Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Schemes for B. Tech 2nd to 4th Year

W.E.F. Academic Session 2020-21

III to VIII SEMESTER

Bachelor of Technology (B. Tech.)

in

[Electronics and Communication Engineering]

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.) III Year

[Electronics and Communication Engineering]

W.E.F. Academic Session 2020-21

III Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	**BCET 301**	BSC-5	Mathematics-III	100	30	20	--	--	150	3	1	0	4
2.	BECT 302 BECP 302	DC-1	Electronic Measurement & Instrumentation	100	30	20	30	20	200	3	1	2	5
3.	BECT 303 BECP 303	DC-2	Digital Electronics	100	30	20	30	20	200	3	1	2	5
4.	BECT 304 BECP 304	DC-3	Electronic Devices	100	30	20	30	20	200	3	1	2	5
5.	BEET 305 BEEP 305	DC-4	Network Analysis & Synthesis	100	30	20	30	20	200	3	1	2	5
6.	BASP 307	DLC-1	Evaluation of Internship-I completed at I year level /Seminar for Lateral Entry	-	-	-	-	50	50			4	2
7		HV	90 hrs Internship based on using various software's –Internship - II	To be completed anytime during Third/ fourth semester. Its evaluation/credit to be added in fifth semester.									
Total				500	150	100	120	130	1000	15	5	12	26
NSS/NCC													

IV Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BAST 401	ESC	Energy & Environmental Engineering	100	30	20	-	-	150	3	1	-	4
2.	BECT 402 BECP 402	DC	Signal & Systems	100	30	20			150	3	1	-	4
3.	BECT 403 BECP 403	DC	Analog Communication	100	30	20	30	20	200	3	1	2	5
4.	BEET 404 BEEP 404	DC	Control System	100	30	20	30	20	200	3	1	2	5
5.	BECT 405 BECP 405	DC	Analog Circuits	100	30	20	30	20	200	3	1	2	5
6.	BHUT-401	HV	Universal Human Value -2	50	30	20	-	-	100	2	1	0.	3
	BCST 408	MC	Cyber Security and PCB Design Software Simulation										
7		DLC	90 hrs Internship based on using various software's –Internship -II	To be completed anytime during Third/ fourth semester. Its evaluation/credit to be added in fifth semester.									
Total				550	180	120	90	60	1000	17	6	6	26
NSS/NCC													

V Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BECT 501 BECP-501	DC	Microprocessors & Interfacing	100	30	20	30	20	200	3	1	2	5
2.	BECT -502 BECP-502	DC	Electromagnetic Theory	100	30	20	30	20	200	3	1	2	5
3.	BECT -503 BECP-503	DC	VLSI Technology and Design	100	30	20	30	20	200	3	1	2	5
4.	BECT -504	DE	Departmental Elective	100	30	20	-	-	150	3	1	0	4
5.	BOEC-505	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
6.	BECP 506	O/E Lab	Simulation Software Lab (Mat Lab, Multisim etc) / PCB design and Fabrication Lab	-	-	-	30	20	50	0	0	2	1
	BECP -507	DLC-1	Evaluation of Internship-II completed at II year level	-	-	-	-	50	50			2	1
8		IN	Internship -III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester.									
Total				500	150	100	120	130	1000	15	5	14	25
NSS/NCC													

Departmental Electives			Open Electives	
BECT 504(A)	CNTL		BOEC -505(A)	Data Structure using C++
BECT 504(B)	Data Communication and Networks		BOEC -505(B)	Computer System Organisation
BECT 504(C)	Advanced Control System		BOEC -505(C)	Process Control Instrumentation
BECT 504 (D)	IC Technology		BOET -504 (D)	Innovation and Entrepreneurship

VI Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Team Work / Lab Work & Sessional		L	T	P	
1.	BECT 601 BECP-601	DC	Digital Signal Processing	100	30	20	30	20	200	3	1	2	5
2.	BECT -602 BECP-602	DC	Antenna and Wave Propagation	100	30	20	30	20	200	3	1	2	5
3.	BECT -603 BECP-603	DC	Digital Communication	100	30	20	30	20	200	3	1	2	5
4.	BECT -604	DE	Departmental Elective	100	30	20		-	150	3	1	0	4
5.	BOEC -605	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
6.	BECP -606	O/E Lab	Open Source S/w Lab	-	-	-	30	20	50	0	0	2	1
7	BECT -607	P	Minor Project -1						50			2	1
8		IN	Internship - III	Non Credit Course									
Total				500	150	100	120	130	1000	15	5	10	25

Note: Meaning of Last Character of Subject Code (T – Theory; P – Practical)

Departmental Electives		**Open Electives (Using SWAYAM etc may be allowed)**	
BECT 604 (A)	Cellular and Mobile Communication	BOEC -605 (A)	Microcontroller and Embedded Systems
BECT 604 (B)	CMOS Design	BOEC -605 (B)	Bio Medical Electronics
BECT 604 (C)	Satellite Communication	BOEC -605 (C)	Power Electronics
BECT 604 (D)	High Speed Electronics	BOEC 605 (D)	IOT and Applications

VII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BECT 701 BECP-701	DC	Microwave Engineering	100	30	20	30	20	200	3	1	2	5
2.	BECT -702 BECP-702	DC	Optical Fibre Communication	100	30	20	30	20	200	3	1	2	5
3.	BECT -703	DE	Departmental Elective	100	30	20	-	-	150	3	1	0	4
4.	BOEC -704	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
5.	BECT -705	D Lab	Virtual Lab	-	-	-	30	20	50	0	0	2	1
7	BECP -706	DLC-1	Evaluation of Internship-III completed at III year level	-	-	-	-	50	50			2	1
8	EC-707	P	Minor Project-II	-	-	-	50	50	100	0	0	4	2
Total				400	120	80	140	160	900	12	4	12	22
NSS/NCC													

Departmental Electives		**Open Electives**	
BECT 703(A)	Mixed Circuit Design	BOEC -704(A)	Mobile Ad Hoc Networks
BECT 703(B)	Digital Image Processing	BOEC -704(B)	Artificial Intelligence
BECT 703(C)	Advanced Communication Systems	BOEC -704(C)	Artificial Neural Networks
BECT 703 (D)	Wireless Sensor Networks	BOEC 704 (D)	Subject from SWAYAM

VIII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz/ Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BECT 801	DC	Television and Radar Engineering	100	30	20	30	20	200	3	1	2	5
2.	BECT -802	DC	Wireless Communications	100	30	20	30	20	200	3	1	2	5
3.	BECT -803	DE	Departmental Elective	100	30	20	-	-	150	3	1	0	4
4.	BOEC -804	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
5.	BECP -805	P	Major Project	-	-	-	100	100	200	0	0	8	4
Total				400	120	80	120	130	900	11	5	12	22
NSS/NCC													

Departmental Electives		**Open Electives**	
EC 803 (A)	Digital System Design using VHDL	BOEC -804(A)	Industrial Automation Technology
EC 803 (B)	Adaptive Signal Processing	BOEC -804 (B)	Machine Learning
EC 803 (C)	**T**elecommunication Switching Systems	BOEC 804 (C)	Under Water Communication
EC 803 (D)	SDN and Cognitive Radio Networks	BOEC 804 (D)	Subject using SWAYAM etc

NOTE: Open elective in all the semesters can be taken from SWAYAM or any other International University after getting permission from authorities

Uttarakhand Technical University, Dehradun
New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester
EC501 MICROPROCESSOR AND INTERFACING

UNIT I

Salient features of advanced microprocessors. RISC & CISC processors. Review and evolution of advanced microprocessors:8086, 8088, 80186/286/386/486/Pentium, introduction to 8086 processor: Register organization of 8086,Architecture,signal description of 8086,minimum mode 8086 systems and timings and maximum mode 8086 systems and timings , Knowledge on iCore processors.

UNIT II

Intel 8086 microprocessor programming: 8086 Instruction Set, Addressing modes, Assembly Language Programming with Intel 8086 microprocessor

UNIT III

Introduction to the various interfacings chips like 8155, 8255, Interfacings keyboards, LEDs , ADC, DAC and memory Interfacing.

UNIT IV

General purposes programmable peripheral devices: Timer (8253/8254), 8259A programmable interrupt controller & 8257 DMA controller, USART, serial I/O & data Communication. Interfacing Programs for chips

UNIT V

Introduction to 8bit and 16 bit microcontrollers and embedded systems, 8051 architecture, pin description , I/O configuration , interrupts, addressing modes instruction set, embedded system, use of microcontrollers in embedded systems, Display systems using microcontrollers

Reference Books:

1. Advance microprocessor and peripheral –A.K. Ray and K. M. Bhurchandi, Tata Mcgraw Hill
2. Microprocessor and Interfacing – D.V. Hall, McGraw Hill.
3. The Intel microprocessor - Barry B. Brey, Pearson
4. The 8086 & 8088 Microprocessor- LIU and Gibson, Tata McGraw Hill
5. GS Tomar, Advanced Microprocessors and Interfacing, Sun India Pub
6. The 8051 microcontroller and embedded systems-M.A. Mazidi, Janice GillispieMazidi, Pearson Prentice Hall

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Electronics & Communication Engineering V-Semester

EC- 502 ELECTROMAGNETIC THEORY

Unit I

Steady Electric Field: Coulomb's Law, units, Electric field intensity, Electric flux and flux density, Gauss law, Boundary relations, concept of divergence, Curl, scalar and vector potential. electric field in dielectric and conductor, continuity equation, methods of images.

