ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

APPLIED ELECTRONICS AND INSTRUMENTATION (AEI)

Semester VIII/ AEI / B.TECH

Sl No	Sub-Code	Subject	Hrs			Credits
			L	T	P	C
Theory						
1	AI131801	Smart Sensors and Network	3	0	0	3
2	AI131802	Modern Control System	3	0	0	3
3	AI1318E03	Elective III(Departmental)	3	0	0	3
4	AI1318E04	Elective IV(Departmental)	3	0	0	3
5	**1318E05	Elective V(Open)	3	0	0	3
Practical						
6	AI131812	Modern Control System Lab	0	0	2	1
7	AI131816	Project	0	0	10	5
8	AI131821	Comprehensive Viva	0	0	0	4
Total			15	0	12	**25**
Total Contact Hours: 27						
Total Credits : 25						

Elective-III Subjects		
Sl No	**Subject Code**	**Subject**
1	AI1318E03(I)	Laser and Radar Instrumentation
2	EC1318E03(II)	Digital Image Processing
3	AI1318E03(III)	Robotics and Automation
4	AI1318E03(IV)	Fluidic Power Control
5	AI1318E03(V)	Any other subject offered from time to time with the approval of the university

Elective-IV Subjects		
Sl No	**Subject Code**	**Subject**
1	EE1318E04(I)	Digital System Design
2	AI1318E04(II)	Instrumentation in Process Industries
3	AI1318E04(III)	Integrated Circuit Technology
4	AI1318E04(IV)	Speech Processing
5	AI1318E04(V)	Any other subject offered from time to time with the approval of the university

Elective-V Subjects		
Sl No	**Subject Code**	**Subject**
1	**1318E05(I)	Multimedia Systems
2	**1318E05(II)	Artificial Intelligence and Expert Systems
3	**1318E05(III)	Nanotechnology and Nano-Electronics
4	**1318E05(IV)	Mobile Communications
5	**1318E05(V)	Any other subject offered from time to time with the approval of the university

Course Title: SMART SENSORS AND NETWORK
Course Code: AI131801
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**SMART SENSORS FUNDAMENTALS**	Basic sensor technology, Sensor systems; Smart sensor definitions; Smart sensor: Characteristics; Smart sensor architectures; Smart sensor buses and interfaces; Smart sensor software; Data acquisition methods for smart sensors; Virtual sensor systems; Smart sensors for electrical and non-electrical variables.	9
2	**SENSOR NETWORK ARCHITECTURES**	Single-node architecture; Multi-node architecture; Design principles; Energy efficient topologies; Wired sensor networks and wireless sensor networks; Applications; Communication.	9
3	**PROTOCOLS**	Physical layer; MAC protocols; Link layer protocols; Localization and positioning; Routing protocols; Transport layer; Data gathering and processing: Protocols for gathering information; Data processing techniques.	9
4	**ENERGY MANAGEMENT**	Energy consumption of sensor nodes; Techniques for reducing consumption of energy; Energy aware routing; Security, reliability and fault-tolerance: Security and privacy protection; Reliability support; Fault-tolerance; Sensor network standards; platforms and tools: IEEE 802.15.4 and IEEE 802.11; Berkeley.	9

RECOMMENDED BOOKS:

1. N. V. Kirianaki, S. Y. Yurish, N. O. Shpak V. P. Deynega: Data Acquisition and Signal Processing for Smart Sensors, John Wiley.
2. H. Karl, A. Willig: Protocols and Architectures for Wireless Sensor Networks, John Wiley.
3. M. Ilyas, I. Mahgoub (ed.): Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC.

