COURSE OF STUDIES

Bachelor in Electronics and Telecommunication

(Based on NEP 2020 Framework)

B.Sc. ETC(Honours)

&

B.Sc. ETC (Honours with Research)

(With effect from 2024-25)

KHALLIKOTE UNITARY UNIVERSITY

BERHAMPUR-760001

DISTRIBUTION OF MARKS

Semester and Continuous Evaluation
(Irrespective of Credit in a course /Paper)

Course Type	Maximum Marks	End-Sem Theory	Continuous Evaluation Marks/Sessional	Mid-Sem Theory Marks	End-Sem Practical Marks	Mid-Sem Practical Marks
Without Practical	**100**	**60**	**20**	**20**	**----**	**----**
With Practical	**100**	**50**	**10**	**10**	**20**	**10**

DISTRIBUTION OF SESSIONAL MARKS
(Departments shall preserve all records of Sessional Examination)

Course Type	Maximum Marks	Mid-Semester	Attendance	Surprise Test	Assignment/Presentation
Without Practical	**40**	**20 marks**	**Above 95% (5 Marks)** **85% to 94% (4 Marks)** **75% to 84% (3 Marks)**	**10 Marks**	**5 Marks**
With Practical	**30**	**20 marks (Theory-10 & Practical-10)**		**5 Marks**	**NIL**

Question Pattern of Term End Examination (End-Sem.)

Term End theory examination shall be for 100 marks of 3 hours duration.

The weightage shall be 50 with practical and 60 without practical.

Question Pattern	Type	With Practical (100 Marks)	Without Practical (100 Marks)
PART-I (Objective)	Answer in MCQ One word sentence (All are compulsory)	1 X 10=10	1 X 10=10
PART-II (Very Short Type)	Answer: Maximum 50 words (All are compulsory)	2 X 9=18	2 X 9=18
PART-III (Short Type)	Answer: Maximum 250 words (Any 8 out of 10 questions)	5 X 8=40	5 X 8=40
PART-IV (Long Type)	Answer: Maximum 800 words (Any 4 out of 5 questions)	8 X 4=32	8 X 4=32

For Practical Paper

- **Full Marks – 20**
- **Duration – 3 hours**
- **One major Experiment - 10 marks**
- **Laboratory Records – 05 marks**
- **Viva Voce – 05 marks**

Semester-1					Semester-2			
S.No.	**Type**	**Credit**	**Subject**		**S.No.**	**Type**	**Credit**	**Subject**
1	Core-1 Major-1	4	Digital Electronics		1	Core-1 Major-3	4	Basic Electronics
2	Core-1 Major-2	4	Basic Electrical Engineering		2	Core-1 Major-4	4	Electrical Circuit Theory
3	Core-2 Minor-1	4	Computers Fundamentals		3	Core-3 Minor-1	4	Programming in C
4	Multi-disciplinary	3	Electronics Instrumentation		4	Multi-disciplinary	3	Indian Knowledge System
5	AEC	4	Communicative English		5	AEC	4	Soft Skill Development
6	VAC	3	EVS & Disaster Management		6	SEC	3	Design and fabrication of PCB
	Total	22				Total	22	
Semester-3					**Semester-4**			
S.No.	**Type**	**Credit**	**Subject**		**S.No.**	**Type**	**Credit**	**Subject**
1	Core-1 Major-5	4	Analog Communication		1	Core-1 Major-8	4	Digital Communication
2	Core-1 Major-6	4	Microprocessor and Peripherals		2	Core-1 Major-9	4	Electronics Devices & Circuits
3	Core-1 Major-7	4	Mathematical Methods for Electronics		3	Core-1 Major-10	4	Power Electronics
4	Core-2 Minor-2	4	Consumer Electronics		4	Core-3 Minor-2	4	Programming in Python
5	Multi-disciplinary	3	Entrepreneurship Development and start-up		5	Internship/Field Work	4	Internship
6	VAC	3	Ethics & Values					
	Total	22				Total	20	
Semester-5					**Semester-6**			
S.No.	**Type**	**Credit**	**Subject**		**S.No.**	**Type**	**Credit**	**Subject**
1	Core-1 Major-11	4	Signal & System		1	Core-1 Major-14	4	Optical Fiber and Satellite Communication
2	Core-1 Major-12	4	Digital VLSI Design using HDL		2	Core-1 Major-15	4	Embedded Systems
3	Core-1 Major-13	4	Data Communication and Network		3	Core-3 Minor-3	4	Internet & Web Technology
4	Core-2 Minor-3	4	Operating System		4	SEC	3	Renewable Energy & Energy Harvesting
5	SEC	3	Robotics		5	VAC	3	Project Development
6	VAC	3	Cyber Security					
	Total	22				Total	18	

In case a student opts for NCC and clears "C" certificate additional 16 credit shall be awarded and total credit shall be 126+16=142 credit

Semester-7					Semester-8			
S.No.	**Type**	**Credit**	**Subject**		**S.No.**	**Type**	**Credit**	**Subject**
1	Core-1 Major-16	4	Electromagnetic Waves & Antenna Theory		1	Core-1 Major-20	4	Microwave Technology
2	Core-1 Major-17	4	Digital Signal Processing		2	Core-1 Major-21	4	Wireless Communication
3	Core-1 Major-18	4	Control System		3	Core-1 Major-22	4	Digital Image Processing
4	Core-1 Major-19	4	Broadband Communication		4	Core-1 Major-23	4	Advanced Microprocessor & Microcontroller
5	Core-2 Minor-4	4	Programming in JAVA		5	Core-2 Minor-5	4	RDBMS with SQL server
	Total	20				Total	20	
Grand Total Credit=166								

Fourth Year Honours with Research

Semester-7					Semester-8			
S.No.	**Type**	**Credit**	**Subject**		**S.No.**	**Type**	**Credit**	**Subject**
1	Core-1 Major-16	4	Electromagnetic Waves & Antenna Theory		1	Core-1 Major-19	4	Microwave Technology
2	Core-1 Major-17	4	Digital Signal Processing		2	Core-1 Major-20	4	Digital Image Processing
3	Core-1 Major-18	4	Control System		3	Internship/Field Work	12	Research
4	Core-2 Minor-4	4	Wireless Communication					
5	Core-2 Minor-5	4	Programming in JAVA					
	Total	20				Total	20	
Grand Total Credit=166								

SEMESTER-I

Core-I (Major-I)	DIGITAL ELECTRONICS	Credit-4

MODULE -I

NUMBER SYSTEM AND CODES

Number System: Decimal to Binary conversion and vice versa, Decimal to octal conversion and vice versa, Decimal to hexadecimal conversion and vice versa, Octal to Binary conversion and vice versa, **Binary Arithmetic:** Addition, Subtraction, Multiplication and Division, 1's and 2's compliments of Binary. **Codes:** BCD, Excess-3, Gray, Octal, Hexadecimal

Boolean algebra and Logic gates:

Logic gates: AND, OR, NOT, NAND, NOR, EX-NOR gates.

Boolean Algebra: Boolean Operations and Expression, Laws of Boolean Algebra, De Morgan's Theorem, Boolean analysis of Logic Circuits, Simplification using Boolean Algebra, The SOP Form and POS Form, The Karnaugh map (up to 4 variables).

MODULE -II

COMBINATIONAL LOGIC AND FUNCTIONS

Combinational Logic Circuits, Universal Property of NAND and NOR gates, Combinational Logic using NAND and NOR gates, Logic functions, Half and full adder, Half and full subtractor, Parallel Binary Adder, Comparator, BCD to Decimal and BCD-to-7-Segment Decoder. Encoder: Decimal to BCD encoder, Multiplexer (4 to 1, 8 to 1), Demultiplexer (1 to 4, 1 to 8)

MODULE -III

FLIP-FLOPS

S-R and clocked S-R Flip-Flop, D-Type Flip-Flop, T-Type Flip-Flop, J-K Flip- Flop, Master Slave Flip-Flop, Flip-Flop Application. Semiconductor memories, RAM, ROM, and types.

Shift Register: Basic Functions, Classifications (SISO, SIPO, PISO, PIPO)

MODULE -IV

SEQUENTIAL LOGIC CIRCUIT

Counters: Asynchronous Counter: Up counter, Down counter, Up/Down counter, Synchronous counter: Up counter, Down counter, Up/Down counter, Ring counter, Johnson counter, Decade counter, Logic Family: TTL, RTL

Books:

Digital Fundamentals by Thomas L. Floyd

Digital Electronics by M. Mano

Digital Electronics by R.P. Jain

DIGITAL ELECTRONICS LAB

1. Study & Verify the Logic gates with their truth tables. (7400, 7408, 7432)
2. Study & Verify the Half-Adder circuit with truth table.
3. Study & Verify the Full-Adder circuit with truth table.
4. Study & Verify the Half-Sub tractor circuit with truth table
5. Study & Verify the Full-Sub tractor circuit with truth table
6. Study & Verify the Multiplexer circuit with truth table (74LS373)
7. Study & Verify the De-Multiplexer circuit with truth table
8. Study the various Decoders. (BCD to Decimal & BCD to Seven segment)
9. Study & Verify the Encoder circuit with truth table
10. Study the Various types of Flip-Flops with truth tables. - (7475, 7474)
11. Study of various Synchronous Counters
12. Study of various Asynchronous Counters

Core-I (Major-II)	BASIC ELECTRICAL ENGINEERING	Credit-4

MODULE -I

D.C. circuits: - Ideas of electric circuits, power and energy in circuits, series and parallel circuits, Kirchhoff's law and their applications, branch, and loop current method of solving networks, use of crammer's rule.

Capacitance: - Capacitor, types of capacitors, Capacitors in series & parallel, charging & discharging of capacitor.

MODULE -II

A.C. circuit fundamentals: -Alternating quantities, sinusoidal rectangular and triangular wave forms, effective average value and form factor, power and power factor addition and subtraction of AC quantities of same frequencies, phasor and complex representation of sinusoidal quantities, simple parallel and series circuits, series and parallel resonance.

MODULE -III

Analysis of Three Phase circuits: - Introduction &advantages**,** relationship between line & phase voltage & currents in a star & Delta connection, measurement of power & power factor of a balanced three phase load.

MODULE -IV

Transformer: - Introduction**,** Working Principle, construction, Ideal Transformer, E.M.F equation of a Transformer, Voltage transformation Ratio, losses in a Transformer & Efficiency of a Transformer.