Unit II

Magnetic field due to steady currents, force between current carrying wires, Stokes theorem, vector magnetic potential, magnetization vector and its relation to magnetic field.

Unit III

Maxwell's Equation**:** Time varying field and displacement current, faraday's law.

Unit IV

Wave Equation: Pointing vector, Plane electromagnetic waves in free space, dielectric medium and conducting medium, Skin depth, slepian vector.

Unit V

Waves propagation in lossy dielectrics, plane waves in lossless dielectrics, reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence.

Reference Books:

1. Elements of Engineering Electromagnetic Third Edition- N.N. Rao- Prentice Hall, India.
2. Elements opf Electromagnetic, Second Edition- Matthew N.O. Sadiku- Saunders coll Publishing.
3. Fields & Waves in Communication Electronics- S.Ramo, J.R. Whinnery& T. Van Duzer- John Wiley & Sons.
4. Electromagnetic- J.D. Kraus-McGraw Hill
5. Electromagnetic Waves & Radiating Systems- E.C. Jordan & K.G. Balmain- Prentice Hall.

Uttarakhand Technical University, Dehradun

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Electronics & Communication Engineering V-Semester
EC- 503 VLSI Technology and Design

UNIT 1

Process steps in IC fabrication Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing

UNIT 2

Diffusion of impurities- physical mechanism- Fick's I and II law of diffusion- Diffusion profiles- complementary (erfc) error function- Gaussian profile- Ion implantation- Annealing process- Oxidation process, Lithography- Photolithography, Fine line lithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation- patterning- wire bonding and packaging.

UNIT 3 :

Monolithic components Isolation of components- junction isolation and dielectric isolation- Transistor fabrication- buried layer- impurity profile- parasitic effects- monolithic diodes- schottky diodes and transistors- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage (V^{th})- silicon gate technology- Monolithic resistors- sheet resistance and resistor design

UNIT 4 :

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modelling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT 5 :

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles.

UNIT 6 :

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT 7: Introduction to ASICs –Types, Standard Cell Array, Gate Arrays, Programmable Array Logic- PLAs, CPLDs, FPGAs, Design Approach- Design capture tools, Design Verification Tools, Synthesis, testing.

TEXT BOOK:

1. VLSI Fabrication Principles Silicon and Gallium Arsenide, Sorab K. Gandhi, Second Edition 1994, Wiley-Interscience Publication.
2. Physics of Semiconductor Devices, Simon. M. Sze, Kwok K.Ng. 3rd Edition,
3. CMOS Digital Integrated Circuits, Analysis and Design, Sung Mo Kang Yusuf Leblebici 2nd edition 2003, McGraw Hill Education.
4. Principles of CMOS VLSI Design by N. Weste and K. Eshranghian

REFERENCE BOOK:

1. Pucknell DA & Eshraghian K, Basic VLSI Design, PHI
2. Physics and Technology of semiconductor devices by A.S Grove
3. VLSI Technology by B.G Streetman
4. The Design and Analysis of VLSI, Circuits by L.Glaser and D. Dobberpuhl

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Electronics & Communication Engineering V-Semester

Departmental Elective EC- 504 (A) Communication Network and Transmission Lines (CNTL)

Unit I

Characteristic Parameters of symmetrical and asymmetrical two port networks and their design Image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfer coefficient, iterative transfer coefficient, Lattice and Bridged T networks, reactive matching networks, matching techniques, insertion loss, symmetrical and asymmetrical attenuators and their design.

Unit II

Passive LC Filters Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters, composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, elliptic function approximation, frequency transformation.

Unit III

Positive real function LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function, Brune's method, Bott-Duffin method, Synthesis-Coefficient.

Unit IV

Transmission line fundamentals Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristic impedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less line, loading, liner reflection on aline, reflection coefficient, input and transfer impedances, open circuit and short circuit line, reflection factors, reflection loss, insertion loss, T and π equivalents of a line, location of line fault, construction and design of two wire line and coaxial cable.

Unit V

Line at radio frequencies Parameters of line and coaxial cable at radio frequencies, dissipation-less line, voltage and current on a dissipation-less line, standing waves, standing wave ratio, input impedance of open circuit and short circuit, power and impedance measurement on lines, eighth-wave, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching .introduction to micro-strip lines and its analysis.

References:

1. Ryder: Networks and Transmission Lines, PHI Learning.
2. Valkenberg: Introduction to Modern Network synthesis, Wiley India.
3. Suresh: Electric Circuits and Networks, Pearson Education.
4. Raju: Electromagnetic field theory and Transmission Lines, Pearson Education.
5. Ganesan: Transmission Lines and Waveguides, TMH.
6. Rao: Electromagnetic Waves and Transmission Lines, PHI learning.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VI-Semester

Departmental Elective EC- 504 (B) DATA COMMUNICATION and Networking

Unit-I

Data Communication: Introduction, Components, data representation Serial & Parallel transmission, Modes of data transmission, Line Encoding: Unipolar, Polar, Bipolar, Networks – Protocols and standards – Standards organizations – Line configurations – Topology– Transmission mode – Categories of networks – Inter networks.

Unit-II

OSI model: Functions of the layers. Transmission media: Guided media – Unguided media – Transmission impairment –Performance. Switching Circuit switching , packet switching (virtual circuit and datagram approach), message switching

Unit-III

ERROR CONTROL AND DATA LINK PROTOCOLS

Error detection and correction: Types of errors – Detection – Vertical Redundancy Check (VRC) – Longitudinal Redundancy Check (LRC) – Cyclic Redundancy Check (CRC) – Check sum –Error Correction. Data Link Layer Protocols: Framing , HDLC, ARQ: Stop and Wait, Sliding Window. Efficiency

Unit-IV

NETWORKS

LAN: Project 802 – Ethernet – Token bus – Token ring – FDDI. MAN: IEEE 802.6 (DQDB) – SMDS.X.25, FRAME RELAY, ATM AND SONET/, SDH

Unit-V. NETWORKING DEVICES AND TCP / IP PROTOCOL SUITE

Networking and internetworking devices: Repeaters – Bridges – Gateways – Other devices – Routing algorithms – Distance vector routing – Link state routing. TCP / IP protocol suite: Overview of TCP/IP.

REFERENCE BOOKS

1. Data and Computer Communication – W. Stallings, Pearson
2. LANs – Keiser, Tata Mc-Graw Hill
3. Data Communication & Networking – B.A. Forouzan, Tata Mc-Graw Hill
4. Internetworking with TCP/IP – VOL-I – D.E. Comer, PHI
5. ISDN and Broad band ISDN with Frame Relay & ATM – W. Stallings, Pearson

Textbooks:

1. Computer Networks by Tanenbum/PHI.
2. Shay, William A. / "Understanding Data communications & Networks" / Vikas Publishing HousePvt. Ltd.

Uttarakhand Technical University, Dehradun

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Electronics & Communication Engineering V-Semester

Departmental Elective EC- 504 (C) ADVANCED CONTROL SYSTEM

Unit I Advantages and disadvantages of digital control system, Ideal sampler, sampled and hold circuit, zero order hold circuit, Z transform, Inverse Z transform by various method, mapping between s plane and Z plane, solution of the linear difference equation.

Unit II Pulse transfer function, general procedure for obtaining pulse transfer function, pulse transfer function of cascaded elements, pulse transfer function of closed loop systems. Transfer function of discrete data system, stability analysis of closed loop system in the z plane, Jury stability test.

Unit III Non Linear Systems: introduction , common physical non linearity's, phase plane method , basic concepts ,singular points, stability of non linear system , construction of phase trajectories, system analysis by phase plane method, Describing functions methods, basic concepts derivation of describing function, liapunov's stability criterion.

Unit IV Review of root locus, lead compensation, lag compensation, lag- lead compensation and their comparison, review of state space methods, observability and controllability of system , pole placement by state feedback.

UnitVTuning rules of PID controller, modifications of PID controllers, Introduction to software package used in control systems- MATLAB SIMULINK.

Reference Books:

1. Automatic control system—B. C.Kuo, wiley
2. Control system engineering—Nagrath&gopal, Publishers: New Age International
3. Modern control engineering –K. Ogata, Pearson; 5 edition
4. Control system engineering—Norman Nise, **P**ublisher: Wiley
5. Discrete time Control system— K. Ogata, Pearson; 2 edition

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Electronics & Communication Engineering V-Semester
Departmental Elective EC- 504 (D) IC Technology

UNIT-I

Semiconductor technology trend, Clean rooms, Wafer cleaning, Phase diagram and solid solubility, Crystal structure, Crystal defects, Czochralski growth, Bridgman growth of GaAs, Float Zone growth, Wafer Preparation and specifications

Unit -2

Deposition: Evaporation, Sputtering and Chemical Vapor Deposition, Epitaxy: Molecular Beam Epitaxy, Vapor Phase Epitaxy, Liquid Phase Epitaxy, Evaluation of epitaxial layers, Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silicon Dioxide, Oxide Quality, high κ and low κ dielectrics, Diffusion: Nature of diffusion, Diffusion in a concentration gradient, diffusion equation, impurity behavior, diffusion systems, problems in diffusion, evaluation of diffused layers, Ion Implantation: Penetration range, ion implantation systems, process considerations, implantation damage and annealing