Course Title: MODERN CONTROL SYSTEM
Course Code: AI131802
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**STATE VARIABLE DESIGN**	Introduction to state Model: Effect of state Feedback, Necessary and Sufficient Condition for Arbitrary Pole placement; pole placement design; design of state Observers, separation principle; servo design: State Feedback with integral control.	8
2	**PHASE PLANE ANALYSIS**	Features of linear and nonlinear systems: Common physical non-linearities; Methods of linearization. Concept of phase portraits; Singular points; Limit cycles. Construction of phase portraits; Phase plane analysis of linear and non-linear systems; Isocline method.	7
3	**DESCRIBING FUNCTION ANALYSIS**	Basic concepts, derivation of describing functions for common non-linearities**;** Describing function analysis of non-linear systems, limit cycles, Stability of oscillations.	7
4	**OPTIMAL CONTROL**	Introduction: Time varying optimal control; LQR steady state optimal control; Solution of Ricatti's equation; Application examples.	7
5	**OPTIMAL ESTIMATION**	Optimal estimation, Kalman Bucy Filter-Solution by duality principle. Discrete systems, Kalman Filter, Application examples.	7

RECOMMENDED BOOKS:

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers.
2. G. J. Thaler, "Automatic Control Systems", Jaico Publishing House.
3. M.Gopal, Modern Control System Theory, New Age International Publishers.

Course Title: ELECTIVE III (Departmental)
Course Code: AI1318E03(I)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

LASER AND RADAR INSTRUMENTATION

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**LASER-THEORY AND TECHNOLOGY**	Principles of emission, modes of resonant cavity, CW and pulse operations, Mode locking gas, Solid state, Semiconductor and liquid lasers, application of lasers. **Optical Fiber and its applications:** Joints, Connectors and couplers, sources-laser, LEDs.	12
2	**DETECTOR**	PIN diodes, APD, Application to Communication and Instrumentation. Pulsed radar: Basic principle, Block diagram, Operation of Pulse, Range, Radar equation and minimum detection signal, Limitation of Radar, PFR and Range ambiguities, Brief idea of pulser circuits and indicators.	12
3	**CW AND FW RADAR**	Doppler effect, CW radar, Range measuring Doppler system, FM CW radar, Airoborne Doppler navigation, Multiple Frequency CW Radar MTI radar, Pulse Doppler radar.	12

RECOMMENDED BOOKS:

1. Young M. Optics and Laser: An Engineering Physics Approach.
2. Cheo,Peter K., Fiber Optics: Devices and Systems,Prentice Hall Series on Solid State Physical Electronics.
3. Skolnock, Introduction to Radar System.
4. E.E. Terman, Electronic and Radio Engineering.
5. Reidnour, Radar System Engineering.

Course Title: ELECTIVE III (Departmental)
Course Code: EC1318E03(II)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

DIGITAL IMAGE PROCESSING

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**FUNDAMENTALS OF IMAGE PROCESSING**	Introduction to structure of human eye, Image formation in eye, brightness adaption and discrimination, Image sensing and acquisition, storage, Sampling and quantization, types of images, relationship between pixels, colour model.	3
2	**IMAGE TRANSFORMS**	DFT and 2D DFT, properties of DFT, FFT and IFFT, Walsh Transform, Hadamard transform, Discrete Cosine Transform, Slant Transform, KL transform.	4
3	**IMAGE ENHANCEMENT IN SPATIAL AND FREQUENCY DOMAIN**	Introduction to image enhancement, Intensity transformations, Histogram Processing and Equalization, Spatial Filtering: Smoothing, Sharpening filters, Frequency Domain Filters: Homomorphic filtering.	7
4	**IMAGE RESTORATION**	Introduction, Degradation model, Inverse Filtering, Weiner Filtering.	3
5	**IMAGE COMPRESSION**	Fundamentals, Redundancies: Coding, Interpixel and psychovisual redundancies, Fidelity criteria, Image Compression Model, Lossy Compression: variable length coding and bit plane coding, Lossless Compresssion: transform coding, Image Compression Standards: Binary Image and Continuous tone still image compression standards.	7
6	**IMAGE SEGMENTATION, REPRESENTATION AND DESCRIPTION**	Detection of discontinuities, Edge linking and boundary detection, Thresholding Region based segmentation, Image Representation Schemes, Boundary Descriptors and regional descriptors.	7
7	**MORPHOLOGICAL PROCESSING**	Introduction, dilation, erosion, opening, closing, Morphological algorithms operation on Binary and Gray scale Image.	5