D.C Motors & Generators: - Construction, working Principle, basic theory & uses.

Measuring Instruments: Construction, Principles of Operation & basic theory of measurement of following Instruments: DC bridges (Wheatstone), PMMC, Moving Iron, Voltmeter, Ammeter,

Ohmmeter, Galvanometer, DC Potentiometer, electrical resonates frequency meter.

Text Books:

1. Basic Electrical engineering by C.L. Wadhwa. (New age Publisher)
2. Basic Electrical engineering by B.L. Thareja
3. Basic Electrical by prof. B.B. Swain

ELECTRICAL LAB

1. To study about various active and passive components used in electronics circuits.
2. To study about resistance value of different types of resistors by using color code.
3. To study about Breadboard Connection.
4. To study about Series and Parallel connection of Resistor.
5. To study about Analog Multimeter functions.
6. To study about Digital Multimeter Functions.
7. To study about Transformer.
8. To study about Diode forward biased and reverse biased.
9. To study about DC motor.

Core II(Minor-I)	COMPUTER FUNDAMENTALS	Credit 4

MODULE-I

Introduction to Computer: - Characteristics of computer, Evolution & Generations of computer, basic computer organization.
Classification of Computers: Notebook Computers, PCs, Work Stations, Main Frame Systems, Super computers, Clients & Servers.
Processors and memory: CPU, CU, ALU, Registers, Types of Processors
Main Memory: (RAM, ROM, PROM, EPROM, EEPROM, and Cache).
Secondary Storage Devices: Magnetic tape, Magnetic disk, Optical disk, Mass Storage Devices, Storage Hierarchy.
Input/output Devices: Keyboard, Mouse, Scanner, Track ball, Joystick, Light Pen, Monitors, Printers, Plotters, Screen Image Projector.
Special Devices: Mother Board, Expansion Card, SMPS, UPS, BUS.

MODULE -II

Computer Software: Introduction, Relation between hardware & software, types of software, Local System Architecture Acquiring software, Steps for software development, Purpose of Algorithm, Flow chart and Pseudo code.

MODULE -III

Computer Language:
Machine Language, Assembly Language, High level language, Interpreter & Compiler, OOP Language, characteristics of good programming language, subprograms.

MODULE -IV

Fundamentals of Computer network: Topologies, Protocol, LAN, MAN & WAN.
The Internet: Definition, History, basic Services, WWW, Browsers, Uses.
Multimedia: Multimedia Computer System, Components, Applications.

Books:

1. Computer Fundamentals by: P. K. Sinha.
2. Fundamentals of Computer by: Leon & Leon.
3. Computer Beginners by B. Ram

COMPUTER FUNDAMENTAL LAB

1. Introduction to Windows operating System
2. Ms-Word
3. Ms-Excel
4. Ms-Power point
5. Ms-Access
6. Internet Uses.

Multidisciplinary	ELECTRONICS INSTRUMENTATION	Credit 3

MODULE-I

Measurement standards and meters: - Accuracy and Precision, Significant Figures, Error, Types of error, Statistical error, Probability errors, Limiting errors

International, Primary, Secondary, and Industrial standards, Importance, and application of standards of measurements, Calibration, rationalized MKS units, dimensions of physical quantities

MODULE -II

Transducers: - Definition of transducer, Primary and secondary of transducers, Classification, Principles, Application and advantages of Electric and Electronic transducers, Linear, Nonlinear and Digital potentiometers

Thermocouple, LVDT, Strain gauge, Thermistor, Capacitive transducer, Hall-effect transducer, Opto-electronic transducers, Temperature transducers, Piezo-electric transducers

MODULE -III

Measurement Systems: - Construction, Principles and Working of Galvanometers, Chopper type DC voltmeter, Analog digital Multimeter, Measurement of AC and DC Voltages, Current and Resistance.

MODULE -IV

Bridges and Signal Generators: - DC and AC bridges, Wheatstone bridge, Kelvin Double bridge, Maxwell's Inductance Bridge, Hay's bridge, Capacitance Comparison Bridge

AF and RF Signal Generators, RF Sweep Generator, Function Generator and Pulse Generator

Principles and types of electronic emissions, Construction & operation of CRT, Block diagram of CRO, Focusing and Deflection, Time Base generator, Triggering Circuit, Dual trace CRO, Storage CRO.

Text Books:

1. Electrical and Electronics Measurement & Instrumentation by A.k. Sawney
2. Electronic Measurement Systems by Kalsi

AEC	COMMUNICATIVE ENGLISH	Credit-4

MODULE-I

Communication in language - its features.

Writing skills - its features - how it differs from other language skills. How to put ideas together, writing paragraphs, identifying the logical development of ideas in piece writing.

MODULE -II

Report writing - How to present facts clearly and logically. Standard formats for writing Preparation of abstract technical documents.

MODULE -III

Reading skills – Reading to get main ideas. Identifying the logical development of ideas in a piece writing, reading to summarize, reading to take and make notes.

MODULE -IV

Speaking – Group discussion based on current topics. Group dynamics Paralinguistic communication - gestures, actions, body language Linguistic tools for better communication.

Audio-visual aids for communication.

Communicative/functional Grammar –Communicative use of structures, collocations.

Books:

1. A Communicative Grammar of English By Geoffrey Leech and Jan Svartvik,Longman

2. A millennium Guide to Writing and Speaking English by J.D. Chand & B.C. Das

3. Oxford Guide to Writing and Speaking, OUP. By John Sealy

VAC	ENVIRONMENTAL STUDIES & DISASTER MANAGEMENT	Credit-3

Unit 1: Multidisciplinary nature of environmental studies (12 Periods)
Definition, scope, and importance
Need for public awareness
Environmental Pollution
Definition
• Cause, effects and control measures of:-

a) Air pollution
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Radiation pollution

Unit 2: Natural Resources: (12 Periods)
Renewable and non-renewable resources:
Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and Overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Biodiversity: -
Introduction-Definition; Biogeographically classification of India
India as a mega diversity nation. Hot sports of biodiversity, Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity. In Situ and Ex-so conservation of biodiversity

Unit-3: Disaster Management (12 Periods)

1. **Disaster Management:** Types of disasters (natural and Man-made) and their causes and effect)
2. **Vulnerability Assessment and Risk analysis:** Vulnerability to various disasters (Flood, Cyclone, Earthquake, Heat waves, Desertification and Lighting)
3. **Institutional Framework:** Institutional arrangements for disaster management (National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), Disaster Management Act, 2005, District Disaster Management Authority (DDMA), National Disaster Response Force (NDRF) and Odisha Disaster Rapid Action Force (ODRAF)

4. **Preparedness measures:** Disaster Management cycle, Early Warning System, Pre-Disaster and Post-Disaster Preparedness, strengthening of SDMA and DDMA, Community Preparedness for flood cyclone, heat waves, fire safety, lightening and snake biting. Stakeholders' participation, Corporate Social Responsibility (CSR)
5. **Survival Skills:** Survival skills adopted during and after disaster (Flood, Fire, Earthquake, Cyclone and Lightening), Disaster Management Act-2005, Compensation, and Insurance

Unit 4: Social Issues and the Environment (9Periods)

A.

a) Environmental Ethics: Issues and possible solutions.
b) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies
c) Environment Protection Act
d) Air (Preservation Control of Pollution) Act
e) Water (Preservation Control of Pollution) Act
f) Wildlife Protection Act
g) Forest Conservation Act
h) Solid waste management Cause, effect and Control Measure of Urban and Industrial waste

(Role of each individual in conservation of Natural resources and prevention of pollution)

B. Human Population and the Environment

Population Ecology: Individuals, species, population, community
Human population growth, population control method
Urbanization and its effect on society

Unit 5: Field work (15 Periods of 30 hrs)

- Visit to an area to document environmental assets: river/forest/flora/fauna, etc.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds, and basic principles of identification.
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

SEMESTER-II

Core-I (Major-III)	BASIC ELECTRONICS	Credit-4

MODULE-I

Properties of Semiconductors: Introduction, Types of semiconductors, intrinsic semiconductors, Extrinsic semiconductor, Position of Fermi level, current flow in semiconductor, charge densities in p and n materials; conduction by charge drift; conduction by diffusion of charge.

Junction Diode: The p-n junctions, The unbiased & biased p-n junction, current-voltage characteristics of a p-n junction, rectifier operation, Filters, Half wave & Full wave rectifier with filters, voltage multiplier, Clipping circuits & Clamping circuits,

Diodes and Applications: Tunnel diode, Varactor diode, Schottky Diode, PIN Diode, Zener diode, Laser diode and their applications.

MODULE -II

Bipolar junction transistor: The junction Transistor, Transistor Amplifier, Configuration of Transistor: CB, CE & CC, Static characteristics of Transistor. Tra0nsistor Biasing, Operating point & load line analysis of transistor amplifier.

Field Effect Transistors: Introduction to FET, Junction field Effect Transistor (JFET), Metal Oxide Semiconductor FET(MOSFET), Types of MOSFET, circuit characteristics of FET; biasing of FET, FET parameters, Comparison between FET & BJT.

MODULE -III

Amplifiers: Basic Concepts of Amplifier, Classification of Amplifiers, Cascading of Amplifiers, RC-coupled CE-amplifier; frequency response of RC amplifier; gain-bandwidth product; Transformer-coupled Amplifier.

Power Amplifiers: class A power amplifier; push-pull principle; class B push-pull amplifier. Tuned amplifier, Amplifier Characteristics.

MODULE -IV

Feedback circuit & Oscillators:

Introduction to feedback circuits, Principles of negative feedback in amplifiers, gain of negative feedback amplifier, advantages of negative feedback.

Introduction to Oscillators, types of Oscillators, Feedback Oscillator concepts, Oscillatory circuits, essentials of transistor oscillators, different types of transistor oscillators: Colpitts, Hartley, Phase shift, Wein – Bridge& Crystal Oscillator.

Books

1. Applied Electronics by R.S. Sedha
2. Principles of Electronics by V. K. Meheta

Core-I (Major-IV)	ELECTRICAL CIRCUIT THEORY	Credit-4

MODULE-I

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorems Reciprocity theorem, Substitution Theorem, Compensation theorem & Tellengen's Theorem, Nodal & Mesh analysis of electric circuits.

MODULE-II

Two port networks: Introduction, network elements, Classification of networks, network configuration, Z-parameters, Y-parameters, Hybrid parameters, ABCD parameters, Relationships between the network parameters. Cascade and Parallel Connections.