Unit-3

Etching: Wet chemical etching, dry physical etching, dry chemical etching, reactive ion etching, ion beam techniques, Lithography: Photoreactive materials, Pattern generation and mask making, pattern transfer, Electron beam, Ion beam and X-ray lithography, Device Isolation, Contacts and Metallization: Junction and oxide isolation, LOCOS, trench isolation, Schottky contacts, Ohmic contacts, Metallization and Packaging, CMOS Process Flow: N well, P-well and Twin tub

Unit 4

Semiconductor Measurements: Conductivity type, Resistivity, Hall Effect Measurements, Drift Mobility, Minority Carrier Lifetime and diffusion length, Packaging: Integrated circuit packages, Electronics package reliability, Testing: Technology trends affecting testing, VLSI testing process and test equipment, test economics and product quality

Unit 5

SOI Technology: SOI fabrication using SIMOX, Bonded SOI and Smart Cut, PD SOI and FD SOI Device structure and their feature, GaAs Technologies: MESFET Technology, Digital Technologies, MMIC technologies, MODFET and Optoelectronic Devices, Silicon Bipolar Technologies: Second order effects in bipolar transistor, Performance of BJT, Bipolar processes and BiCMOS

Reference Books:

1. VLSI Technology, S.M. Sze
2. Physics of Semiconductors, S.M. Sze

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Electronics & Communication Engineering V-Semester

Open Elective EC- 505 (A) Data Structure using C++

UNIT 1

COMPLEXITY ANALYSIS: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

LINEAR LISTS: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

UNIT 2

STACKS AND QUEUES: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

UNIT 3

HASHING: Search efficiency in lists and skip lists, hashing as a search structure, hash table, collision avoidance, linear open addressing, chains, uses of hash tables in text compression, LZW algorithm.

UNIT 4

TREES: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heapsort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in mergesort as an external sorting algorithm, bin packing.

UNIT 5

GRAPHS: Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation – adjacency matrix and linked adjacency chains, graph traversal – breadth first and depth first, spanning trees.

SUGGESTED BOOKS:

1. M. T. Goodrich and R. Tamassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, John Wiley & Sons, 2001.
2. Drozdek, A., "Data Structures and Algorithms in C++", Vikas Publishing House. 2002
3. Wirth, N., "Algorithms and Data Structures", Prentice-Hall of India. 1985
4. Lafore, R., "Data Structures and Algorithms in Java", 2nd Ed., Dorling Kindersley. 2007
5. Datastructure using C, Bandopadhyaya, "Data Structures, Algorithms, and Applications in Java", WCB/McGraw-Hill. 2001
6. C and datastructure, Padnabham, BSP, Hyderabad

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Electronics & Communication Engineering V-Semester

Open Elective EC- 505 (B) Computer System Organization

Unit-I

COMPUTER BASICS AND CPU Von Newman model, various subsystems, CPU, Memory, I/O, System Bus, CPU and Memory registers, Program Counter, Accumulator, Instruction register, Micro-operations, Register Transfer Language, Instruction Fetch, decode and execution, data movement and manipulation, Instruction formats and addressing modes of basic computer.

Unit-II

CONTROL UNIT ORGANIZATION Hardwired control unit, Micro and nano programmed control unit, Control Memory, Address Sequencing, Micro Instruction formats, Micro program sequencer, Microprogramming,

ARITHMETIC AND LOGIC UNIT Arithmetic Processor, Addition, subtraction, multiplication and division, Floating point and decimal arithmetic and arithmetic units, design of arithmetic unit.

Unit-III

INPUT OUTPUT ORGANIZATION Modes of data transfer – program controlled, interrupt driven and direct memory access, Interrupt structures, I/O Interface, Asynchronous data transfer, I/O processor. Data transfer – Serial / parallel, synchronous/asynchronous, simplex/half duplex and full duplex.

Unit-IV

MEMORY ORGANIZATION Memory Maps, Memory Hierarchy, Cache Memory -Organization and mappings. Associative memory, Virtual memory, Memory Management Hardware.

Unit-V

MULTIPROCESSORS Pipeline and Vector processing, Instruction and arithmetic pipelines, Vector and array processors, Interconnection structure and inter-processor communication.

Books:

1. Morris Mano: Computer System Architecture, Pearson Education.
2. William Stallings: Computer Organization and Architecture, PHI
3. Carl Hamacher: Computer Organization, TMH
4. Tanenbaum: Structured Computer Organization, Pearson Education

Uttarakhand Technical University, Dehradun

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Electronics & Communication Engineering V-Semester

Open Elective EC- 505 (C) Process Control Instrumentation

Unit-I

Introduction: Historical Perspective, incentives of process control, synthesis of control system. Classification and definition of process variables. Mathematical modeling: Need and application of mathematical modeling, Lumped and distributed parameters, Analogies, thermal, Electrical, and chemical systems, Modeling of CSTR, Modeling of heat exchanger, Interactive and non-interactive type of system, Dead time elements, Developing continuous time and discrete time models from process data.

Unit-II

Control Modes: Definition, Characteristics and comparison of on-off, proportional, Integral, Differential, PI, PD, PID, Dynamic behavior of feedback controlled processes for different control modes, Control system quality, IAE, ISE, IATE criterion, Tuning of controllers Ziegler-Nichols, Cohen-Coon Methods, controller trouble shooting.

Unit-III

Realization of Control Modes: Realization of different control modes like P, I, D in Electric, Pneumatic, Hydraulic controllers. Use of DDC and PLC, Process monitoring, man machine interface, real time systems: RTS introduction and its characteristics.

Unit-IV

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, control valves, Types, Functions, Quick opening, Linear and equal percentage valve, Ball valves, Butterfly valves, Globe valves, Pinch valves, valve application and selection, Cavitations and flashing, Dampers and variable speed Drives.

Unit-V

Advanced Controls: Introduction to advanced control system like Cascade, Feed forward, Ratio, Selective, Override, Split range and Auctioneering control, Plant wide control. PI Diagrams: Symbols, Terminology, Case studies, a brief study of instrumentation and control relevant to industries.

References:

1. Dale Patrick, Stephen Fardo, “Industrial Process Control System”.
2. Shinskey F.G., “Process Control System”, III Ed., McGraw Hill.
3. Smith C.A. & A.B. Corripio, “Principle & Practiced Automatic Process Control”, J. Willey.
4. Rao M &S.Qiv, “Process Control Engg.”,Gorden& Breach.
5. S Levi and AK Agrawala. Real-time system design. McGraw-Hill International.
6. GeorgeStephanopoulos “ Chemical Process Control” PHI, Delhi
7. C.D. Johnson “Process control instrumentation technology’ PHI
8. Harriott- Process Control 1st ed., TMH
9. Patranabis- Principles of Process Control 2nd ed., TMH

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester

Open Elective EC- 505 (D) Innovation and Entrepreneurship

Course Objectives:

- Think critically and creatively about the nature of business opportunities, resources, and industries.
- Describe the processes by which innovation is fostered, managed, and commercialized.
- Spot new business opportunities in the environment, whether by recognition, development, or creation.
- Effectively and efficiently evaluate the potential of new business opportunities.
- Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.
- Develop a business model for a new venture, including revenue, margins, operations, working capital, and investment.
- Develop pro forma financial statements that reflect business model decisions and that can be used to determine future funding requirements.
- Write a clear, concise, and compelling business plan for a new venture.
- Identify appropriate sources of financing for an entrepreneurial business plan.
- Develop a compelling sales pitch to acquire financing necessary to a new venture.
- Explain the operational implications of common terms and conditions for early-stage investment deals.
- Describe the process by which new ventures are created and launched.

Course Learning Outcomes:

1. Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
2. Demonstrate an ability to design a business model canvas.
3. Evaluate the various sources of raising finance for startup ventures.
4. Understand the fundamentals of developing and presenting business pitching to potential investors.

Course Content:

Unit I: Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioral; entrepreneurial challenges.

Unit II: Entrepreneurial Opportunities: Opportunities. Discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

Unit III: Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation.

Unit IV: Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.

Unit V: Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of Organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Text/Reference Books:

1. Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.
2. Blank, Steve (2013), The Startup Owner's Manual: The Step by Step Guide for Building a Great Company, K&S Ranch.
3. S. Carter and D. Jones-Evans, Enterprise and small business- Principal Practice and Policy, Pearson Education (2006)
4. T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013).

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering VI-Semester

EC- 601 Digital Signal Processing

Unit – I: Discrete-Time Signals and Systems

Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

UNIT –II: z-Transform

The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z transform,analysis of linear time-invariant systems in the z- domain, block diagrams and signal flow graph representation of digital network, matrix representation.

Unit – III: Frequency Analysis of Discrete Time Signals

Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), propertiesof DFT, two dimensional DFT, circular convolution.

Unit – IV: Efficient Computation of the DFT

FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for 'N'composite number.

Unit – V: Digital filters Design Techniques

Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques rectangular and other windows, examples of FIR filters, design using windowing.

References:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.
2. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI Learning.
3. Proakis: Digital Signal Processing, Pearson Education.
4. Rabiner and Gold: Theory and Application of Digital Signal Processing, PHI Learning.
5. Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.

List of Experiments:

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
7. Computation and plots of linear/circular convolution of two sequences.
8. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of **v**arious window design techniques (Rectangular, Bartlett, Hann, Hamming etc).

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Electronics & Communication Engineering, VI-Semester

EC- 602 Antennas and wave Propagation

Unit I

Radiation

Potential function and the Electromagnetic field, potential functions for Sinusoidal Oscillations, retarded potential, the Alternating current element (or oscillating Electric Dipole), Power radiated by a current element, Application to short antennas, Assumed current distribution, Radiation from a Quarter wave monopole or Half wave dipole, sine and cosine integral, Electromagnetic field close to an antenna, Solution of the potential equations, Far-field Approximation.