TEXT BOOKS:

1. R. C Gonzalez and R.E. Woods, Digital Image Processing, Prentice Hall
2. R. C Gonzalez ,Digital Image Processing using MATLAB, TMH-2nd edition

REFERENCE BOOKS:

1. A.K.Jain, "Fundamentals of Digital Image Processing", PHI
2. S. Annadurai and R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson
3. K.R. Castleman, "Digital Image Processing", PHI
4. W.K.Pratt, "Digital Image Processing", John Wiley Interscience
5. S. Sridhar, "Digital Image Processing", Oxford

Course Title: ELECTIVE III (Departmental)
Course Code: AI1318E03(III)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

ROBOTICS AND AUTOMATION

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**BASIC CONCEPTS**	Definition and origin of robotics ; Different types of robotics ;Various generations of robots ; Degrees of freedom ; Asimov‟s laws of robotics ; Dynamic stabilization of robots.	6
2	**POWER SOURCES AND SENSORS**	Hydraulic, pneumatic and electric drives ; Determination of HP of motor and gearing ratio ;Variable speed arrangements ; Path determination ; Micro machines in robotics ; Machine vision ; Ranging ; Laser ; Acoustic; Magnetic, Fiber optic and tactile sensors.	8
3	**MANIPULATORS, ACTUATORS AND GRIPPERS**	Construction of manipulators; Manipulator dynamics and force control; Electronic and pneumatic manipulator control circuits; End effectors; Various types of grippers, design considerations.	8
4	**KINEMATICS AND PATH PLANNING**	Solution of inverse kinematics problem: multiple solution, jacobian work envelop, hill Climbing techniques; Robot programming languages.	7
5	**CASE STUDIES**	Mutiple robots; Machine interface; Robots in manufacturing and non- manufacturing applications; Robot cell design; Selection of robot.	7

RECOMMENDED BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., “Industrial Robotics”, Mc Graw-Hill Singapore.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai.
3. Deb. S.R.,“Robotics Technology and flexible Automation”, John Wiley, USA.
4. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi.
5. Mc Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA.

Course Title: ELECTIVE III (Departmental)
Course Code: AI1318E03(IV)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

FLUIDIC POWER CONTROL

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**INTRODUCTION**	Scope & potential of application of pneumatics, hydraulics in instrumentation and control.	3
2	**FUNDAMENTALS OF FLUID FLOW**	Fundamentals of fluid flow through orifices, restrictions, linearization of fluid flow equations.	8
3	**PNEUMATIC SYSTEM ELEMENTS AND DEVICES**	Pneumatic system elements and devices and their linearized modelling, e.g.- sources, regulated sources, valve actuators etc. Hydraulic system elements & devices & their linearized modeling.	9
4	**FEEDBACK & ITS APPLICATIONS**	Feedback & its applications to development of hydraulic controllers. Pneumatic controllers, control schemes & control circuits, pneumatic telemetering, hydraulic power transmission.	8
5	**HYDRAULIC PUMPS & MOTORS**	Hydraulic pumps & motors, hydraulic and pneumatic valves, Fluidic elements, characteristics, logic devices. Analysis & synthesis of fluid logic systems with applications.	8

RECOMMENDED BOOKS:

1) Control system components, Gibson & Tutor, McGraw hill.
2) Analysis & design of pneumatic Systems, Anderson & Blaine.
3) Fluidic power systems, Morse, AC
4) Fluid Power & applications, Esposito

Course Title: ELECTIVE IV (Departmental)
Course Code: EE1318E04 (I)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