MODULE-III

Network Functions & Responses: Concept of complex frequency, driving point and transfer functions for one port and two network, poles & zeros of network functions, Restriction on Pole and Zero locations of network function.

Coupled Circuits: Dot Convention, Coefficient of coupling. Loop Analysis of coupled circuits, single and double tuned coupled circuits.

MODULE-IV

Filters: Low pass, high pass, band pass & band elimination filters. Active filters. Input Power, Power Transfer and Insertion loss.

Network topology: Concept of Network Graph, Relation between Twigs & links, Properties of a tree in a graph, No. of trees in a graph, Tie-set matrix, Cut-set matrix.

Text Book: -

1. Circuit Theory (Analysis & Synthesis) by A.K. Chakrabarti
2. Network Analysis by Van Valkenburg

Core-III (Minor-I)	PROGRAMMING IN C	Credit-4

MODULE-I

Introduction to C-compiler, Program structure, ASCII characters, Identifiers, Key words, Syntax, I/O statements, Escape Sequence, Application of Keywords, preprocessor, Macro, Assignment Operators, Arithmetic Operators, Logical Operators, Bitwise Operators, Conditional Operators, Special Operators, Conditional statements if, if-else, nested if-else, switch, case, break, continue, go-to, while, do-while, for.

MODULE -II

Function: Introduction to function, function Declaration, need for user defined function, category of function, Pass by Value, Pass by Reference, Storage Class of Variables. recursion, Introduction of Arrays, Declaration of one-dimensional arrays, initializing of one-dimensional arrays, two dimensional arrays, Declaration of two-dimensional arrays, Initializing of two-dimensional arrays,

MODULE -III

Pointer: Understanding Pointers, accessing the address of a variable, declaring pointer variables, initializing pointer variables, accessing a variable through its pointer, chain of pointers, pointer expression, pointers and arrays, Pointers to Function, pointers as function arguments.

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MODULE -IV

Structure: Defining a Structure, declaring structure variables, accessing structure members, arrays of structure, structures with in structures, size of structures, union, defining and opening files, closing files, input/output operations on files, error handling during I/O operations, command line arguments.

Text Books:

1. **Programming in ANSI C by E. Balguruswamy**
2. **Let us C by Yashavant Kanetkar,**
3. **Programming in CP. Radhaganesan**

Multi-disciplinary	INDIAN KNOWLEDGE SYSTEMS	Credit-3

Course Objectives

• To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana &Itihasa

• To help students to trace, identify and develop the ancient knowledge systems.

• To help to understand the apparently rational, verifiable and universal solutionfrom ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing

• To build in the learners a deep rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Unit 1: Introduction to IKS

What is Knowledge ? Subject, Object and sources of Knowledge , Four Vedas, Indian Philosophical Systems , Vedic and Non-Vedic schools ,(Nyaya) theory of Knowledge, Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Niti Sastras, Four Purusharthas(Dharma, Artha, Kama, Moksha)

Unit 2: Indian traditional scientific knowledge, Technology and practices IKS

Traditional agriculture practices, Traditional Ayurveda and plants based medicines, sixty-four art forms and occupational skills (64 Kalas) Metals and Metal working technology (Copper, Gold, Zinc, Mercury, Lead and Silver, Iron & Steel, Dyes and Painting Technology), Town & Planning Architecture in India, Vastu Sastra. A Vaiśeṣikan approach to physical reality, constituents of the physical reality,

Unit 3: Indian Mathematics & Astronomy in IKS

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.

Unit 4: Humanities & Social Sciences in IKS

Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in Wellbeing, Yoga way of life(Astanga Yoga) , Indian approach to Psychology, the Triguna System Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

AEC	Soft Skill Development	Credit 4

UNIT-I

Communication skills 1: The basics
Topics to be covered:
i. Understanding the communicative environment-I
ii. Understanding the communicative environment-II
iii. What to listen for and why
iv. When to speak and how
v. Starting and sustaining a conversation
Communication skills 2 : Presentation and interaction
Topics to be covered:
i. What to present and how – I
ii. What to present and how – II
iii. Multimedia presentation: Understanding the basics
iv. Communication styles
v. Speaking in groups

UNIT-II

Communication skills 3: Visual, nonverbal and aural communication
Topics to be covered:
i. The world of visual culture
ii. Visual perception
ii. The aural: Its relevance and impact
iv. The body and the way it communicate
v. The face, its expressions and what it says

UNIT-III

Interpersonal communication 1: Individuals, groups, and cultures
i. Building Relationships
ii. Understanding Group Dynamics- I
iii. Understanding Group Dynamics- II
iv. Groups, Conflicts, and their Resolution
v. Social Network, Media, and Extending Our Identities

Interpersonal communication 2: Emotional and social skills

UNIT-IV

Developing key traits 1: Creativity, critical thinking and problem solving
Developing key traits 2: Motivation, persuasion, negotiation, and leadership
i. Motivating oneself
ii. The art of persuasion-I
iii. The art of persuasion-II
iv. From persuasion to negotiation
v. Leadership and motivating others

SEC	DESIGN AND FABRICATION OF PRINTED CIRCUIT BOARDS	Credit 3

Module-1: PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD). Classification of PCB - single, double, multilayer, and flexible boards, Manufacturing of PCB,PCB standards.

Module-2: Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

Module-3: Technology OF PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, properties of laminates (electrical & physical), types of laminates, soldering techniques.

Module-4: PCB Technology: Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing, and quality controls, PCB technology trends, Environmental concerns in PCB industry.

Suggested Books:

1. Printed circuit Board – Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
2. Printed Circuit Board –Design, Fabrication, Assembly & Testing, R.S. Khandpur, TATA McGraw Hill Publisher

SEMESTER-III

Core-I (Major-V)	ANALOG COMMUNICATION	Credit-4

MODULE -I

Spectral Analysis: Review of Fourier series & Transform, Parseval's Theorem, The Sampling Function, The Response of a linear System, Normalized Power in a Fourier expansion. Impulse Response, Power Spectral Density, Effect of Transfer Function on Power Spectral Density, Correlation between waveforms; Auto-and cross correlation. Expansion in Orthogonal Functions, Distinguishability of Signals.

MODULE -II

Amplitude Modulation: Frequency translation, Recovery of baseband Signal, Amplitude Modulation, Spectrum of AM Signal, The Balanced Modulator, The Square law Demodulator, Double Side Band (Suppressed Carrier), Single Side Band (Suppressed Carrier) and Vestigial Side Band, Their Methods of Generation and Demodulation, Carrier Acquisition. Phase-locked Loop (PLL) in Amplitude demodulator.

MODULE -III

Frequency Modulation: Concept of Instantaneous Frequency. Generalized concept of Angle Modulation. Frequency modulation, Frequency Deviation, Spectrum of FM Signal with Sinusoidal Modulation. Bandwidth of FM Signal Narrowband and Wideband FM, Bandwidth required for a Gaussian Modulated WBFM Signal, Generation of FM Signal, FM Demodulator, Phase-locked Loop (PLL) in Frequency demodulator, Pre-emphasis & Deemphasis, Threshold in frequency modulation. Frequency Division Multiplexing.

MODULE -IV

Noise in Communication Systems: Sources and Types of Noise. Frequency Domain Representation of Noise, Spectral Components of Noise, Response of a Narrow band filter to noise. Signal to Noise Ratio (SNR), Effect of a Filter on the Power spectral density of noise. Superposition of Noises, Mixing involving noise, Linear Filtering, Noise Bandwidth.

Noise in AM Systems: The AM Receiver, Super heterodyne Principle, Calculation of Signal Power and Noise Power in SSB-SC, DSB-SC and DSB. Figure of Merit.

Noise in FM Systems: Mathematical Representation of the operation of the Limiter, Discriminator; Calculation of output SNR, Comparison of SNR in FM and AM signal, Improvement using pre-emphasis.

Text Books:

1. Modern Digital and Analogue Communication Systems by B.P. Lathi
2. Communication Systems by Siman Haykin, 4th Edition, John Wiley & Sons, Inc.

Core-I (Major-VI)	MICROPROCESSOR AND PERIPHERALS	Credit-4

MODULE-I

Eight-bit Microprocessor (Intel 8085): Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, Intel 8085 Instruction, Timing and Execution, Interrupts in 8085, Address decoding for memories and peripherals, Memory mapped IO and IO mapped IO.

Sixteen-bit Microprocessor (Intel 8086): Internal organization of 8086, Signal descriptions, Physical memory organization, Bus Interface Unit (BIU), Execution Unit (EU), Minimum and Maximum modes of 8086 system and their timings.

MODULE-II

Assembly Language Programming with Intel 8085 and 8086: Instruction sets, Memory and I/O Addressing, Assembly language programming, Use of Stack & Subroutines, Addressing modes, Assembler directives and Operators, Data movement instructions, Arithmetic and logic instructions, Program control instructions, and Recursive procedures.

MODULE-III

Basic Peripherals and Their Interfacing: Memory interfacing, Interfacing I/O ports, Programmable Peripheral Interface (8255), Interfacing A/D and D/A converters.

Programmable Peripheral Devices and Their Interfacing: Programmable Interval Timer (8253/8254), Programmable Interrupt Controller (8259), Keyboard/Display Controller (8279), Programmable Communication Interface (8251), DMA Controller (8237/8257).

MODULE-IV

Single Board Computers and Microcontrollers: Single Board Computers (SBC), Microcontrollers, Intel 8051 microcontroller architecture and Intel 8051 based systems, Assembly language programming with Intel 8051, Interfacing of scanned and multiplexed displays, Interfacing of Liquid crystal displays, Interfacing of matrix keyboard, Stepper motor, General Purpose Interface Bus (GPIB, IEEE 1284) architecture and ports.

Books Recommended:

1. Microprocessor Architecture, Programming and Application with Intel 8085 by Ramesh S Gaonkar
2. Microprocessors and Microcomputer based System Design- M. Rafiquzzaman
3. Fundamentals of Microprocessor and Microcontrollers by B. Ram
4. The 8051 Microcontroller by K.J. Ayela

Core-I (Major-VII)	Mathematical Methods for Electronics	Credit-4

Unit 1

Vectors Analysis: Vector Concepts, Products of Vectors, Vector functions, Vector Differentiation, Gradient, Divergent and Curl of Vector functions. Vector Integration: Surface Revolution, Vector Integral Theorem: Green, Gauss, and Stokes's Theorem

Linear Algebra: Notation and Terminology of Matrices, The solution of Simultaneous Linear equations by Gauss-elimination, Arithmetic of Matrices, Inverse of Matrices, Determinants, Solution of linear equation by Cramer's and matrix inverse methods, Vector Spaces, Linear Dependence, Rank of Matrix, Eigen values and Eigen vectors, Calay-Hamiltonian Theorem.