Unit II: Antenna Fundamentals

Introduction, network theorems, directional properties of dipole antennas, travelling –wave antennas and effect of feed on standing-wave antennas, two –element array, horizontal patterns in broad-cast arrays, linear arrays, multiplication of patterns ,effect of earth on vertical patterns, Binomial array, antenna gain, effective area.

Unit III: Types of antennas

Log periodic antenna, loop antenna, helical antenna, biconical antenna, folded dipole antenna, Yagi-Uda antenna, lens antenna, turnstile antenna. Long wire antenna: resonant and travelling wave antennas for different wave lengths, V-antenna, rhombic antenna, beverage antenna,

Unit IV: Aperture and slot

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas, Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis

Unit V: Propagation of radio waves

Fundamentals of electromagnetic waves, effects of the environment, modes of propagation. Ground wave propagation- Introduction, plane earth reflection, space wave and surface wave, transition between surface and space wave, tilt of wave front due to ground losses. Space wave propagation- Introduction, field strength relation, effects of imperfect earth, curvature of earth and interference zone, shadowing effect of hills and buildings, absorption by atmospheric phenomena, variation of field strength with height, super refraction, scattering, tropospheric propagation, fading, path loss calculations. Sky wave propagation- Introduction, structural details of the ionosphere, wave propagation mechanism, refraction and reflection of sky waves by ionosphere, ray path, critical frequency, MUF, LUF, OF, virtual height, skip distance, relation between MUF and skip distance.

References:

1. Jordan and Balmain: Electromagnetic Waves and Radiating System, PHI Learning.
2. Krauss: Antennas and wave propagation, TMH.
3. Balanis: Antenna Theory Analysis and Design, Wiley India Pvt. Ltd.
4. Harish and Sachidananda: Antennas and wave propagation, Oxford University Press.
5. Raju: Antennas and Wave Propagation, Pearson Education.
6. Kennedy: Electronic Communication Systems, TMH.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester

EC603 DIGITAL COMMUNICATION

Unit I

Sampling theorem for low pass and band pass signals, Ideal sampling, Natural sampling, Flat top sampling, crosstalk, aliasing, time division multiplexing, PAM, PWM and PPM their generation and detection.

Unit II

Pulse code modulation, Quantization, quantization noise, companding, Inter symbol interference, Eye pattern, Delta and adaptive modulation, Encoding techniques: On-Off signaling, Polar signaling, RZ signaling, Bipolar signaling, AMI, Manchester code, Differential encoding their advantage and disadvantages.

Unit III

Band pass data transmission: ASK, Binary phase shift keying (BPSK), QPSK, DPSK, coherent and non coherent BFSK, minimum shift keying, QAM, Concept of M-ary PSK and M-ary FSK. Spectral properties of QPSK and MSK.

UNIT IV

Matched filter and correlator detector. Gram Schmidt orthogonalization procedure and concept of signal space for the computation of probability of error, calculation of error probability for BPSK, QPSK, QAM and coherent BFSK, comparison of different modulation techniques.

Unit V

Concept of information theory, entropy, information rate, channel capacity, Shannon's theorem, Shannon Hartley theorem , BW and signal to noise ratio trade off, sources encoding, extension of zero memory source, Error correcting codes**:** linear block codes and cyclic codes: encoder and decoder circuits, burst error correcting codes, concept of convolution codes.

Reference Books:

1. Communication Systems –Simon Haykins, Wiley
2. Principle of Communication Systems-Taub and Schilling, Tata McGraw-Hill
3. Communication Systems-Singh and Sapre, Tata McGraw-Hill
4. Analog communication-Tomar and Ashish, PHI

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Electronics & Communication Engineering VI-Semester

Departmental Elective EC- 604 (A) Cellular and MOBILE COMMUNICATION

Unit I Introduction to wireless communication systems, different generations of wireless networks. Cellular system design fundamentals, frequency reuse, handoff strategies, Interference and system capacity, Trunking and grade of service.

Unit II Mobile radio propagation**:** free space propagation model, Ground reflection propagation model, Long term fading, Small scale multipath propagation, Time dispersion parameters, Coherence bandwidth, Doppler spread and coherence time, types of small scale fading, Clarke's model for flat fading, level crossing and fading statistics.

Unit III Capacity in cellular systems, cell splitting and sectoring, cell-site antennas and mobile antenna, cochannel interference reduction, Frequency management and channel assignment.

Unit IV Frequency division and time division multiple access. Global System for Mobile: System Architecture. GSM Radio subsystem,. GSM.. GSM Traffic Channel and Control Channel, Frame Structure. Introduction to 3G/4G/LTE/5G communication Systems.

Unit V Spread spectrum multiple access (Frequency Hopped Multiple Access and. Code Division Multiple Access). Different spreading codes. CDMA Digital Cellular system: different standards with detailed description of forward and reverse channels. Capacity of cellular systems. Introduction to Cognitive Radio Networks.

Reference Books:

SUGGESTED BOOKS:

1. Alaxendar K, Introduction to Mobile Network Engg: GSM, 3G-WCDMA, LTE and road to 5G", 2018.
2. Simon Haykin & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
3. Sridhar Iyer, "Wireless and Mobile communications", , 2013.
4. Gordon L. Stuber, "Principles of Mobile Communication", Springer International Ltd., 2001.
5. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

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Electronics & Communication Engineering, VI-Semester

Departmental Elective EC- 604 (B) CMOS DESIGN

Unit I

Introduction

Introduction to CMOS VLSI circuit, VLSI design flow, Design strategies ,Hierarchy, regularity,modularity, locality, MOS Transistor as a Switches, CMOS Logic, Combinational circuit, latchesand register, Introduction of CAD Tool , Design entry, synthesis, functional simulation.

Unit II

Specification of sequential systems

Characterizing equation & definition of synchronous sequential machines. Realization of statediagram and state table from verbal description, Mealy and Moore model machines state tableand transition diagram. Minimization of the state table of completely and incompletely specifiedsequential machines.

Unit III

Asynchronous Sequential Machine

Introduction to asynchronous sequential machine, Fundamental mode and Pulse modeasynchronous sequential machine, Secondary state assignments in asynchronous sequential
machine, races and hazards.

Unit IV

Introduction, Size and complexity of Integrated Circuits, The Microelectronics Field, IC Production Process, Processing Steps, Packaging and Testing, MOS Processes, NMOS Process, CMOS Process, Bipolar Technology, Hybrid Technology, Design Rules and Process Parameters

Unit V

Dc Models, Small Signal Models, MOS Models, MOSFET Models in High Frequency and smallsignal, Short channel devices, Sub threshold Operations, Modeling Noise Sources in MOSFET's,Diode Models, Bipolar Models, Passive component Models.

Refrences:

1. Neil Weste: Principle of CMOS VLSI Design, TMH.
2. Kohavi: Switching & Finite Automata Theory, TMH.
3. Lee: Digital Circuits and Logic Design, PHI Learning..
4. Geiger, Allen and Strader: VLSI Design Techniques for Analog and Digital Circuits, TMH.
5 Sorab Gandhi: VLSI Fabrication Principles, Wiley India.
6. Weste and Eshraghian: Principles of CMOS VLSI design, Addison-Wesley

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Electronics & Communication Engineering, VI-Semester

Departmental Elective EC- 604 (C) Satellite Communication

Unit-I

Overview of satellite systems: Introduction, Frequency allocations for satellite systems.

Orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

Unit-II

The Geostationary orbit: Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits.

Polarization: antenna polarization, polarization of satellite signals, cross polarization discrimination.

Depolarization: ionospheric, rain, ice.

Unit-III

The Space segment: introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Anik satellites, Advanced Tiros-N spacecraft.

The Earth segment: introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

Unit-IV

The space link: Introduction, Equivalent isotropic radiated power (EIPR), transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, inter modulation noise, inter satellite links. Interference between satellite circuits.

Unit-V

Satellite services

VSAT (very small aperture terminal) systems: overview, network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network.

Direct broadcast satellite (DBS) Television and radio: digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting.

References:

1. Roddy: Satellite Communications, TMH.
2. Timothy Prattt: Satellite Communications, Wiley India.
3. Pritchard, Suyderhoud and Nelson: Satellite Communication Systems Engineering, PearsonEducation.
4. Agarwal: Satellite Communications, Khanna Publishers.
5. Gangliardi: Satellite Communications, CBS Publishers.
6. Chartrand: Satellite Communication, Cengage Learning.
7. Raja Rao: Fundamentals of Satellite communications, PHI Learning.

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Electronics & Communication Engineering, VI-Semester

Departmental Elective EC- 604 (D) High Speed Electronics

Unit-I

Silicon based MOSFET and BJT circuits for high speed operation and their limitations:- Emitter coupled Logic (ECL) and CMOS Logic circuits with scaled down devices. Silicon On Insulator (SOI) wafer preparation methods and SOI based devices and SOICMOS circuits for high speed low power applications.