DIGITAL SYSTEM DESIGN

MODULE	TOPIC	CONTENTS	HOURS
1	**REVIEW**	High speed addition, Modular design using IC chips, Hazard and hazard-free realization, design of decoder circuit FPGA, CPLD, PLA, PLD, RAM, ROM	6
2	**SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN**	Design and analysis of sequential circuit, State machine and timing diagram of Mealy and Moore machines, design of sequential circuit from state table and state diagram, sequence generator and sequence detector	6
3	**VHDL**	Introduction to VHDL, Basic language elements, Behavioral modeling, dataflow modeling, structural modeling, Design of combinational circuit using VHDL(half adder, full adder, half subtractor and full subtractor, parallel adder, ripple carry adder, 4-bit adder, parity checker, parity generator, encoder, decoder, multiplexer, demultiplexer, comparator, tristate buffer), Design of sequential circuit using VHDL(flip-flop, counter, register, shift register)	6
4	**DESIGN CONVENTION**	Register transfer, electronic realization of hardwired control unit, conditional transfer	6
5	**AHPL**	Introduction to AHPL, AHPL operators, operand convention of AHPL, AHPL conventions for combinational logic and memory arrays	6
6	**HIGH-VOLTAGE LABORATORY**	Planning, testing and other facilities, test equipment, clearance and layout safety measures, grounding, High-voltage connections.	6

RECOMMENDED BOOKS:

1. J. Frederic and G.R. Peterson- Digital Systems: Hardware Organization and Design, John Wiley and Sons.
2. F.J. Hill and G.R. Peterson- Switching theory and logical Design: John Wiley and Sons.
3. VHDL Primer- J. Bhasker.
4. Circuit design with VHDL-V.Pedroni.

Course Title: ELECTIVE IV (Departmental)
Course Code: AI1318E04 (II)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

INSTRUMENTATION IN PROCESS INDUSTRIES

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**INTRODUCTION TO PROCESS**	Definition of a process, Block diagram representation of a process, Position and regulatory control system.	2
2	**INSTRUMENTATION SYSTEM DESIGN FOR DIFFERENT PROCESSES**	Desecrator of power plant: i. Safety Interlock instrumentation system of a turbine driven boiler feed water pump, ii. Digester-paper pulp, iii. Control of Distillation Column, iv. Control of Furnace, v. Klin Instrumentation and control in Brewing industry.	14
3	**PROCESS PLANT INSTRUMENTATION**	Ammonia Production in a Fertilizer plant, Instrumentation system design for Carbon, Sulphur and Hydrogen Sulphide gas removal process, Evaporators: Single effect evaporators, Short Tube Vertical Type, Vacuum pan, Long Tube Vertical Evaporator, Long Tube Vertical Black Liquor Evaporator, Studies of different units related to process plant: Annunciator, Transmitter.	12
4	**MODERN CONTROLLERS USED IN PROCESS INDUSTRIES**	Study of PLC, SCADA and DCS systems and their comparison.	8

RECOMMENDED BOOKS:

1. Instrument Engineers Handbook, B. G. Liptak- Chilton Book Co., Philadelphia
2. Process control instrumentation technology – C. D. Jhonson
3. Hand Book Of Process Control – Considine
4. Principles of Process Control, D. Patranabis- TMH, New Delhi, 2nd Ed
5. Applied technology and Instrumentation for Process control-D O J deSa, Taylor and Francis.

Course Title: ELECTIVE IV (Departmental)
Course Code: AI1318E04 (III)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