Unit 2

Ordinary Differential Equations: Degree and Order, Differential equations of first order and first degree and its methods of solutions, Linear differential equations, Homogeneous and Non-Homogeneous Linear differential equations with constant coefficients, Second order linear differential equations with Variable coefficients (Cauchy's Equation), Method of Variation of Parameters.

Unit 3

Fourier Series & Laplace Transformation: Fourier Series expansion, Fourier coefficients, point of discontinuity, Half-range Fourier series, Laplace Transformation: Linearity, change of scale and Shifting properties of Laplace transform, Inverse Laplace transform, Solving ODEs using Laplace transforms, Dirac Delta function

Unit 4

Complex variables: Basics of Complex Numbers and their Graphical Representation, De-Moivre's Theorem, Functions of Complex Variables, Limit, Continuity and Differentiability, Analytic Function, Definition, Cauchy-Riemann Conditions, Examples of Analytic Functions, (Analyticity), Cauchy Integral Theorem and Residues.

Suggested References:

Higher Engineering Mathematics, B.S Grewal, Khana Publishers, New Delhi

Mathematical Physics, H. K. Dass, S. Chand & Co. Ltd. (2010).

Mathematical Physics, Sathya Prakash, Sultan Chand & Sons, New Delhi, Fifth Revised and Enlarged Edition, 2006, (Reprint 2007).

Mathematical Physics, B. D. Gupta, Vikas Publishing house Pvt. Ltd. (2010)

Mathematical Methods for Physicists, G. Arfken, (5th Edition), Academic Press, (2000).
Mathematical Physics, B.S. Rajput, 8th Edition,Pragati Prakashan(1978).
Foundations of Mathematical Physics, Sadri Hassani, Second Edition.Springer
Mathematical methods for Physics and Engineering, K.F.Riley, M.P.Hobson &S.J.Bence , Cambridge University Press, 3rd Edition.

Core-II (Minor-II)	CONSUMER ELECTRONICS	Credit-4

MODULE-I

Audio systems: PA system, Microphone, Amplifier, Loudspeakers. Radio receivers, AM/FM. Audio recording and reproduction, Cassettes, CD and MP3.

MODULE-II

TV and Video systems: Television standards, BW/Colour, CRT/HDTV. Video system, VCR/VCD/DVD players, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV. Projectors: DLP, Home Theatres, Remote Controls

MODULE-III

Landline and Mobile telephony: Basic landline equipment, CLI, Cordless. Intercom/ EPABX system. Mobile phones: GPRS & Bluetooth. GPS Navigation system. Smart Phones

Office Equipment: Scanners, Barcode / Flat bed, Printers, Xerox, Multifunction units (Print, Scan, fax, and copy)

MODULE-IV

Electronic Gadgets and Domestic Appliances: Digital clock, Digital camera, Handi-cam, homesecurity system, CCTV. Air conditioners, Refrigerators, Washing Machine/Dish Washer, Microwave oven, Vacuum cleaners

References

1. R. P. Bali Consumer Electronics Pearson Education (2008)
2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Multidisciplinary	Entrepreneurship Development and Start-up	Credit 3

Course Objectives
The paper aims to provide exposure to the students to the entrepreneurial culture and industrial growth
and to prepare them to set up and manage their own small units.
Course Outcomes:
After completion of the course, learners will be able to:
• Identify and assess the different types of entrepreneurs and barriers to entrepreneurship;
• Develop the decision-making skills to be an entrepreneur by creating new ideas;
• Understand the financial assistance provided by the government and other organizations;
• Demonstrate capacity to improve student achievement, engagement and retention;
• Enhances the critical thinking skills and gives a chance to think from a different perspective about industries.

Unit 1: Introduction

Evolution of term 'Entrepreneurship'; Factors influencing; Characteristics of an entrepreneur; Types of entrepreneurs; Edupreneurship; Barriers to entrepreneurship; Creativity and entrepreneurship- Creativity and entrepreneurship; Steps in Creativity; Innovation and inventions; Skills of an entrepreneur; Decision making and Problem Solving (steps indecision making);

Unit 2: Organisation Assistance and legal aspects

Assistance to an entrepreneur; New Ventures; Financial assistance to MSME; Copyright, Patent, Trademark, Franchise. Acts governing Entrepreneurship.

Unit 3: Mobilizing Resources

Resource Mobilization for entrepreneurship: Resources mobilization, types of resources, Process of resource mobilization, Arrangement of funds; writing a Funding Proposal, Traditional sources of financing, Venture capital, Angel investors, Business Incubators.

Unit 4: Managerial Aspects of Business and Government Initiatives

Managing finance; Understanding capital structure; organisation structure and management of human resources of a new enterprise; Marketing-mix; Management of cash; Relationship management; Cost management, Government initiatives for promoting entrepreneurship.

Suggested Readings

✓ Aron, R. A., & Tang, J. (2021). The Role of Entrepreneurs in Society: An Action Perspective. Edward Elgar Publishing.
✓ Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2021). Entrepreneurship. McGraw-Hill Education.
✓ Kuratko, D. F., & Neck, H. M. (2017). Entrepreneurship: Theory, Process, and Practice. Cengage Learning.
✓ Shane, S. A. (2017). A General Theory of Entrepreneurship: The Individual-Opportunity Nexus. Edward Elgar Publishing.
✓ Shepherd, D. A., &Patzelt, H. (2020). The New Field of Sustainable Entrepreneurship: Studying Entrepreneurial Action Linking "What Is to Be Sustained "with" What Is to Be Developed". Springer.
✓ Desai, V. (2009). Dynamics of Entrepreneurial Development and Management. Mumbai: Himalaya Publishing House.
✓ Dollinger, M. J. (2008). Entrepreneurship: Strategies and Resources. New Jersey: Prentice Hall.
✓ Hisrich, R., Peters, M., & Shepherd, D. (2017). Entrepreneurship. New York: McGraw Hill Education.
✓ Rao, T. V., &Kuratko, D. F. (2012). Entrepreneurship: A South Asian Perspective. Boston: Cengage Learning Business Model Innovation

VAC	Ethics & Values	Credit 3

COURSE OUTCOME

- Development of a good human being and a responsible citizen
- Developing a sense of right and wrong leading to ethically correct behavior
- Inculcating a positive attitude and healthy work culture
- To equip the students to prepare themselves national and state level civil service and other competitive examination.

COURSE CONTENTS

UNIT-I- ETHICS AND HUMAN INTERFACE [5 Hours]

Learning Outcome-

- ✓ *Understand the basic concept of ethics and its relevance in life*

- Ethics and Human Interface: Essence, Determinants and consequence of ethics and human action.
- Dimensions of Ethics in private and public relationship
- Human Values: Tolerance, Compassion, Rationality, Objectivity, Scientific Attitude Integrity, Respecting conscience and Empathy etc.
- Mahatma Gandhi and Ethical Practices: Non-Violence, Truth, Non-hatred and love for all, concern for the poorest, objective Nationalism and Education for man making. Relation between Ends and Means.

Subject Teacher: Philosophy/Political Science or Any other Teacher.

UNIT-II- ETHICS AND MAJOR RELIGIONS AND CIVILIZATIONS [7 hours]

Learning Outcome-

- ✓ *Be familiar with ethical principles and values promoted by major religious traditions and civilization*

- Hinduism- Dharma and Mokhya (out of 4 goals of life Dharma, Artha, Kama and Mokhya), Concept of Purusartha, Nisakama Karma(work without attachment to results), Concept of Basudev Kutumba and Peace (Whole world including all animals, plants, inanimate beings and human form one world)
- Ten Commandments: (Christianity and Judaism Tradition)
- Islamic Ethics: Justice, Goodness, Kindness, Forgiveness, Honesty, Purity and Piety
- Egyptian- Justice, Honesty, Fairness, Mercy, Kindness and Generosity
- Mesopotian-Non-indulgence in lying, stealing, defrauding, maliciousness, adultery, coveting possession of others, unworthy ambition, misdemeanors and injurious teaching.
- Buddhism-Arya Astangika Marg: Right View, Thought, Speed, Action, Livelihood, Efforts, Attention and Concentration.
- Jainism-Right faith, knowledge and conduct(Triralna)

- Chinese-Confucianism- Respect for Autonomy, Beneficence, non-maleficence and justice. Taoism: No killing, No stealing, No sexual misconduct, No false Speech and No taking of intoxicants.

Subject Teacher: History/Philosophy/Political Science or Any other Teacher.

UNIT-III- CONSTITUTIONAL VALUES, GOOD CITIZENSHIP, PATRIOTISM AND VOLUNTEERISM [10 Hours]

Learning Outcome-

- ✓ *Students Learns about constitutional values of India, Civic Sense and good Citizenship (both National and International) Patriotism and need for Volunteerism*

- Salient Values of Indian Constitution: Sovereign, Socialist, Secular, Democratic, Republic, Justice, Liberty, Equality and Fraternity
- Patriotic values and ingredients of National Building, Examples of great Patriots, Rani Laxmi Bai, Bhagat Singh, Mangal Pandey, Birsa Munda, Laxman Naik, Subhas Chandra Bose and Khudiram Bose.
- Law abiding citizenship
- Concept of Global citizenship in contemporary world
- Volunteerism- concept and facts of Volunteerism, building a better society through Volunteerism, Blood Donation, Social work, Helping the Aged, Promotion of Green Practices and Environment protection.

Subject Teacher: Philosophy/Political Science /History/ or Any other Teacher.

UNIT-IV- WORK ETHICS [6 hours]

Learning Outcome-

- ✓ *Understand the concept of work ethics, ethics in work place and ethical practices to be adopted by various professionals*

- The concept of professionalism.
- Professional ethics at work place
- Core values needed for all professionals. Reliability, Dedication, Discipline, Productivity, Co-operation , Integrity, Responsibility, Efficiency, Professionalism, Honesty, Purity and Time Management, Accountability, Respect Diversity, Gender Sensitivity, Respect for others, Cleanliness, Rational Thinking, Scientific Attitude, Clarity in Thinking . Diligence, cleanliness and Environment Consciousness.
- Codes of conduct for Students(both in College and Hostels),Teachers, Business professional, Doctors, Lawyers, Scientist, Accountants, IT professionals and Journalist.
- Practical ethics in day to day life.