Unit-II

Materials for high speed devices and circuits
Merits of III –V binary and ternary compound semiconductors (GaAs, InP, InGaAs, AlGaAs ETC.), silicon-germanium alloys and silicon carbide for high speed devices, as compared to silicon based devices. Brief outline of the crystal structure, dopants and electrical properties such as carrier mobility, velocity versus electric field characteristics of these materials. Material and device process technique with these III-V and IV – IV semiconductors

Unit-III

Metal semiconductor contacts and Metal Insulator Semiconductor and MOS devices: Native oxides of Compound semiconductors for MOS devices and the interface state density related issues. Metal semiconductor contacts, Schottky barrier diode. Thermionic Emission model for current transport and current-voltage (I-V) characteristics. Effect of interface states and interfacial thin electric layer on the Schottky barrier height and the I-V characteristics.

Unit-IV

High Electron Mobility Transistors (HEMT):
Hetero-junction devices. The generic Modulation Doped FET (MODFET) structure for high electron mobility realization. Principle of operation and the unique features of HEMT. InGaAs/InP HEMT structures.

Unit-V

Hetero junction Bipolar transistors (HBTs): Principle of operation and the benefits of hetero junction BJT for high speed applications. GaAs and InP based HBT device structure and the surface passivation for stable high gain high frequency performance. SiGe HBTs and the concept of strained layer devices

References:

1. Stephen: High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices, Wiley.
2. Tomar: Fundamentals of Electronic Devices & Circuits, Springer.
3. Lee: The Design of CMOS Radio-Frequency Integrated Circuits, Cambridge University Press
4. Razavi: RF Microelectronics, Prentice-Hall.
5. Gonzalez: Microwave Transistor Amplifiers, Prentice Hall.

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VI-Semester

Open Elective EC- 605 (A) Microcontroller & Embedded system

UNIT-I

Introduction to 8-bit microcontrollers:8051 Interfacing, Applications and serial communication8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/ counter functions, 8051based data acquisition system 8051 connections to RS-232, 8051 Serial communication , Serialcommunication modes, Serial communication programming, Serial port programming in C.

UNIT II:

Microcontroller 8096 Introduction to 16-bit Microcontroller, functional block-diagram, memorystatus, complete 8096 instruction set, classification of instruction set, addressing modes,programming examples using 8096, hardware features of 8096,parallel ports, control &statusRegisters, Introduction to 16/32 bit PIC microcontrollers and DSPIC.

UNIT-III

Introduction to Embedded Systems:

Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, common design metrics, and processor technology: general purpose processor, application specific processor, single purpose processor.

UNIT-IV

Embedded System Architecture:

Von Neumann v/s Harvard architecture, instruction set architecture, CISC and RISC. instructions set architecture, basic embedded processor, microcontroller architecture, CISC & RISC examples: 8051, ARM, DSP processors.

UNIT-V

Input Output and Peripheral Devices

Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analogto digital converters, real time clock.

Reference Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and EmbeddedSystems, Pearson education, 2005.
2. Kenneth J. Ayala, The 8051 Microcontroller Architecture, III edition, CENGAGE Learning.
3. V. Udayashankara and M.S. Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software& Applications, Tata McGraw - Hill, 2009.
4. McKinlay, The 8051 Microcontroller and Embedded Systems - using assembly and C, PHI,2006 / Pearson, 2006.
5. Tim Wilmshurst, Designing embedded system with PIC microcontrollers Principles and applications. 2nd ed. 2011 Bsp books pvtlt
6. Shibu K V, “Introduction to Embedded System”, TMH.
7. David E Simon, “An Embedded Software Primer”, Pearson education Asia, 2001.
8. Steven F. Barett, Daniel J. Pack, “Embedded Systems” Pearson education, First Impression2008.

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VI-Semester

Open Elective EC- 605 (B) BIOMEDICAL ELECTRONICS

UNIT I - PHYSIOLOGY AND TRANSDUCERS

Cell and its structure - Resting and Action Potential - Nervous system: Functional organization of the nervous system - Structure of nervous system, neurons - synapse - transmitters and neural communication - Cardiovascular system - respiratory system - Basic components of a biomedical system - Transducers - selection criteria - Piezo electric, ultrasonic transducers – Temperature measurements - Fiber optic temperature sensors.

UNIT II - ELECTRO - PHYSIOLOGICAL MEASUREMENTS

Electrodes -Limb electrodes -floating electrodes - propelled disposable electrodes - Micro, needle and surface electrodes - Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers -Isolation amplifier. ECG - EEG - EMG - ERG - Lead systems and recording methods– Typical waveforms. Electrical safety in medical environment: shock hazards leakage current-Instruments for checking safety parameters of biomedical equipments

UNIT III - NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound –Pulmonary function measurements - Spiro meter - Photo Plethysmography, Body Plethysmography Blood Gasanalyzers : pH of blood -measurement of blood pCO2, pO2, finger-tip oxymeter ESR, GSR measurements .

UNIT IV - MEDICAL IMAGING

Radio graphic and fluoroscopic techniques - Computer tomography - MRI - Ultrasonography-

Endoscopy - Thermography - Different types of biotelemetry systems and patient monitoring -Introduction to Biometric systems

UNIT V- ASSISTING AND THERAPEUTIC EQUIPMENTS

Pacemakers - Defibrillators - Ventilators - Nerve and muscle stimulators - Diathermy - Heart -Lung machine - Audio meters - Dialysers - Lithotripsy

REFERENCES

1. M. Arumugam, ‘Bio-Medical Instrumentation’, Anuradha Agencies, 2003.
2. L.A. Geddes and L.E. Baker, ‘Principles of Applied Bio-Medical Instrumentation’, John Wiley& Sons, 1975.
3. J. Webster, ‘Medical Instrumentation’, John Wiley & Sons, 1995.
4. C. Rajarao and S.K. Guha, ‘Principles of Medical Electronics and Bio-medical Instrumentation’, Universities press (India) Ltd, Orient Longman ltd, 2000.

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Electronics & Communication Engineering, VI-Semester

Open Elective EC- 605 (C) POWER ELECTRONICS

Unit-1

Power Semiconductor Switches

Power diodes - Basic structure and V-I characteristics - various types - **DIACs** – Basic structureand V-I characteristics – **TRIACs** - Basic structure and V-I characteristics

Power BJT: Construction and working principle, quasisaturation, primary breakdown,secondary breakdown.

IGBTs - Basic structure and V-I characteristics.

Power MOSFETs - Basic structure and V-I characteristics

Thyristors- basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT

Unit 2: Rectifiers

Thyristors- series and parallel operation, methods of turning off - commutation circuits.

Line frequency phase controlled rectifiers using SCR

Single Phase – Half wave rectifier with R and RL loads – Full wave half controlled and fully controlled converters with continuous and constant currents - Input side harmonics and power factor - Effect of source inductance

Three Phase - Half wave rectifier with R and RL loads - Full wave fully controlled converterswith continuous and constant currents

Unit 3: Inverters &Cycloconverters Inverters –

Single phase inverters – series, parallel andbridge inverters. Single Phase Pulse Width Modulated (PWM) inverters – Basic circuit andoperation.Single phase series resonant inverter, Single phase bridge inverters,Three phase bridge inverters,Voltage control of inverters, Harmonics reduction techniques, Single phase and three phasecurrent source inverters

Unit-IV

AC Voltage Controllers

Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads Three phase ac voltage controllers (various configurations and comparison only),Single phase transformer taps changer. Cyclo Converters-Basic principle of operation, singlephase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation

Unit V: DC – DC Converters

Choppers - Principle of operation - step-up and step-down choppers.

Switching regulators - Buck regulators - Boost regulators - Buck-boost regulators – Switchedmode power supply - principle of operation and analysis

Text/Reference Books:

1. Ned Mohan, Power Electronics., John Wiley and Sons, 2nd edition, 1995.
2. Rashid, Power Electronics, Circuits Devices and Applications, Pearson Education, 3rdedition,2004.
3. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
4. Dewan&Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
5. Cyril W Lander, Power Electronics, McGraw Hill, 3rd edition, 1993.
6. M.D. Singh and K.B.Khanchandani, "Power Electronics"Tata MC Graw Hill, 2005
7. P.C Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2nd Edition.
8. P.S Bhimbhra , " Power Electronics", Khanna Publishers, 2012

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Electronics & Communication Engineering, VI-Semester

Open Elective EC- 605 (D) IoT and Applications

UNIT 1

Introduction – Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs .

UNIT 2

IoT & M2M:

Machine to Machine, Difference between IoT and M2M, Software define Network.

UNIT 3

Network & Communication aspects:

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination, Communication with Cognitive radio networks: OSI model and framework.

UNIT 4

Challenges in IoT:

Design challenges, Development challenges, Security challenges, Other challenges.

UNIT 5

Domain specific applications of IoT:

Home automation, Industry applications, Surveillance applications, Other IoT applications

Developing IoTs:

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

Suggested Books:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On Approach,

2. Waltenegus Dargie,Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice"

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester

Open Elective EC- 703 (D) Wireless Sensor Networks

Unit I Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Issues and challenges in wireless sensor networks.

Unit II Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit III Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit IV Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules-Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Unit V WSN Applications with 5G Networks, efficient energy routing protocol, 5G with Adhoc networks, wireless Adhoc network with 5G, WSN: Home Control - Building Automation - Industrial Automation - Medical Applications, Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. Cognitive Radio N: Introduction applications, features, challenges.

Reference Books:

1. Wireless Sensor Networks Technology, Protocols, and Applications- Sohraby, Minoli and Znati Wiley.
2. Advanced Wireless Sensing Techniques for 5G Networks- Tomar, and Ashish, CRC Press, T&F.
3. Protocols and Architectures for Wireless Sensor Networks- Karl and Willig, John Wiley & Sons.
4. Sensors Handbook- Sabrie Soloman, McGraw Hill.