INTEGRATED CIRCUIT TECHNOLOGY

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**BASIC OUTLINE OF FABRICATION TECHNIQUES**	Silicon bipolar transistor as an example. Cost benefits of mass produced circuit blocks, reliability and performance considerations. Disadvantages. Exploiting the inherent component matching capabilities of I.C.s - example from linear and digital circuits.	7
2	**INTRODUCTORY IDEAS ABOUT CRYSTAL GROWTH AND WAFER PREPARATION**	Short description of the Czochralski process. The diffusion process. Simple diffusion theory and the evaluation of impurity diffused insilicon - determination of junction depth and sheet resistance. Oxidation and epitaxial growth of silicon. Pre-deposition and drive-in diffusions in junction devices. Fick's law, distribution of impurities and the calculation of emitter and base depths. Lateral diffusion. Diffusion related parameters for boron and phosphorous. Preparation of a simple process schedule.	10
3	**LITHOGRAPHY**	Optical lithography, minimum line-width consideration, layout fundamentals and mask making. Brief references to X-ray, electron beam and deep UV lithography. Interconnection. Aluminium metallization -- resistance heated evaporated and CVD methods. Brief mention about metallization failures -- step covering and electromigration. Other methods of interconnection.	7
4	**PASSIVE COMPONENTS**	MOS capacitors and resistors. Calculation of area and the layout of capacitors and resistors. NMOS and	7

		CMOS fabrication techniques. Polysilicon self aligned gate devices. Layout of simple circuits. Introduction to VLSI processing and layout Stick diagrams and layout and simulation tools.	
5	**OTHER RELATED PROCESSES**	Ion implantation, dry etching, sputtering, assembly and reliability related evaluation. Future trends.	5

RECOMMENDED BOOKS:

1. Douglas J. Hamilton and William G. Howard - Basic Integrated Circuit Engineering, McGraw-Hill Book Company.
2. S M. Sze - Basic VLSI Technology. McGraw-Hill Book Company
3. Douglas A. Pucknell and Karman Eshraghain - Basic VLSI Design, Prentice Hall of India.
4. Andrew S. Grove - Physics and Technology of Semiconductor Devices, John Wiley and Sons.
5. R Jacob Baker, Harry W. Li and David E. Boyce - CMOS circuit design layout and simulation,PHI.

Course Title: ELECTIVE IV (Departmental)
Course Code: AI1318E04 (IV)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

SPEECH PROCESSING

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**SPEECH AND ACOUSTIC PHONETICS**	Introduction, Anatomy and physiology of the speech Organs, Articulatory Phonetics, Acoustic Phonetics, Acoustic theory of speech production, Practical vocal tract models for Speech Analysis, Coarticulation, Prosody.	6
2	**HEARING**	Introduction: Anatomy and physiology of the ear, Sound Perception, Response of the ear to complex Stimuli.	3
3	**SPEECH PERCEPTION**	Introduction: Perceptually- important features of speech signals, Vowel perception, Consonant perception.	4
4	**SPEECH ANALYSIS**	Introduction, Short-Time speech analysis, Time-domain parameters, Frequency-domain (Spectral) parameters, Linear Predictive Coding (LPC) Analysis, Cepstral analysis, F0 (‘Pitch”) Estimation.	7
5	**SPEECH ENHANCEMENT**	Introduction, Nature of interfering sounds, Speech Enhancement (SE) techniques.	3
6	**SPEECH SYNTHESIS**	Introduction, Principles of speech synthesis, Synthesizers methods.	3
7	**AUTOMATIC SPEECH RECOGNITION**	Introduction, Networks for Speech recognition, Artificial neural networks.	6
8	**SPEAKER RECOGNITION**	Introduction, Verification vs Recognition, Recognition techniques, Features that distinguish speakers, System design.	4

RECOMMENDED BOOKS:

1. R Rabiner and S.W. Schafer, “Digital processing of speech signals”; Pearson Education.
2. Thomas F. Quateri 1ed, “Discrete Time Speech Signal Processing: Principles and Practice”
3. Deller J. R. Proakis J. G. and Hanson J.H., “Discrete Time Processing of Speech Signal”, Macmillian.
4. L.R Rabinar and B.H. Juang, “Fundamentals of Speech Recognition”.
5. O’ Shaughnessy, “Speech Communication: Human and Machine”,Ieee Press, 2nd edition, New York.