Subject Teacher: Commerce/Philosophy/Education/History/ or Any other Teacher.

UNIT-V-ETHICS AND SCIENCE AND TECHNOLOGY [7 Hours]

Learning Outcome-

- ✓ *Understand how Science is related to ethics and values has ethical implications.*

- Ethics of Science and Technology. Are science and Technology ethically neutral? Are Science and Technology Value Free?
- Ethics of scientific Research ,Innovation and Technology
- Ethics of Social Media, Modern Gadgets
- AI and Ethics

Subject Teacher: Philosophy or Any Science Teacher

UNIT-VI- ETHICS AND VULNERABLE SECTIONS OF SOCIETY [10 hours]

Learning Outcome-

- ✓ *Understand how various vulnerable sections of our society are treated unequally and what needs to be done to address their inequality*
- ✓ *Understand dimensions of substance abuse*

1. **Women and family-**Gendered practices in the family, marriages (dowry, child marriage, women's consent).

   Women and work- women's work at home and at work place, pay gap, gendered roles, harassment at work place and working women and role conflict.
   Women and Society- Gender sensitive language, property right, marriage-divorce/Separation and women's right; violence against women
2. **Issues Relating to Children:** Nutrition and health , Child Exploitation: Child labour ,trafficking, sexual exploitation
3. **Issues Relating to Elderly Persons :** Abuse of Elders, Financial insecurity, Loneliness and Social insecurity, Health Care Issues, Needs for a happy and Dignified Ageing
4. **Issues Relating to persons with disability:** Rights of PWD, affirmative action, prevention of discrimination, providing equal opportunity, various scheme for empowering PWD and social justice for PWD.
5. **Issues Relating to Third Gender:** Understanding LGBTQ, Social justice for them, Removal of discrimination, Affirmative action and Acceptance of diversity of gender.

Subject Teacher: Sociology/political Science /Anthropology or Any Science Teacher

Sample Questions-

1. Birsa Munda belongs to which state of India?[1 mark]
2. Recall at least 4 constitutional values from the preamble to India constitution.[2 marks]
3. Explain utility of being Punctual.[5 marks]
4. Explain the ethical principles a scientist should follow.[8 marks]

SEMESTER-IV

Core-I Major-VIII	DIGITAL COMMUNICATION	Credit 3

MODULE -I

Sampling and Reconstruction of Signals: Sampling Theorem, Aliasing, Antialiasing Filters. **Pulse Modulation:** Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse Code Modulation (PCM), Differential PCM (DPCM), Adaptive DPCM (ADPCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM).

MODULE -II

Digital Modulation: Generation, Transmission, Reception, Spectrum and Geometrical Representation in the Signal Space, Phase Shift Keying (PSK), Binary PSK (BPSK), Differential PSK (DPSK), Differentially-Encoded PSK, Quadrature PSK (QPSK), $\pi/4$ QPSK, M-ary PSK, Frequency Shift Keying (FSK), Binary FSK (BFSK), Minimum Shifting Keying (MSK), Amplitude Shift Keying (ASK). **Signal Multiplexing:** Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM).

MODULE -III

Noise In PCM & DM: Transmission Bandwidth and output SNR in case of PCM and DM, Differential PCM, Delta Modulation, Adaptive Delta Modulation, DPCM and ADPCM, Comparison with PCM, Calculation of Quantization Noise Power, Output Signal Power and Thermal Noise Power.

MODULE -IV

Principles of Digital Transmission and Reception: Line Coding, Power Spectral Density of various Line codes, Polar Signaling, ON-OFF Signaling, Bipolar Signaling, Pulse Shaping, Nyquist's Criterion for Zero ISI, Scrambling, Regenerative Repeater. Baseband Signal Receiver, Probability of Error, Optimum Filter, White Noise, The Matched Filter, Coherent Reception, Application to PSK, QPSK, BPSK and BFSK.

Information and Coding: Amount of information, Average information, Entropy; Shannon-Fano Algorithm, Information Capacity Theorem, S/N Tradeoff, Shannon's limit and efficiency of orthogonal signal transmission, Block code, Parity check bit coding, Hamming distance, Probability of error with coding, Hadamard, Hamming, Extended, Cyclic, Golay and BCH codes.

Books Recommended:

1. Modern Digital and Analogue Communication Systems by B.P. Lathi
2. Communication Systems by Siman Haykin
3. Principles of Communication Systems by H. Taub, D. Schilling, G Saha

Core-I Major-IX	ELECTRONIC DEVICE & CIRCUIT	Credit 4

MODULE-I

OPERATIONAL AMPLIFIER (Op-amp): Operational overview, analysis of op-amp equivalent circuits. Differential, Inverting and Non-inverting Open loop OP-AMP configurations, Voltage Series, Voltage Shunt, Current Series and Current Shunt negative feedback configurations, **Op-amp parameters:** Input offset voltage, bias current, offset current, Thermal drift, Effect of variation in power supply voltages, Noise, Common Mode Rejection Ratio (CMMR).

MODULE-II

FREQUENCY RESPONSE OF OP-AMP: Frequency response and compensating networks of OP-Amp, High-Frequency Op-AMP equivalent circuits, Open loop voltage gain, closed loop frequency response Circuit stability, slew rate and its effect. **APPLICATIONS:** AC and DC amplifiers, Peaking, summing, scaling and averaging amplifiers, differential input and differential output amplifiers, voltage to current and current to voltage converters, integrator, differentiator circuits.

MODULE-III

ACTIVE FILTER CIRCUITS (Butterworth): First order low pass, second order low pass, first order high pass, second order high pass, higher order filters, Band pass, Band reject and all pass filters.

MODULE-IV

SPECIAL PURPOSE DEVICES: Circuit configurations and characteristics of MESFET, Gunn Diode, light activated SCR, Shockley diode, Phototransistors, Opto-isolator, Programmable Unijunction Transistor. Avalanche Transit Time Devices: IMPATT Diode, TRAPATT Diode, and BARITT Diode. **CONTROLLED RECTIFIERS:** Single phase: circuit configuration and principle of operation of half wave, full wave-controlled rectifiers for RL and RLE Load, effect of source inductance, importance of free-wheeling diode for inductive loads. Input power factor for R& RL load, Average output voltage and currents.

Test Books:

Electronic Devices by Boylsted & Nashelsky

Microwave Engineering by M. Kulkarni

Power Electronics by P.S. Bhimra

Op-Amp and linear integrated circuits by R.A. Gayakwad

Core-I Major-X	POWER ELECTRONICS	Credit 4

Module-I

Power Devices: Need for semiconductor power devices, Power diodes, Enhancement of reverse blocking capacity, Introduction to family of thyristors.
Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Factors affecting the characteristics/ratings of SCR, Gate-triggering circuits, Control circuits design and Protection circuits, Snubber circuit.
Application of SCR: SCR as a static switch, phase-controlled rectification, single phase half wave, full wave, and bridge rectifiers with inductive & non-inductive loads; AC voltage control using SCR and Triac as a switch.

Module-II

Triac: Basic structure, Equivalent circuit, working and V-I characteristic of Triac, Triac Phase controlled circuit, Application of Triac as an electronic change-over of transformer taps
Diac: Structure**,** Operation and V-I characteristics, application of a Diac as Lamp dimmer and heat control
Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.
Power MOSFETs: operation modes, switching characteristics, power BJT, second breakdown, saturation, and quasi-saturation state.

Module-III

Power Inverters: Need for commutating circuits and their various types, d.c. link invertors, Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Invertor, limitations and its improved versions, bridge invertors.
Choppers: basic chopper circuit, types of choppers (Type A-D), step-down chopper, step-up chopper, operation of d.c. chopper circuits using self-commutation (A & B- type commutating circuit), cathode pulse turn-off chopper (using class D commutation), load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper

Module-IV

Electro mechanical Machines: DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor (Induction Motor only), Rotor and stator, torque &speed of induction motor, Thyristor control of ac motors (block diagrams only)

Suggested Books:

1. Power Electronics, P.C.Sen, TMH
2. Power Electronics & Controls, S.K.Dutta
3. Power Electronics, M.D. Singh & K. B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rdEdition, M.H. Rashid, Pearson Education

Core-III Minor-II	PROGRAMMING IN PYTHON	Credit 4

MODULE-1:

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

MODULE-2:

Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

MODULE-3:

Overview of Programming: Structure of a Python Program, Elements of Python

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator)

MODULE-4:

Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, exit function, Difference between break, continue and pass.), Defining Functions, default arguments.

Text Books

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Reference Books

1. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012

Online References:

Python Tutorial/Documentation www.python.or 2015

http://docs.python.org/3/tutorial/index.html

http://interactivepython.org/courselib/static/pythonds

http://www.ibiblio.org/g2swap/byteofpython/read/

Internship/Field Work	INDUSTRIAL VISIT/ INTERNSHIP	Credit 4

Course Description: This course enables students to earn credit for qualifying internships/job experiences in their areas of study.

Course Objectives: Each internship position is unique, and the experience depends on the needs of the employer and student qualifications. The following are general course objectives. Students will…. • Gain practical experience in their respective fields of study.

• Expand their professional networks.

• Improve their interpersonal and communications skills.

Once all the requirements have been met, a grade will be issued.

Component	Weight	Description
Written log of work activities	10%	Keep a written log of your work activities … nothing formal, just the facts
Midterm Report	15%	Complete a short (1-2 page) written interim summary of your internship experience.
Final Report	65%	At the end of the semester, submit a report.
Final Student Survey	5%	Complete a short survey on your internship experience
Employer Survey	5%	The Internship Coordinator will contact the employer to verify hours and the work performed.

SEMESTER-V

Core-I Major-XI	SIGNALS AND SYSTEMS	Credit 4

MODULE-I

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

MODULE-II

Linear Time -Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative. LTI systems with and without memory, Invariability, Causality, Stability, Unit Step response. Differential andDifference equation formulation, Block diagram representation of first order systems.

MODULE-III

Fourier Series Representation of Periodic Signals: Continuous-Time periodic signals, Convergence of the Fourier series, Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of Discrete-Time Fourier series. Frequency-Selective filters, Simple RC high-pass and low-pass filters.

Fourier Transform: Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform, Convolution and Multiplication Properties, Properties of Fourier transform and basicFourier transform Pairs.