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Electronics & Communication Engineering, VI-Semester

Open Elective EC- 704 (A) Mobile Ad hoc networks

Unit-1

Introduction to adhoc networks – definition, characteristics features, applications. Charectristics of Wireless channel, Adhoc Mobility Models:- Indoor and out door models.

Unit -2

Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, Hierarchical Routing, Table drive routing protocol, On-demand routing protocol. Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT IV

Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

Unit-V

Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

Unit-VI

Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

TEXT BOOKS

1. C. Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network
4. Research,” Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering VII-Semester

EC701 MICROWAVE ENGINEERING

UNIT 1

ELEMENTS OF MICROWAVE/MILLIMETER WAVE INTEGRATED CIRCUITS: classification of Transmission lines: Planar, quasi- planar and 3D structure and their properties, field distribution and range of application, Transverse transmission the techniques for multi-dielectric planar structure, Analysis of discontinuities in planar and non-planar transition line.

UNIT 2

PROPAGATION THROUGH WAVEGUIDES: Rectangular and circular waveguides solution of wave equation for TE & TM modes, degenerate and dominant modes, power transmission power loss, Excitation of wave guides , Non existence of TEM mode in waveguide, Introduction to stripline and Microstrip-line.

UNIT 3

MICROWAVE CAVITY RESONATORS: Rectangular and cylindrical cavities, Quality factor and Excitation of cavities. Microwave Components: Waveguide couplings, bends and tourists, Design and circuit realization of filters, couplers, phase shifters, E-plane, H-plane and hybrid Tees, Hybrid ring wave meters: Isolators and circulators, tunable detectors, slotted line carriage, VSWR meter.

UNIT 4

MICROWAVE MEASUREMENTS: measurement of frequency, wave length, VSWR, impedance, Attenuation Low and high power radiation patterns. Limitation of Conventional active devices at microwave frequency.

UNIT 5

MICROWAVE TUBES: Klystron, Reflex klystron, magnetron, TWT, BWO: principle of operation and its performance characteristic and application.

SUGGESTED BOOKS:

1. Pozar « Microwave Engineering » 3rd edition, John Wiley (India).
2. Microwave Engg. , Radhakrishna, BSP Publication
3. Collin, R.E. Foundations for Microwave Engineering; TMH 2nd Ed.
4. Rizzi, Microwave Engineering: Passive Circuits; PHI.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester

EC- 702 OPTICAL FIBRE COMMUNICATION

Course Objective:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

UNIT 1

INTRODUCTION: Introduction to Optical fiber Communication System, Technology used in OFC System, Structure and types of Fiber, modes and Configuration**,** mode theory for circular guide modal equation, modes in optical fiber, linearly polarized modes, attenuation factors, pulse broadening in optical fiber, single mode fiber, mode field diameter, single distortion in single mode fiber, Derivation of material dispersion and waveguide dispersion.

Attenuation, Signal Degradation in Optical Waveguides, Pulse Broadening in Graded index fiber Waveguides, Mode Coupling.

UNIT 2

Transmission Characteristic of Optical Fiber

Attenuation-absorption –scattering losses-bending losses-core and cladding losses-signal dispersion - inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersiondispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profilecutoff wave length-dispersion calculation-mode field diameter.

UNIT 3

Optical Sources and Detectors

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

UNIT 4

ANALYSIS AND PERFORMANCE OF OPTICAL RECEIVER: Receiver Sensitivity, Photodiode for optical receiver, Optical Receiver Design, recent receiver circuits, System configuration and power budget.

UNIT 5

Optical Communication Systems and Networks

System design consideration Point – to -Point link design -Link power budget -rise time budget, WDM -Passive DWDM Components-Elements of optical networks-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton. networks,

Course Outcome:

At the end of the course, the student should be able to:

- Realize basic elements in optical fibers, different modes and configurations.
- Analyze the transmission characteristics associated with dispersion and polarization techniques.
- Design optical sources and detectors with their use in optical communication system.
- Construct fiber optic receiver systems, measurements and coupling techniques.
- Design optical communication systems and its networks.

Text Books:

1. P Chakrabarti, "Optical Fiber Communication, McGraw Hill Education (India)Private Limited, 2016 (Unit I, II, III)
2. Gred Keiser,"Optical Fiber Communication, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (Unit I, IV, V)

References:

1. John M.Senior, Optical fiber communication, Pearson Education, second edition.2007.
2. Rajiv Ramaswami, Optical Networks , Second Edition, Elsevier , 2004.
3. J.Gower, Optical Communication System, Prentice Hall of India, 2001.
4. Govind P. Agrawal, Fiber-optic communication systems, third edition, John Wiley and sons, 2004.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering VII-Semester

Elective - EC- 703 (A) MIXED CIRCUIT DESIGN

Course Objective:

The student should be made to:

- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio
- Study the integrated circuit of oscillators and PLLs

Unit I

CMOS Amplifiers- Common Source with diode connected loads and current source load, CS stage with source degeneration, CG stage and Source Follower (Only Voltage Gain and Output impedance of circuits)

Unit II

Integrator Based Cmos Filters
Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

Unit III

Data Converter Architectures
DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADCs, Successive Approximation ADC.

Unit IV

Comparator- Characterization of a comparator-static and dynamic, A Two stage open loop comparator (analysis not required)

Unit V

Oscillators and PLL
LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

Course Outcome:

Upon completion of the course, student should be able to

- Apply the concepts for mixed signal MOS circuit.
- Analyze the characteristics of IC based CMOS filters.
- Design of various data converter architecture circuits.

- Analyze the signal to noise ratio and modeling of mixed signals.
- Design of oscillators and phase lock loop circuit.

References:

1. CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.
2. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33rd Reprint, 2016.

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New Scheme of Examination as per AICTE Flexible Curricula
Electronics and Communication Engg, VII-Semester Dep Elective
EC- 703 (B) Digital Image Processing

UNIT 1

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models.

UNIT 2

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT 3

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

UNIT 4

Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.Representation and Description: Representation, Boundary descriptors.

UNIT 5

Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation- Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Suggested Books:

1. Rafael C. Gonzalez, Digital Image Processing Using MATLAB, Mc Graw Hill Pvt. Ltd.
2. Jain, Fundamentals of Digital Image Processing, PHI.
3. Pratt, Digital Image Processing, John Willey.
4. Pakhira, Digital Image Processing and Pattern Recognition, PHI.

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New Scheme of Examination as per AICTE Flexible Curricula
Electronics and Communication Engg, VII-Semester Dep Elective
EC- 703 (C) Advanced Communication Systems

Objective: The objective of the course is to introduce the students to advanced topics in digital communications. The course aims to provide the students an understanding of the fundamental concepts and techniques, used in the design, performance analysis, and implementation of current communication systems and useful in the development of the communication systems of the future.

Syllabus:
Unit 1.
Review of digital modulation schemes for baseband and bandlimited channels and their corresponding optimal detectors and error probabilities.

Unit 2
Digital TV: Digitized Video, Source coding of Digitized Video, Compression of Frames, DCT based (JPED), Compression of Moving Pictures (MPEG). Basic blocks of MPEG2 and MPE4, Digital Video Broadcasting (DVB)

Unit 3
Spread Spectrum Communications:Spreading sequences- Properties of Spreading Sequences, Pseudo-noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes Direct sequence spread spectrum – DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser detector, Liner multiuser detection.

UNIT – 4 : MIMO Systems:Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM

UNIT – V : ATM Traffic and congestion Control: Requirements for ATM Traffic and Congestion Control, CellDelay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control

TEXT BOOKS:

- Gary J. Mullett, “Introduction to Wireless Telecommunications Systems and Networks”, CENGAGE
- Upena Dalal, “Wireless Communication”, Oxford University Press, 2009
- William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM” Prentice Hall, 4th edition

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering VII Semester

Dep Elective EC- 703 (D) Wireless Sensor Networks

Unit I Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Issues and challenges in wireless sensor networks.

Unit II Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit III Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit IV Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules-Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Unit V WSN Applications with 5G Networks, efficient energy routing protocol, 5G with Adhoc networks, wireless Adhoc network with 5G, WSN: Home Control - Building Automation - Industrial Automation - Medical Applications, Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. Cognitive Radio N: Introduction applications, features, challenges.

Reference Books:

1. Wireless Sensor Networks Technology, Protocols, and Applications- Sohraby, Minoli and Znati Wiley.
2. Advanced Wireless Sensing Techniques for 5G Networks- Tomar, and Ashish, CRC Press, T&F.
3. Protocols and Architectures for Wireless Sensor Networks- Karl and Willig, John Wiley & Sons.
4. Sensors Handbook- Sabrie Soloman, McGraw Hill.

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIIII-Semester

Open Elective EC- 704 (A) Mobile Ad hoc networks

Unit-1

Introduction to adhoc networks – definition, characteristics features, applications. Charectristics of Wireless channel, Adhoc Mobility Models:- Indoor and out door models.

Unit -2

Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, Hierarchical Routing, Table drive routing protocol, On-demand routing protocol. Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT IV

Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

Unit-V

Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

Unit-VI

Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

TEXT BOOKS

1. C. Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network
4. Research,” Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VII-Semester

Open Elective EC- 704 (B) Artificial Intelligence

Course Objectives:

- The adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, and code analysis and product recommendations. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behaviour.

Course Learning Outcomes:

1. Acquire advanced Data Analysis skills.
2. Stay Industry relevant and grow in your career.
3. Create AI/ML solutions for various business problems. Ÿ Build and deploy production grade AI/ML applications.
4. Apply AI/ML methods, techniques and tools immediately

Course Content:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI. Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)

Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience.

Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)

Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy

sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees.
Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)

Introduction, Knowledge acquisition, Knowledge base, Working memory, Inference engine, Expert system shells, Explanation, Application of expert systems.
Fundamentals of Neural Networks: Introduction and research history, Model of artificial neuron, Characteristics of neural networks, learning methods in neural networks, Single-layer neural network system, Applications of neural networks.
Fundamentals of Genetic Algorithms: Introduction, Encoding, Operators of genetic algorithm, Basic genetic algorithm.

Text/Reference Books:

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.
3. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann
4. Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VII-Semester

Open Elective EC- 704 (C) Artificial Neural Network

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

Unit 1

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

Unit 2

Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem. Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

Unit 3

Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.

Unit 4

S**upport Vector Machines and Radial Basis Function:** Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

Unit 5

Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

TEXT BOOKS:

- Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
- Artificial Neural Networks – B. Yegnanarayana Prentice Hall of India P Ltd 2005
- Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
- Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
- Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

EC- 801 Television and Radar Engineering

Course Content:

Unit I : **Basic Television System**

Introduction: Scanning principles: sound and picture transmission, scanning process, camera pick-up devices, video signal, transmission and reception of video signals, brightness perception and photometric quantities, aspect ratio and rectangular scanning, persistence of vision and flicker, vertical resolution, the Kell factor, horizontal resolution and video bandwidth, interlaced scanning.
Composite Video Signal: Lines and scanning, video signal components, horizontal sync and blanking standards, vertical sync and blanking standards, video modulation and vestigial side band signal, sound modulation and inter-carrier system.
Television Standards: Standard channel characteristics, reception of the vestigial side band signals, television broadcast channel, consolidated CCIR system-B standard, various television broadcast systems.
Television Pick-up devices and Cameras: Camera lenses, auto-focus systems, television camera pick-ups, Silicon Vidicon, CCD image sensors, video processing of camera pick-up signal.

Unit II : **Colour Television**

Colour fundamentals: mixing of colours and colour perception, chromaticity diagram, colour television camera, colour TV signals and transmission, NTSC, SECAM and PAL system, Trinitron picture tube, automatic degaussing, plasma, LCD displays.
Television transmission and reception: requirement of TV broadcast transmission, design principle of TV transmitters, IF modulation, power output stages, block diagram of TV transmitter, co-channel interference and ghost images during propagation of television signals, antenna requirements for television system, block schematic and function requirements for television receivers, trends in circuit design, colour television receiver.

Unit III : **Digital Television Technology**

Merits of digital technology, fully digital television system, digital television signals, digitized video parameters, digital video hardware, transmission of digital TV signals, bit rate reduction, digital TV receivers, video processor unit, audio processor unit.
Other television systems: Closed Circuit television system (CCTV), Cable television system (CATV), multiplexed analog component encoding television system (MAC TV), High definition television system (HDTV), High definition multiplexed analog component television (HD-MAC TV), High Performance Computer Controlled TV (HPCC TV), 3-D stereoscopic television techniques..

Unit IV : **RADAR**

The Radar range equation, block diagram and operation, performance factors: prediction of range performance, minimum detectable signal, receiver noise, probability density functions, signal to noise ratios. Radar cross section of targets, transmitter power, pulse repetition frequency and range ambiguities, antenna parameters.
The CW radar: the Doppler effect, FM-CW radar.
The Moving Target Indicator (MTI) Radar: delay line cancellers.

Unit V : **Radar Receivers**

The radar receiver, noise figure, mixers, low noise front ends, displays- type A and PPI representations, duplexer and receiver protectors**Other Radar systems:** Synthetic aperture radar, HF over the horizon radar, Air Surveillance Radar (ASR), Bistatic radar.

References:

1. M. Dhake: Television and Video Engineering, 2nd Edition,TMH, New Delhi.
2. M. I. Skolnik: Introduction to Radar Systems, TMH, New Delhi.
3. R. G. Gupta: Television Engineering and Video Systems, TMH, New Delhi.
4. R. R. Gulati: Monochrome and Colour Television, New Age International.
5. Grob and Herndon: Basic Television and Video Systems, McGraw Hill International.
6. P. Z. Peebles, Jr.: Radar Principles, Wiley India Pvt. LTD.
7. Edde: Radar- Principles, Technology Applications, Pearson Education.

List of Experiments:

Section A: Television Engg.

1. (a) To Study the Circuit Description of RF Tuner Section.
(b) To Study the RF Section by Measuring Voltages at Various Test Points.
(c) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for RF Section.
2. (a) To Study the Circuit Description of VIF Tuner Section.
(b) To Study the VIF Section by Measuring Voltages at Various Test Points.
(c) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for VIF Section.
3. (a) To Study the Circuit Description of Video and Chroma Section Tuner Section.
(b) To Study the Video and Chroma Section by Measuring Voltages at Various Test Points
(c) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for Video and Chroma Section.
4. (a) To Observe the Horizontal Oscillator and Horizontal Output Section through Various Test Point.
(b) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for Horizontal Oscillator and Horizontal Output
Section.
5. (a) To Observe the Vertical Oscillator and Vertical Output Section through Various Test Point.
(b) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for Vertical Oscillator and Vertical Output Section.
6. To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for Sound Output Section.
7. To Study the Circuit Description of Audio and Video Section Tuner Section.
8. (a) To Study the System Control Section by Measuring Voltages at Various Test Points.
(b) To Study the Fault Simulation and Step-by-Step Fault Finding Procedure for System Control Section.

Section B: RADAR

1. Study of Doppler Effect.
2. To Measure Speed of a fan and various Other Objects (Pendulum, Tuning Fork, Plate etc.)
3. To Simulate the Variable Speed of Moving Objects using Velocity Simulator.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

EC- 802 Digital System Design using VHDL

UNIT 1

INTRODUCTION TO VHDL: VHDL description, combinational networks, modeling flip-flop using VHDL, VHDL model for multiplexer, compliance and simulation of VHDL, codes, modeling a sequential machine, variables, signals and constants, arrays VHDL operators, VHDL functions, VHDL procedures, packages and libraries, VHDL model for a counter. Attributes, transport and inertial delays, operator over loading, multi valued logic and signal resolution, IEEE-1164, standard logic, generic, generates statements, synthesis of VHDL codes.

UNIT 2

DESIGN OF NETWORKS FOR ARITHMATIC OPERATIONS: Design of serial adder with accumulator, state graph for control networks design of binary multiplier, multiplication of signed binary numbers, design of binary divider.

DIGITAL DESIGN WITH SM CHART: state machine charts, derivation of SM charts, realization of SM charts, implementation of dice game, alternative realization of SM charts using microprogramming.

UNIT 3

FLOATING POINT ARITHMETIC: Representation of floating point numbers, floating point multiplication, and other floating point operations.

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC

DEVICES: Xilinx 3000 series FPGAs, Xilinx 4000 series FPGAs, using one hot state assignment.

UNIT 4

MEMORY MODELS FOR MEMORIES AND BUSES: Static RAM, a simplified 486 bus model, interfacing memory to microprocessor bus

UNIT 5

DESIGN EXAMPLES: UART design, description of MC68HC05 microcontroller, design of microcontroller CPU, and complete microcontroller design.

SUGGESTED BOOKS:

1. Charles H Roth Jr, “Digital System Design using VHDL”, Thomson Learning, 02.

2. Stephen Brown & Zvonko Vranesic, “Fundamentals of digital logic design with VHDL”, TMH, 2nd Ed., 2007.

3. Jhon F Wakerly, “Digital design”, PHI, 4th Ed.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Dep Elective EC- 803 (A) Wireless Communications

UNIT 1

SERVICES AND TECHNICAL CHALLENGES: Types of Services, Requirements for the services, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems, Principles of Cellular networks, Multiple Access Schemes.

UNIT 2

WIRELESS PROPAGATION CHANNELS : Propagation Mechanisms (Qualitative treatment), Propagation effects with mobile radio, Channel Classification, Link calculations, Narrowband and Wideband models, propagation models, Path loss components.

UNIT 3

WIRELESS TRANSCEIVERS: Structure of a wireless communication link, Modulation and demodulation – Quadrature/4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, Power spectrum and Error performance in fading channels.

UNIT 4

SIGNAL PROCESSING IN WIRELESS SYSTEMS : Principle of Diversity, Macro-diversity, Microdiversity, Signal Combining Techniques, Transmit diversity, Equalizers- Linear and Decision Feedback equalizers, Review of Channel coding and Speech coding techniques.

UNIT 5

ADVANCED TRANSCEIVER SCHEMES

Spread Spectrum Systems- Cellular Code Division Multiple Access Systems- Principle, Power control, Effects of multipath propagation on Code Division Multiple Access, application of Orthogonal Frequency Division Multiplexing in GSM, IS–95, IS-2000 and Third Generation Wireless Networks and Standards

SUGGESTED BOOKS:

1. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2006.
2. Simon Haykin & Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.
3. Rappaport. T.S., “Wireless communications”, Pearson Education, 2003.
4. Gordon L. Stuber, “Principles of Mobile Communication”, Springer International Ltd., 2001.
5. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Dep Elective EC- 803(B) Adaptive Signal Processing

UNIT 1

INTRODUCTION: Definition and characteristics, general properties open and closed loop adaptation.

UNIT 2

ADAPTIVE LINEAR COMBINER: General description, input signal and Weight vectors, desired response and error performance function, gradient and minimum mean square, alternative definition of gradient, decorelection of error and input components.