Course Title: ELECTIVE V (Open)
Course Code: **1318E05 (I)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MULTIMEDIA SYSTEMS

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**INTRODUCTION**	Hypermedia/multimedia, hypertext/hypermedia. Components of multimedia system, Applications, Multimedia software tools, Authoring systems, metaphors, content design, Multimedia architecture.	7
2	**TEXT, IMAGE, SOUND/AUDIO, ANIMATION, VIDEO**	Types of text, text file formats, Image types, Color models, Image file formats, Basics of digital audio, MIDI (Musical Instrument Digital Interface), Audio file formats, Animation type, techniques and file formats, Analog video, digital video, Broadcasting video standards, Recording formats	7
3	**COMPRESSION**	Lossy and lossless compression, Text compression: Huffman coding, Lempel-Ziv-Welch algorithm, Image compression: JPEG, 4 JPEG modes, JPEG 2000, Video compression: H.261, H.263, MPEG, New MPEG standards, Audio compression, Simple audio compression methods, Psychoacoustics.	9
4	**STORAGE MEDIA**	Magnetic media, Optical media(CD ROM, DVD, Scanner) and File systems	6
5	**SYNCHRONIZATION AND DOCUMENT ARCHITECTURE**	Synchronization Notions requirements; Documents; SGML; ODA; MHEG	7

RECOMMENDED BOOKS:

1. Tay Vaughan-Multimedia: Making It Work, TATA McGRAW HILL
2. Ranjan Parekh-Principles of Multimedia, TATA McGRAW HILL
3. Ralf Steinmetz, Klara Nahrstedt-Multimedia Computing, Communications & Applications, PEARSON.
4. Prabhat K. Andleigh & Kiran Thakrar-Multimedia Systems Design, PHI.

Course Title: ELECTIVE V (Open)
Course Code: **1318E05 (II)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**INTRODUCTION**	Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.	2
2	**INTELLIGENT AGENTS**	Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	2
3	**PROBLEM SOLVING**	Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	2
4	**SEARCH TECHNIQUES**	Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	4
5	**HEURISTIC SEARCH STRATEGIES**	Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	4
6	**ADVERSARIAL SEARCH**	Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	3
7	**KNOWLEDGE & REASONING**	Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	3

8	**USING PREDICATE LOGIC**	Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	2
9	**REPRESENTING KNOWLEDGE USING RULES**	Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.	3
10	**PROBABILISTIC REASONING**	Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	2
11	**PLANNING**	Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	2
12	**NATURAL LANGUAGE PROCESSING**	Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.	2
13	**LEARNING**	Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.	2
14	**EXPERT SYSTEMS**	Representing and using domain knowledge, expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog & Lisp.	3

RECOMMENDED BOOKS:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson.

Course Title: ELECTIVE V (Open)
Course Code: **1318E05 (III)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

NANOTECHNOLOGY AND NANOELECTRONICS

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**INTRODUCTION TO NANOTECHNOLOGY AND NANO-ELECTRONICS**	Introduction to nanotechnology and nanoelectronics, Nanostructure types and properties, electronic and optical properties of nano materials, Fabrication of nano-layers -Physical vapor deposition, Chemical vapor deposition, Epitaxy, Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide. Fabrication of nanoparticle- Grinding with iron balls, Laser ablation, Reduction methods, Sol gel, Self assembly, Precipitation of quantum dots.	10
2	**QUANTUM MECHANICS**	Introduction to Quantum Mechanics; Schrodinger equation and expectation values, Solutions of the Schrodinger equation for free particle, particle in a box, particle in a finite well, Reflection and transmission by a potential step and by a rectangular barrier. Band gap engineering, Quantum confinement of electrons in semiconductor nano structures, One dimensional confinement (Quantum wires), Two dimensional confinement (Quantum wells), three dimensional confinement (Quantum dots) and Bottom up approach, Single electron transistors, coulomb blockade effects in ultra small metallic tunnel junctions.	12
3	**MOLECULAR TECHNIQUES**	Molecular electronics, Chemical self-assembly, carbon fullerenes and nano tubes, Self assembled mono layers, Applications in biological and chemical detection.	6