MODULE-IV

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Laplace Transform for signals, Laplace Transform Methods in Circuit Analysis, Impulse and Step response of RL, RC and RLC circuits.

Suggested Books:

1. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education (2007)
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons (2004)
3. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
4. H. P. Hsu, Signals and Systems, Tata McGraw Hill (2007)
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling, OrchardPublications (2008)
6. W. Y. Young, Signals and Systems with MATLAB, Springer (2009)
7. M. Roberts, Fundamentals of Signals and Systems, Tata McGraw Hill (2007)

Core-I Major-XII	Digital VLSI Design using HDL	Credit 4

UNIT I

INTRODUCTION: Introduction to IC Technology, VLSI Design Methodology, Y-Chart, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Process Technology: Photolithography, Oxidation, Diffusion, Ion Implantation, Etching, Metallization, Packaging, VLSI Testing: Introduction, Importance of Testing, Fault Models & Simulation, Design for Testability, Boundary Scan Test, Built-In Self-Test, MOS Transistor: Structure, Structure & Operation of MOS transistor, V-I Characteristics Of MOSFET, MOSFET Scaling, MOSFET Capacitances, MOSFET Threshold Voltage

UNIT II

CMOS Logic Design: Design of CMOS Inverter, Design of CMOS NAND gate, NOR gate, XOR gate, XNOR gate, AND gate, OR gate, Bi-CMOS Inverter, VLSI circuit design processes: Stick Diagrams, Design Rules and Layout, Layout Diagrams for CMOS Inverters and Gates, Pass transistor Logic, Combinational MOS logic circuits: Adder, Subtractor, Comparator, Multiplexer, Demultiplexer, Sequential MOS Logic Circuits: SR flipflop, D flipflop, JK flip-flop, T flip-flop, Programmable Logic Devices: Basic concepts on CPLD & FPGA Technology

UNIT III

Digital Design using VHDL: Introduction to HDL, Language Fundamentals: Introduction, Basic sequential statements, Data types, Assignment statements and operators, Operators, Objects in VHDL- Signals, variables, constants, Files, VHDL Package, Package Body, and Configurations, Entity declarations and statements, Null statement, Modeling in VHDL: Combinational & sequential circuit design Using Dataflow, Behavioral and Structural Modeling- All logic gates, Adders, Subtractors, Multiplexers, Demultiplexers, Comparator, SR flip-flop, D flip-flop, JK flip-flop, T flip-flop, Counters

UNIT IV

Introduction to Verilog: Overview of Digital Design with Verilog HDL- Evolution of CAD, Typical Design flow, Basic Concepts: Lexical Conventions- Whitespace, Comments, Operators, Number Specification, Strings, Identifiers and Keywords, Data types- Value set, Nets, Registers, Vectors, Arrays, Memories, Parameters, Strings, Modules and Ports- Modules, Ports, Dataflow modeling, Behavioral modeling, Structural modeling

Text Book:

Sung Mo-Kang & Yussuf Leblebici : Digital Integrated Circuits- Analysis & Design , TMH.
Perry : VHDL Programming by example , TMH.
Douglas L. Perry: VHDL programming by example
S S Limaye: VHDL-A design oriented Approach
Samir Palnitkar: Verilog HDL, Pearson publication

Reference Books

Rabey et.ai :Digital Integrated Circuits: A Design Perspective, Pearson Education.
Geiger et.AI.McGraw Hill :VLSI design Techniques for analog and digital circuits,
Puckneln & Eshagraine :VLSI , (PHI)

Core-I Major-XIII	DATA COMMUNICATION & NETWORKING	Credit 4

MODULE –I

Overview of Data Communications and Networking: Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals. Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing: FDM 150, WDM 155, TDM 157, Transmission Media: Guided Media, Unguided media (wireless) Circuit switching and Telephone Network

MODULE –II

Overview of OSI Model, Data Link Layer
Error Detection and correction: Type of Errors, Detection, Error Correction
Data Link Control and Protocols: Flow and error Control, Stop-and-wait ARQ. Go- Back. N ARQ, Selective Repeat ARQ, HDLC.

MODULE –III

Point-to – Point Access: PPP
Point –to- Point Protocol, PPP Stack,
Multiple Access: Random Access, Controlled Access, Channelization.
Local area Network: Ethernet.

MODULE –IV

Traditional Ethernet, Fast Ethernet, Gigabit Ethernet.
Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.
Network Layer: Host to Host Delivery: Internetworking, addressing, and Routing
Network Layer Protocols: ARP, IPVA, ICMP, IPV6 ad ICMPR6
Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.
Security: Cryptography, Message security, User Authentication.

Text Book:

1. Behrouz A. Forouzan Tata Mc Graw-Hill: Data Communications and Networking, Third Edition. Publishing company Limited.
2. William Stallings: Computer networks,
3. A.S. Tannenbum: Computer Network,

Core-II Minor-III	Operating Systems	Credit 4

Unit I:

Introduction to Operating System, Computer System Architecture, System Structures: Operating system services, User and Operating-System Interface, system calls, system programs, Operating system design and implementation, Operating system structure, Batch processing, multi-programming, time-sharing and real-time systems

Unit II:

Process Management: Process Concept, Operations on processes, Process scheduling, Inter-process Communication, Threads, Multithreading Models. CPU Scheduling algorithms: Scheduling Criteria, FCFS, SJF, Priority, Round Robin, Multilevel Queue, Multilevel Feedback Queue. Deadlocks: Deadlock detection, deadlock prevention, and deadlock avoidance fundamentals.

Unit III:

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Management: Concepts, Demand Paging, Page Replacement techniques: FIFO, LRU, Optimal, Thrashing.

Unit IV:

- Storage Management: Overview of Mass-Storage Structure, Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, RAID technology.
- File System concept, Access Methods, Directory and Disk Structure, File System systems, File, Sharing and File Protection.

Text Books:

- ✓ *Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, and GregGagne, Eighth Edition, Wiley Student Edition 2009*
- ✓ *Operating Systems, Rajiv Chopra, S. Chand Pubs.*

Reference Books:

- ✓ *Modern Operating System, Tanenbaum, Pearson, 4/ed. 2014*
- ✓ *Operating Systems 5th Edition, William Stallings, Pearson Education India*
- ✓ *Richard Blum, Linux Command Line and Shell Scripting Bible, O' Reilly*

SEC	ROBOTICS	Credit 3

MODULE -I

Programming Environments: Integrated Development Environment (IDE) for AVR microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP), loading program on Robot

Actuators: DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control, and its implementations

MODULE -II

Sensors: White line sensors, IR range sensor of different range, Analog IR proximity sensors, Analog directional light intensity sensors, Position encoders, Servo mounted sensor pod/ Camera Pod, Wireless Colour camera, Ultrasound scanner, Gyroscope and Accelerometer, Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing

MODULE -III

LCD interfacing with the robot (2 x 16 Characters LCD)

Other indicators: Indicator LEDs, Buzzer

Timer / Counter operations: PWM generation, Motor velocity control, Servo control,velocity calculation and motor position Control, event scheduling

MODULE -IV

Communication: Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Simplex infrared Communication (IR remote to robot)

References

1. Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014
2. R.K. Mittal, I.J. Nagrath, ―Robotics & Control‖, Tata McGraw & Hills, 2005.

VAC	Cyber Security	Credit 3

Unit I:

Introduction: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles. Confidentiality, Integrity, Availability, Computer Criminals, Motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit II:

Cryptography: History and development of Cryptography. Substitution and affine ciphers, Transpositions Cipher, Confusion, diffusion, Symmetric, Asymmetric Encryption. DES, Modes of DES, Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates.

Unit III:

- Software Security: Types of Malicious Software, Advanced Persistent Threat, Propagation, Infected Content - Viruses, Propagation, Vulnerability Exploit - Worms, Propagation, Social Engineering, SPAM E-Mail, Trojans, Payload, System Corruption, Attack Agent, Zombie, Bots, Information Theft, Keyloggers, Phishing, Spyware, Stealthing, Backdoors, Rootkits, Countermeasures.
- Network Security: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Overview of Intrusion Detection, Honeypots, The Need for Firewalls

Unit IV:

Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.

Text Books:

- ✓ *C. P. Pfleeger, S. L. Pfleeger; Security in Computing, Prentice Hall of India, 2006*
- ✓ *W. Stallings, L. Brown, Computer Security: Principles and Practice, 4th edition, Pearson Education, 2018.*
- ✓ *Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley*

SEMESTER-VI

Core-I Major-XIV	OPTICAL FIBER & SATELLITE COMMUNCATION	Credit 4

MODULE-I

Int. to optical communication, principles of light transmission, optical fiber modes and configuration, Optical sources: L.E.D., LASER Diodes, Power Launching & Coupling, Population Inversion, Fiber splicing, optical connector, photo detector: PIN, Avalanche, Modulation Techniques: Misalignment, Fiber to Fiber joints.

MODULE -II

Signal Degradation in optical fibers, Attenuation losses, signal distortion in optical waveguides, material dispersion, chromatic dispersion, Intermodal distortion, mode coupling, Advance fiber design: Dispersion shifted, Dispersion flattened, Dispersion compensating fiber, Design optimization of single mode fibers. Coherent optical fiber communication,

MODULE -III

WDM concepts and components, operation, Tunable Filters, Directional coupler, Dispersion Management. Optical Amplifiers – EDFA, Photonic Switching, Optical Networks: SONET/SDH, Optical Interfaces, Ring Topology, Star Architecture

MODULE -IV

Evolution of Satellite Technology, Communication Satellites, Orbital Mechanics, Kepler's Laws of planetary motion, Specialization to Geostationary satellites, LEO, MEO, GEO, Carrier to Noise ratios in Uplink and Downlink. Satellite multiple access methods. FDMA, TDMA, CDMA Systems, VSAT systems: Overview, Network architecture, Basic Techniques, Satellite Mobile services, Radarsat, Global positioning Satellite System

Text Books:

1. G. Keiser, "Optical Fiber Communication (3rd Edition) ", Mc Graw Hill International, 2000.
2. A. Ghatak and K. Thyangarajan: "Int. to fiber optics"Cambridge University press, 1998.
3. Dennis Roddy PHI : Satellite Communication ,
4. Richharia, M: Satellite communication,
5. Timotty Pratt: Satellite communication,
6. Senior. (PHI): Optical Fibre Communication,

Core-I Major-XV	EMBEDED SYSTEMS	Credit 4

Module – I
Introduction: An embedded system, Processor in the system, other hardware units, software embedded into a system, exemplary embedded system-on-chip (SOC) and VLSI circuit

Module – II
Devices and Device Drivers; I/O devices, Timer and counting devices, serial communication using the IC, CAN and advance I/O buses between the networked multiple devices, Host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advance buses, Device drivers, Parallel port devices drivers in a system, Serial port device drives in a system, Interrupt servicing (Handling) mechanism.