UNIT 3

THEORY OF ADAPTATION WITH STATIONARY SIGNALS: Input correlation matrix, Eigen values and eigenvectors of the correlation matrix, and their geometrical significance. Basic ideas of gradient search methods, gradient search by newton's method and method of steepest descent, gradient component estimation by derivative measurement, effects of gradient noise, on weight vector solution, excess MSE, time constant and mis-adjustment, performance comparison of Newton and S.D. methods.

UNIT 4

ADAPTIVE ALGORITHMS: Least mean square algorithm, convergence, learning curve noise in Weight vector misadjustment and performances of LMS algorithms, sequential regression algorithm, adaptive recursive LMS algorithm, random search algorithm.

RECURSIVE LEAST SQUARE ALGORITHM: Preliminaries, matrix inversion lemma, exponentially weighted RLS algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS algorithm

UNIT 5

ADAPTIVE FILTER STRUCTURES: Lattice structures, all poles and all zeroes versions, adaptive lattice predictor. Lattice LMS algorithms, and lattice SER algorithms, adaptive filters with orthogonal signals, DFT and lattice preprocessors.

ADAPTIVE FILTER APPLICATIONS: (i) Adaptive modeling and systems identification. (ii) Inverse adaptive modeling, equalization and deconvolution

SUGGESTED BOOKS:

1. Adaptive Signal Processing, Widrow and Stearns, Pearson Education
2. Adaptive Filter Theory, Simon Haykin, Pearson Education

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Dep Elective EC- 803(C) Telecommunication Switching Systems

UNIT 1

INTRODUCTION: Message switching, circuits switching, functions of a switching system, register translator- senders, distribution frames, crossbar switch, a general trunking. Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Bi-phase, Differential Encoding, Time Division Multiplexing (T1 carrier system CCIT and DS lines) Time Division Multiplex Loops and Rings.

UNIT 2

DIGITAL SWITCHING: Switching functions, space division switching, multiple stage switching, nonblocking switches, blocking Probabilities DCS hierarchy, integrated cross connect equipment, digital switching in environment, zero loss switching.

UNIT 3

TELECOM TRAFFIC ENGINEERING: Network traffic load and parameters, grade of service and blocking probability, Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

UNIT 4

NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT: Timing Recovery, Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT 5

DIGITAL SUBSCRIBER ACCESS: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. HD-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL.

Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service.

SUGGESTED BOOKS:

1. Tele communication switching system and networks - Thyagarajan Viswanath, PHI, 2000.
2. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001.
3. Data Communications & Networks - Achyut. S.Godbole, TMH, 2004.
4. Principles of Communication Systems – H. Taub & D. Schilling , TMH, 2nd Edition, 2003.
5. Telecommunication switching, Traffic and Networks - J E Flood, Pearson Education, 2002

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New Scheme of Examination as per AICTE Flexible Curricula
Electronics & Communication Engineering, VIII-Semester
Dep Elective EC- 803(D) SDN and Cognitive radio Networks

UNIT I
INTRODUCING SDN
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN
UNIT II SDN ABSTRACTIONS
How SDN Works - The Openflow Protocol - SDN Controllers: Introduction - General Concepts - VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK

UNIT III
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3

UNIT IV

Reconfigurable Wireless communication Systems, Digital Radio Processing. Concept of Cognitive Radio: Cognitive Radio Bands, Spectrum policy, Application of Cognitive radio, Cognitive radio network design, spectrum coexistence in Cognitive radio network

UNIT – V:

Carrier Sensing, Routing, Flow Control. Cooperative Communications and Networks: Information Theory for Cooperative Communications, Cooperative Communications, Cooperative Wireless Networks. Cognitive Radio Communications: Cognitive Radios and Dynamic Spectrum Access, Analytical Approach and Algorithms for Dynamic Spectrum Access, Fundamental Limits of Cognitive Radios, Mathematical Models toward Networking Cognitive Radios. Spectrum Sensing in Cognitive Radio Networks.

REFERENCES
1. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014
2. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
3. Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013
4. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
5. GS Tomar and A Bagwari "Introduction to Cognitive Radio Networks and Application, CRC Press 2016

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Open Elective EC- 804 (A) Industrial Automation Technologies

Unit I

Automation, Role of PLC ,SCADA and IoT in Industrial Automation System, Design in automation system, relays, Scope of Automation field , Ethernet, RS232. Profibus DP, Signal Types, Comparison of PLC & PC, How does a PLC work, Applications of PLC, Different types of PLC's ,Specifications of PLC, Onboard/ Inline IO's, Memory allocation in PLC, scan time. Hardware details, Wiring & Connection Techniques, Safety measures for handling the PLC, Diagnosis of PLC status & other hardware connected to PLC, Industrial Sensors: Classification and type of sensors preferred in Automation, Characteristics of various proximity sensors like inductive, capacitive, magnetic, photoelectric and ultrasonic.

Unit II

Introduction: Hydraulics, Important basic terms, Industrial Hydraulics, Basic physical properties, Comparisons of Drives, Basic elements, commonly used symbols, Circuit symbols, Principle of Energy Conversion, Functional Groups in a Hydraulic System, Functionality of a Hydraulic System,Main functions of Hydraulic fluids, Requirements of Hydraulic fluids, Types of Hydraulic Fluids, Selection of Hydraulic fluid for an applications, Functions and Operating principle Different types of Hydraulic pumps and its selection, Design and operation of Hydraulic Cylinder, Types of cylinder

Unit-III

Pressure control valves, Directional Control Valves, Flow Control Valves , Accessories: Accumulator, Filter Introduction to Electro – Hydraulics: Solenoids, Function and operating principle of a relay, Relay as a logical switch, Symbols of most important switching elements (NO an NC), Signal storage concept, Electrical interlocking concept, Electrical ladder diagram, Momentary-contact limit switches

Unit-IV

Introduction to pneumatics: Pneumatics, Important basic terms Characteristics of Industrial Pneumatics, advantages and limitations, Comparisons of Pneumatics over other technology like Hydraulics, Electrical/ Electronic and Mechanical drives (Systems Comparison), Applications, circuits: Basic elements, commonly used symbols, Circuit symbols. Compressed Air Preparation. Compressor Unit, Drying of Compressed Air, Distribution of Compressed air, Filter, Pressure control valve, lubricator, air dryer

Unit-V

Direction Control Valve: Design Principle, Symbols, Operations, 3/2 Directional control valve, Manual operated, 5/2 Directional control valve, pneumatically operated, 5/3 Directional control valve, electrically operated, Pressure Valve, Flow Control Valves, Pneumatic cylinders, Introduction to Electro-Pneumatics: Electro – mechanical Relays, Symbols of electrical components like switch, contacts, solenoid, relay, LED etc, NO and NC contacts, magnetic proximity switch working principle, Electrical signal storage, Electrical ladder diagram, Logic flow diagram, Solenoid working principle, Solenoid operated valves, Advantages of solenoid operated valves over manual valves.

References:

1. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K. Deb, Jaico Publishing House, 2013
2. Programmable logic controller, Dunning, Delmar
3. Pneumatic Systems: Principles and Maintenance, S R Majumdar, TMH 1996
4. Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991

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New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering, VIII-Semester

Open Elective EC- 804 (B) Machine Learning

Course Objectives:

In this course we will study the basic component of an intelligence system i.e. machine learning, their functions, mechanisms, policies and techniques used in their implementation and examples.

Course Learning Outcomes:

1. List various approaches of Machine Learning.
2. Describe machine learning algorithms to solve the real world problems
3. Develop Hypothesis and machine learning models
4. Identify appropriate models for solving machine learning problems.
5. Apply learning techniques to solve real world machine learning problems.
6. Evaluate and interpret the results of the algorithms.

Course Content:

Unit I: Introduction: What Is Machine Learning?, Why Use Machine Learning? ,Types of Machine Learning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Hypothesis generation, Main Challenges of Machine Learning, Data sets and Testing and Validating.

Unit II: Concept Learning: Introduction to Concept Learning, Concept Learning Task, Notation, Inductive Learning Hypotheses, Concept Learning as Search: Generic-to-Specific Ordering of Hypotheses, Finding a Maximally Specific Hypotheses, Version Spaces, Candidate-Elimination Algorithms.

Unit III: Classification: MNIST Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label and Multi output classification.

Unit IV: Training Models: Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Estimating Probabilities, Training and Cost Function, and Decision Boundaries.

Unit V: Support Vector Machines Linear SVM Classification, Soft Margin Classification, Nonlinear SVM Classification, Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, Decision Function and Predictions, and The Dual Problem.

Unit VI: Decision Trees Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy, Regularization of hyper parameters, and Random Forests.

Unit VII: Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Choosing the Right Number of Dimensions.

Unit VIII: Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using clustering for image segmentation, Using Clustering for Pre-processing and for Semi-Supervised Learning.

Unit IX: Introduction to Neural Networks: From Biological to Artificial Neurons, Biological Neurons, Logical Computations with Neurons, The Perceptron, Multi-Layer Perceptron and Backpropagation.

Text/Reference Books:

1. Machine Learning, TOM M MITCHELL, TMH
2. Introduction to Machine Learning, 2nd Ed, Ethem Alpaydin, The MIT Press Cambridge, Massachusetts,London, England.
3. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Ed, Aurelien Geron, O'RIELLY.

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Electronics & Communication Engineering, VIII-Semester

Open Elective EC- 804 (C) Underwater Communication