clellan, A. V. Oppenheim, R. W. Schafer and H. W. Schuessler

4. Digital Filtering: An Introduction – Edward P. Cunni

DSE – 6Major Elective – III (Credits:03)
Paper – IV (PSCELT204)
Digital Image Processing

Course Outcomes:

Students after successful completion of the course will be able to:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.

Unit-1: Introduction to Digital Image Processing

Basic components of image processing system, image sensing and acquisition, digital camera working principle; image sampling and quantization; representation of digital images, matrix, pyramid, quad-tree; elements of color image processing, hue, saturation and intensity, chromaticity diagram.

Unit-2: Image Enhancement, Filtering and restoration

Enhancement in spatial domain; pixel grey level transformation, image negatives, logarithmic transformation; bit-plane slicing, histogram processing; enhancement in frequency domain; image smoothing (low pass filter), image sharpening (high pass filter), selective filtering (band pass and band reject filters); noise models for images, signal-to-noise ratio, image restoration in the presence of noise using spatial filtering, periodic noise reduction by frequency domain filtering; estimating the degradation function, inverse filtering.

Unit-3: Color Image Processing and Image Segmentation

Color fundamentals, colour models, RGB, CMY and CMYK colour models, HSI model; pseudo-color image processing, basics of full color processing, colour transformations, smoothing and sharpening; noise in color images, grey level to colour transformation; Image Segmentation: fundamentals, edge-based segmentation; image thresholding, intensity thresholding; basic global thresholding, multi-variable thresholding.

Unit-4: Image compression and Digital Image Watermarking

Pixel and data redundancy, fidelity criteria, image compression models; Image file formats and compression standards, BMP, GIF, TIFF, JPEG, CDR; types of compression, lossless coding techniques, LZW coding, Lossy transform coding, DCT Wavelet coding, discrete wavelet transform, Haar wavelets, digital image watermarking, need for image watermarking; visible and invisible watermarks, a typical watermarking system, watermark insertion and extraction methods.

Text / Reference Books:

1. Rafel C. Gonzalez and Richard. E. Woods, *Digital Image Processing*, Third Edition, Pearson (2008)
2. Malay K. Pakhira: Digital Image Processing and Pattern Recognition. PHI (2011)
3. Rafel C. Gonzalez, Richard.E. Woods and Steven L. Eddins, *Digital Image Processing using MATLAB*, Pearson 2004
4. Anil K. Jain, *Fundamentals of Digital Image Processing*, Pearson, 2002
5. Keenneth R Castleman, *Digital Image Processing*, Pearson Education, 1995

SEMESTER - II

Lab Course III (Credits: 02)

Interfacing and Optical Communication (PSCELP203)

Section A

1. Study of expansion buses ISA, EISA, PCI and USB ports
2. Study of parallel port interfacing accessing
3. Study of serial/com port accessing
4. Interfacing of 5x7 display for character display
5. Interfacing of ADC 0808/DAC 0800
6. Interfacing of DAC 0800
7. Interfacing of stepper motor to parallel port
8. Interfacing to 8-bit ISA bus

Section B

1. Characteristics of reflex Klystron
2. Attenuation Measurement
3. Coupling and directivity of a directional coupler
4. Standing wave plotting and measurement of guide wavelength
5. Measurement of low VSWR and high VSWR
6. Measurement of unknown impedance using Smith chart
7. Transmission characteristics of optical fiber link
8. Attenuation measurement
9. Dispersion measurement
10. Refractive index profile measurements

Lab Course IV (Credit: 02)

IoT and Digital Signal Processing (PSCELP204)

Section A

1. To interface LED / Buzzer with Arduino/ Raspberry Pi and write a programme to turn on LED for 1 seconds after every 2 seconds.
2. To interface Push button/ Digital sensor with Arduino/ Raspberry Pi and write a programme to turn on LED when push button is pressed
3. To interface DHT 11 sensor with Arduino/ Raspberry Pi and write a program to print temperature and humidity readings.
4. To interface motor using relay with Arduino/ Raspberry Piand write a program to turn on motor when push button is pressed.
5. To interface Bluetooth with Arduino/ Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth
6. Write a program on Arduino/ Raspberry Pi to upload temperature and humidity data to things peak cloud.
7. Write a program on Arduino/ Raspberry Pi to retrieve temperature and humidity data from things peak cloud.
8. Write a program to create TCP server on Arduino/ Raspberry Pi respond with humidity data to TCP Client.