Module – III

Software and Programming Concept: Processor selection for an embedded system, memory selection for an embedded system, Embedded programming in C ++, Embedded programming in JAVA, Unified modeling language (UML), Multiple processes and application, problem of sharing data by multiple tasks and routines, Inter process communication.

Real time Operating System: Operating system services, I/O subsystem, Network operating system, Real Time and embedded system, need of well tested and debugged Real time operating system (RTOS), Introduction to C/ OS- II.

Module –IV
Case studies of programming with RTOS: Case study of an embedded system for a smart card

Hardware and Software Co-design: Embedded system project management, Embedded system design and co-design issues in system development process, design cycle in the development phase for an embedded system, Use of software tools for development of an embedded system, Issues in embedded system design.

Text Book
1. Embedded System Architecture, Programming and Design, Raj Kamal, TMH
2. Hardware Software Codesign of Embedded System, Ralf Niemann, Kulwer Academic
3. Embedded Real time system Programming, Sriram V. Iyer and Pankaj Gupat, TMH

Core-III Minor-III	Internet & Web Technology	Credit 4

MODULE – I

Introduction: Dial-up connection, ISDN connection, DSL connection, client server model & type, Action to Internet: Modem, characteristics of a modem, connectivity for es.

Protocol**:** SMTP, POP3, PPP / SLIP, TCP / IP, HTTP, FTP, WAP, internet IP Address, Domain name, browser, URL, internet services, electronic mail & its advantages & disadvantages, World Wide Web, E-commerce & Electronic Data Interchange (EDI)

MODULE– II

Introduction to HTML, HTML tags, documents, header section, body section, headings, formatting characters (text), font tag, image & pictures, listing, link documents using anchor tag, table handling in HTML, creating frames & forms (Frameset definition, frame definition, nested frameset, HTML forms, elements of a form).

MODULE– III

Introduction to JavaScript, client-side JavaScript and server-side JavaScript, advantages of JavaScript, writing JavaScript into HTML, Elements of JavaScript**:** Data types, variables, operators, conditional statements, array objects, date objects, string objects, Objects & Events: Document object, Image object, forms & elements, event handling & data validation.

Functions in JavaScript**:**(Built in function, declaring functions, passing parameters, recursive functions) Dialog boxes: (Alert, prompt, & confirm dialog boxes).

MODULE– IV

Introduction to JSP, Client responsibility, server responsibility, JSP architecture, JSP server, JSP tags, request object, response object, business processing with JSP.

JSP with JDBC: creating ODBC data source, introduction to JDBC, prepared statement class, reading from database table, result set class, extracting data from result set object, creating new row in a table, update data in a table & deleting rows from the table, Examples.

Text Books:

1. **C. Xavier: Unit- I, II, III & IV ---- Web Technology & Design,**
2. **Ivan Bayrons: Unit-, V ------Web Technologies (part-I), (BPB)**

SEC	RENEWABLE ENERGY AND ENERGY HARVESTING	Credit 3

UNIT – 1

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, bio gas generation, geothermal energy tidal energy, Hydroelectricity.

UNIT – 2

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems.

UNIT – 3

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezo electric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.

UNIT – 4

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications; Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

Reference Books:

✓ non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi

✓ Solar energy - M P Agarwal - S Chand and Co. Ltd.

✓ Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.

✓ Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, OxfordUniversity Press, in association with The Open University.

✓ Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009

✓J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

✓ http://en.wikipedia.org/wiki/Renewable_energ

VAC	Project Development	Credit 3

Every student will have to do project report in any area of Information Science & Telecommunication detailed in the curriculum under the guidance of regular / guest faculty/ Industry experts. It should be research based to create new knowledge in any area of Information Science & Telecommunication. The student shall submit the project report before the Term – End examination. Marks will be awarded (out of 100) for the project report after viva internally.

Core-I Major-XVI	ELECTROMAGNETIC WAVES & ANTENNA THEORY	Credit 4

MODULE-I

Electrostatics: Potential gradient, electric dipole, equipotential surfaces, energy stored in an electrostatic field, Gauss'law, boundary conditions, capacitors and capacitances, Poisson's and Laplace's equations, method of images.

Electromagnetism: Biot-Savart law, Ampere's circuit law, torque exerted on a current carrying loop by a magnetic field, magnetic vector potential, magnetic field intensity and Ampere's circuit law, boundary conditions, magnetic materials, energy in magnetic field, magnetic circuits.

MODULE -II

Maxwell's equations from Ampere's and Gauss's laws, Maxwell's equations in differential and integral forms, equation of continuity, concept of displacement current, electromagnetic boundary conditions, Poynting's theorem, time-harmonic EM fields, application to transformer.

MODULE -III

Plane wave propagation: Helmholtz wave equation, plane wave solution, plane wave propagation in lossless and lossy dielectric medium and conducting medium, plane wave in good conductor, surface resistance, depth of penetration, polarization of EM wave - linear, circular and elliptical polarization, normal and oblique incidence of linearly polarized wave at the plane boundary of a perfect conductor, dielectric – dielectric interface, reflection and transmission co-efficient for parallel and perpendicular polarizations, Brewster angle.

MODULE - IV

Antennas: Physical concept of radiation from an antenna, wave equations in terms of potential functions, the concept of retarded vector potential, Hertzian dipole, near zone fields, radiation fields, radiation resistance, directive gain and directivity, magnetic dipole, short dipole antenna, half wave dipole antenna, monopole antenna, pattern multiplication antenna arrays, linear antenna arrays, antenna types (horn, helical, yagi, log periodic, disc).

Text Books:

1. B. S. Guru &Huseyn:Electromagnetic Field Theory, Fundamental,
2. J.D.Krauss: Electromagentic fields & Antenna Theory,
3. E. C. Jordan & K. G. Balmin: Electromagnetic waves and Radiating Systems, 2nd Edition. PHI Pvt.Ltd.
4.W.H.Hayt Jr: Electromagnetic fields,
5. Saddique Electromagnetic Theory

Core-I Major-XVII	DIGITAL SIGNAL PROCESSING	Credit 4

MODULE– I

Discrete Time Signals and System: Discrete Time Signals (Elementary examples, classification: periodic and a periodic Signals energy and Power signals, Even and Odd Signals). Discrete Time System: Block diagram representation of discrete time systems, classification of discrete time systems time variant and time – invariant, linear and non-linear, casual and anti-casual, stable and unstable.

MODULE-II

Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system. Constant coefficient differences equations and their solutions, impulse response of LTI system, structures of LTI systems Recursive and Non-recursive realization of FIR system. The Z transform: The Z-transform and one-sided Z-transform, properties of Z-transform, inverse of the Z-transform, Solution of difference equations.

MODULE-III

The Discrete Fourier Transform: The DFT and IDFT, relationship, DFT with Z- transform, the DFT as a linear transformation Relationship of DFT with Z-transform, properties of DFT: periodicity, linearity, summery and time reversal of a sequence. Circular convolution, and correlation by DFT method, Overlap add and save filtering by DFT method.

MODULE-IV

Fast Fourier Transform: Operation counts by direct copulation of DFT, Radix – 2 FFT algorithm- Decimation –in-time (DIT) and Decimation – in frequency (DIF) algorithm, Efficient computation DFT of Two real sequences, Efficient Computation of DFT of a 2 N-pt real sequences.

Design and Digital Filters:

Casually and its implication, Design of linear phase FIR filters using different windows. Design of IIR filters – Impulse Invariance Method and Bilinear transformation method. Implementation of Discrete Time System structure of FIR systems – Direct form, cascaded form. Structure IIR Systems - Direct form I & II realizations

Text Books:

1. J. G. Proakis and D. G. Manolakis: Digital Signal Processing – Principles, Algorithms and Applications, 3rd Edition, Pearson.
2. S. Salivahanan, TMH: Digital Signal Processing,

Reference Book:

Digital Signal Processing, schaums Outlines series
Ramesh babu: DSP,
Oppen Ham & Shaffer: DSP,

Core-I Major-XVIII	CONTROL SYSTEM	Credit 4

MODULE–I

Basic concepts of control systems, Open loop and closed loop systems, difference between open loop and closed loop systems, classifications, Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula, application of SFG to control systems, Feedback theory: Types of feedbacks, effect of degenerative feedback on control system, regenerative feedback.

MODULE–II

Time domain analysis: Standard test signals, Step, ramp, parabolic and impulse signals, Time response of first order systems to unit step and unit ramp inputs, Time response of second order systems to unit step input, Time response specifications, Steady state errors and error constants of different types of control systems, Generalised error series method.

Concepts of stability: Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feedback systems, relative stability.

Root locus techniques: Root locus concepts, rules for construction of root loci, determination of roots from root locus, root contours, systems with transportation lag

MODULE- III

Frequency domain analysis of systems, advantages and limitations, co-relation between time domain and frequency domain, Bandwidth, Bode plots for systems, Nyquist plots for systems.

Compensation of control system: Types of compensation, compensating networks, Lead and Lag compensator, Compensation using root-locus.

State variable analysis: state model of linear systems, State-Space representation using physical phase and canonical variables, Transfer function for State model, Solutions to state models.

MODULE–IV

Controller Principles: Properties and classification of controllers, Proportional controllers, Integral controllers, Derivative controllers, Composite controllers, PI, PD and PID controller, effet of controllers on first order and second systems.