4	**SURFACE ANALYTICAL INSTRUMENTATION TECHNIQUES FOR NANOTECHNOLOGY**	Introduction to characterization tools of nano materials- -principle of operation of STM, AFM, SEM, TEM, XRD, PL & UV instruments.	8

RECOMMENDED BOOKS:

1. J.M. Martinez-Duart,R.J. Martin Palma,F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics, Elsevier.
2. W.R. Fahrner, Nanotechnology and Nanoelctronics, Springer.
3. Beenaker and Van Houten "Quantum Transport in Semiconductor Nanostructures in Solid state Physics" Ehernreich and Turnbell, Academic press.
4. Quantum Physics – A. Ghatak
5. Quantum wells, Wires & Dots,: Theoretical & Computational Physics of Semiconductors Nano-stuructures, Paul Harrison.
6. David Ferry "Transport in Nano structures" Cambridge University press.
7. Principles of Quantum Mechanics 2nd ed. - R. Shankar

Course Title: ELECTIVE V (Open)
Course Code: **1318E05 (IV)
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MOBILE COMMUNICATIONS

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS**	Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. **Cellular Concept**: Frequency reuse, channel assignment, handoff, Interference and system capacity, trunking and grade of service, Improving Coverage and capacity in Cellular systems.	8
2	**MOBILE RADIO PROPAGATION**	Large scale path loss: Free space propagation model, Reflection, ground reflection model (Two-Ray model), diffraction. Small scale fading and multi-path: Small-scale multipath propagation, parameter of multi-path channels, types of small scale fading, Rayleigh and Ricean distribution, Level crossing rates and average fade durations.	7
3	**MODULATION TECHNIQUES FOR MOBILE COMMUNICATION**	Digital modulation vs. analog modulation: an overview, Digital modulation techniques, Performance of various modulation techniques.	6
4	**SPREAD SPECTRUM**	Spread spectrum principles, Direct sequence spread spectrum, Frequency hopping spread spectrum.	5
5	**EQUALIZATION AND DIVERSITY TECHNIQUES**	Fundamentals of equalization, Equalizers in a communication receiver, linear equalizers and nonlinear equalizers, Diversity techniques, RAKE Receiver.	5
6	**MULTIPLE ACCESS TECHNIQUE IN WIRELESS COMMUNICATIONS**	Frequency division multiple access, Time division multiple access, Spread spectrum Multiple access, Space division multiple access.	5

RECOMMENDED BOOKS:

1. T. S. Rappaport, Wireless Communications, 2nd Edition, Prentice Hall.
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press.
3. G. L. Stüber, Principles of Mobile Communication, 2nd Edition, Kluwer Academic Publishers.
4. S. Haykin, Communication Systems, 4th Edition, John Wiley and Sons.
5. W. C. Y. Lee - Mobile Communication Design Fundamentals, 2nd Edition, John Wiley and Sons.
6. Schiller, Mobile Communications, Pearson Education.

PRACTICAL

Course Title: MODERN CONTROL SYSTEM LAB
Course Code: AI131812
L-T-P-C: 0-0-2-1
Expected No. of weeks : 12 (approx)

EXPERIMENT NO	AIM OF EXPERIMENT	HOURS
1	Find out State space model of a given system.	3
2	Derive transfer function of a system from its state space model.	3
3	Construct State space model of a system from given transfer function.	3
4	Analyse Root locus technique using MATLAB.	3
5	Construct Bode Plot of a system using MATLAB.	6
6	Analyse Nyquist criterion for stability analysis using MATLAB.	6
	TOTAL	24

AI131816	**PROJECT**	L = 0 T = 0 P = 10 C = 5
GUIDELINES WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
AI131821	**COMPREHENSIVE VIVA**	L = 0 T = 0 P = 0 C = 4
GUIDELINES WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		