Section B

1. Study of some discrete- time signals
2. Design and study of some FIR filters
3. Study of triangular and Blackman windows
4. Design of FIR filters using windowing technique
5. Design of filters based on pole-zero placements
6. Study of linear convolution
7. Design and study of FFT using programming
8. Design and study of digital filters (HF and LF) using programming
9. Study of experiments based on DSP chips.

M. Sc Electronics
(2 Year P. G. Course)
DSC major Basket

Semester	Course type	Course Name	Course Code	Credit
I	DSC (Major)	DSC 1 Semiconductor Devices and Electronic Circuits	PSCELT101	3
I	DSC (Major)	DSC 2 Analog and Digital System	PSCELT102	3
I	DSC (Major)	DSC 3 Advanced Microprocessors	PSCELT103	3
II	DSC (Major)	DSC 4 Computer Organization and Interfacing	PSCELT201	3
II	DSC (Major)	DSC 5 Microwave and Optical Communication	PSCELT202	3
II	DSC (Major)	DSC 6 Fuzzy Logic and Artificial Neural Networks	PSCELT202	3
III	DSC (Major)	DSC 7 Electromagnetic Fields and Antennas	PSCELT301	3
III	DSC (Major)	DSC 8 Digital Communication	PSCELT302	3
III	DSC (Major)	DSC 9 Mobile and Satellite Communication	PSCELT303	3
IV	DSC (Major)	DSC 10 Mechatronics	PSCELT401	3
IV	DSC (Major)	DSC 11 Network Analysis and Synthesis	PSCELT402	3
IV	DSC (Major)	DSC 12 Analog Circuit Design	PSCELT403	3

DSE Major Elective Basket

(Students shall select any one elective from basket for each semester)

Semester	Course type	Course Name	Course Code	Credit
I	DSE (Major Elective)	DSE 1 Virtual Instrumentation **OR** DSE 2 Embedded Systems and Applications **OR** DSE 3 Communication Techniques and Networking	PSCELT104	3
II	DSE (Major Elective)	DSE 4 Internet of Things **OR** DSE 5 Digital signal Processing **OR** DSE 6 Digital Image Processing	PSCELT204	3
III	DSE (Major Elective)	DSE 7 Optoelectronic and Optical Fiber communication **OR** DSE 8 IC Technologyand VLSI Design **OR** DSE 9 CMOS System Design	PSCELT304	3
IV	DSE (Major Elective)	DSE 10 Fabrication and characterization Techniques for Electronic Devices **OR** DSE 11 Technologies in Smart City **OR** DSE 12 Electronic Commerce	PSCELT404	3

Lab Course Basket

Semester	Course type	Course Name	Course Code	Credit
I	DSC Major	Lab Course I (Semiconductor devices & Digital System)	PSCELP101	2
I	DSC Major	Lab Course II (Microprocessor & Virtual system)	PSCELP102	2
II	DSC Major	Lab Course III (Interfacing and Optical Communication)	PSCELP203	2
II	DSC Major	Lab Course IV (IoT and Digital Signal Processing)	PSCELP204	2
III	DSC Major	Lab Course V (Antenna and Digital Communication)	PSCELP305	2
III	DSC Major	Lab Course VI (CMOS Design and Optoelectronics)	PSCELP306	2
IV	DSC Major	Lab Course VII (Mechatronics & Network analysis)	PSCELP407	2
IV	DSC Major	Lab Course VIII Analog Circuit Design and E-Commerce	PSCELP408	2