Text Books:

1. I J. Nagrath, M. Gopal :Control Systems Engineering, Third Edition, New Age International Publishers.
2.K. Ogata :Modem Control Engineering, PHI
3.B.C.KUO: ADVANCED CONTROL SYSTEM,

Core-I Major-XIX	BROADBAND COMMUNICATION	Credit 4

UNIT-I

Telecommunication Concepts: Components of Broadband Communication Systems, Communication Network Architecture & Cable Broadband Data Network Architecture & its Importance, Internetworking,

Internet-Based Networks: internet protocol Suite, IPv6, Applications and services, Voice over IP: VoIP network, applications & benefits, Internet security, Flow control

Intranet & Extranet: Overview, technologies, Applications, Design Issues, Power-Law Rule for Intranet & extranet

UNIT-II

Integrated Service Digital Network (ISDN): ISDN Devices & Interfaces, Services, Architecture, BISDN: Interface & Terminals, ATM technology, ATM Standards & Network, BISDN Architecture and its application
Virtual Private Network: General Architecture, Dial-In VPN, Advantages & Disadvantages, VPN Standards & Security Issues

UNIT-III

Cellular Communication: Fundamental Features, Cellular Network, Cellular Standards, Cellular Digital Packet data network Architecture & its application, Fax Machine-Introduction to various working and operational Techniques, Important Features, Application, Cable Modem technology, External & Internal Cable Modem, Cable Modem systems Standards compliance

UNIT-IV

Introduction to New technologies: Wi-fi, Wi-Max, IPTV, Wireless ATM

Networking Technologies: X.25 Technology: X.25 devices, X.25 Virtual Circuits, X.25 Protocol Suite, Benefits and Drawbacks of X.25, Frame Relay Technology: Frame Relay Protocol Data Unit, Advantages & disadvantages, Frame relay Versus X.25, Application of Frame relay

Digital Subscriber Line Systems (DSL) Technology, IDSL, CDSL, VDSL

BOOKS:

1. C. M. Akujuobi, M.N.O. Sadiku: Broadband communication Systems, PHI Publications

Core-II Minor-IV	Programming in Java	Credit 4

Unit I:

Introduction to Java: Java History, Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords (super, this, final, abstract, static, extends, implements, interface) , Data Types, Wrapper class, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods). Input through keyboard using Command line Argument, the Scanner class, Buffered Reader class.

Unit II:

Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining & Using Classes, Class Variables & Methods, Objects, Object reference, Objects as parameters, final classes, Garbage Collection. Constructor- types of constructors, this keyword, super keyword. Method overloading and Constructor overloading. Aggregation vs Inheritance, Inheritance: extends vs implements, types of Inheritance, Interface, Up-Casting, Down-Casting, Auto-Boxing, Enumerations, Polymorphism, Method Overriding and restrictions. Package: Pre-defined packages and Custom packages.

Unit III:

Arrays: Creating & Using Arrays (1D, 2D, 3D and Jagged Array), Array of Object, Referencing Arrays Dynamically. Strings and I/O: Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability& Equality, Passing Strings To & From Methods, String Buffer Classes and StringBuilder Classes. IO package: Understanding Streams File class and its methods, Creating, Reading, Writing using classes: Byte and Character streams, File Output Stream, File Input Stream, FileWriter, File Reader, Input Stream Reader, Print Stream, Print Writer. Compressing and Uncompressing File.

Unit IV:

Exception Handling, Threading, Networking and Database Connectivity: Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

Text Book:

- ✓ E. Balagurusamy, “Programming with Java”, TMH, 4/Ed

Reference Book:

- Herbert Schildt, “The Complete Reference to Java”, TMH, 10/Ed.

Core-I Major-XX	MICROWAVE TECHNOLOGY	Credit 4

MODULE – I

Introduction to Microwave: History, microwave region & band descriptions, advantages of microwave, applications of microwave.

Electromagnetic: Introduction, Maxwell's equation, amperes law, faradays law, gauss's law.

Transmission Lines: - Introduction, two wire parallel transmission line, voltage & current relationship, characteristic impedance, reflection co-efficient, propagation constant, input impedance, standing waves, voltage standing wave ratio, impedance at a voltage minimum & at a voltage maximum, impedance matching, stub matching.

MODULE – II

Waveguides (single line), types of wave guides, propagation of waves in rectangular wave guide, propagation of TEM waves, TE and TM modes, propagation of TM waves in rectangular wave guide, Boundary conditions, propagation of TE waves in a rectangular wave guide, Bounday condition, Guide wavelength, Group velocity and phase velocity, expression for phase velocity and group velocity, relation between TM modes in rectangular waveguide,

MODULE – III

Semiconductor Microwave Tubes: Klystrons: (Two cavity, reflex), magnetrons

Semiconductor Microwave Devices: - Introduction, varactor diodes: construction, equivalent circuit& applications, parametric amplifier, PIN diode: operation & applications, Schottky barrier diode, tunnel diode, Gunn diode, IMPATT diode, MASER & Laser.

MODULE – IV

Microwave Communication Systems: -Introduction, propagation modes, microwave systems, analog microwave communication (LOS system, OTH system, transmission interference & signal damping, duet propagation, fading in troposphere and its effect on Troposcatter propagation, digital microwave communication, microwave antenna (Horn antenna, parabolic reflectors, lens antenna)

Text Books:

1 M. Kulkarni: Microwave & Radar Engineering,
2. A.K. Maini: Microwave & Radar Systems,

Reference Books:

1.Reich, Oudong and Others: Principles of Microwave Engineering,
2.Sammuel Y., Liao, Perason: Microwave Device and Circuit, 3rd Edition,

Core-I Major-XXI	WIRELESS MOBILE COMMUNICATION	Credit 4

MODULE-I

A brief introduction to Mobile Telephony, Technologies, and Choices.

Cellular Concept – System Design: Fundamentals: Frequency reuse, Channel Assignment, Handoff Strategies, Interferences and System Capacity, Trunking and Grade of Service; Improving coverage and capacity in Cellular Systems – Cell Splitting, Sectoring, Repeaters and Range Extension, Microcell & Picocell Zone Concept. Antennas for Base Station and hand-held Cellular phone.

MODULE -II

Mobile Radio Propagation: Large –Scale path loss, Ground Reflection Model, Diffraction, Scattering. Outdoor propagation Model – Okumura Model; Indoor Propagation Model: Partition loses, Log distance Path loss Model. Small Scale Fading and Multipath, Doppler Shift. Types of Small-Scale Fading and their effect on received signal.

MODULE -III

Wireless Networking: Various Generations of Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing in Wireless Networks – Circuit Switching, Packet Switching. The X. 25 Protocol. Global System for Mobile (GSM): features, architecture, channel types, Frame Structure in GSM. Signal processing in GSM, CDMA Architecture.

MODULE -IV

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML), Wireless Local Loop (WLL) : Introduction to WLL Architecture, wireless Local Loop Technologies.

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision,

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.

Text Books:

1. Theodore S. Rappaport, Wireless Communication, 2nd Edition, Pearson Publication.
2. William C. Y. Lee Mc Graw: Mobile Communication Engg., 2nd Edition, Hill International Edition.
3. William C. Y. Lee Mc Graw: Mobile Cellular Communications, 2nd Edition, Hill International Edition.
4. Jocken Schiller: Mobile Communication, 2nd Edition, Pearson Education.
5. Andreas F. Molisch :Wideband Wireless Digital Communication , Editor Pearson Education.

Core-I Major-XXII	DIGITAL IMAGE PROCESSING	Credit 4

Module I

Introduction: Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing, Digital Image Formation, A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform. Mathematical Preliminaries, Neighbor of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier

Module – II

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering. Colour Image Processing.

Module III

Image Restoration Degradation Model, Diagonalization of Circulant and Block Circulant of Matrices. Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filter, Constrained Least squares restoration, Iterative Restoration, Restoration in the Spatial Domain.

Module – IV

Image Compression Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Image Compression Standards.

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books

1. Digital Image Processing, R.C. Gonzalez & R.E Wood, PHI, 2nd edition.

Reference Book

1. Digital Image Processing and Analysis, B. Channda & D. Dutta, Prentice Hall
2. Fundamentals of Digital Image Processing, Anil Ku Jain, PHI
3. Fundamental of Electronic Image Processing, Arther R. Weeks Jr. PHI

Core-I Major-XXIII	ADVANCED MICROPROCESSOR & MICROCONTROLLER	Credit 4

MODULE-I

Review of 8086 microprocessor, memory addressing, interrupt mechanism and types of instruction.

80186 and 80286 microprocessor architecture, memory organization, interrupt mechanism, types of instructions, and modes of operation.

MODULE-II

80386 and 80486 microprocessor architecture, memory organization, interrupt mechanism, DMA mechanism.

Memory addressing, virtual memory, paging, and segmentation

MODULE-III

RISC and CISC architecture, Superscalar architecture, floating point unit and MMX unit in Pentium processors, Pentium architecture, Hyperthreading, Cache memory organization, Virtual memory, Interrupt mechanism, DMA mechanism Types of instructions.

Multicore processor architectures.

MODULE-IV

ARM microprocessor architecture, types instructions, interrupt mechanism and DMA mechanism

Digital Signal Processor (TMS 320 series) architecture, types instructions, interrupt mechanism, DMA mechanism

Motorola 680X0 processor architecture, types of instruction interrupt mechanism, DMA mechanism

Case studies: Traffic control system, electronic weighing scale, Barcode reader.

TEXT BOOKS:

1. A.K.Ray and K.M. Bhruchandi : Advanced microprocessors and peripherals,
2. Hamacharvranesic and Zaky: Computer organization,
3. Bary B Brey: Intel microprocessors,

Core-II Minor-V	RDBMS WITH SQL SERVER	Credit 4

MODULE-I

Database: Introduction, File based approach & Database approach, Basic Components of database design. **DBMS:** Introduction, Features, Merits, Limitations, Applications, Components of Database Environment, Roles of DBA, Components of Database Language (DDL, DQL, DML, DCL, TCL).

RDBMS: Introduction, Features, Comparison of DBMS & RDBMS.

Database System Architecture – Data Abstraction, 3-Level Architecture, Data Independence, **Data models** – Hierarchical Model, Relational Model, Entity Relationship (ER) Model, Network Model.

Constraints: Introduction & Types.

MODULE -II

Relational Algebra: Introduction & Operations

Relational Query Languages, Relational Calculus: Tuple and Domain Relational Calculus, SQL, and QBE. Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Comparison of Oracle & DB2

Normal Forms: Introduction, Types (1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Dependency Preservation, Lossless design.

MODULE -III

Concepts of Database Transaction, ACID properties, Transaction states, Serializability, Concurrency control in DB systems, Locking and Timestamp based Schedulers, Lock based protocols, 2PL, Failure & Recovery of DB systems. Shadow Paging.

MODULE -IV

Advanced topics: Object-Oriented and Object Relational databases, Mobile Database, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Text Books: -

1. Elmaski & Navathe: Fundamentals of Database Systems, 4th Edition, Pearson Education
2. C.J.Date : An introduction to Database Systems, Pearson Education
3. Bipin Desai: An introduction to Database System, Galgotia Publication.