EE-402-E **WIRELESS COMMUNICATION**

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT 1. INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS:

Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

UNIT 2. MODERN WIRELESS COMMUNICATION SYSTEMS:

Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area networks.

UNIT 3. INTRODUCTION TO CELLULAR MOBILE SYSTEMS:

Spectrum Allocation, basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems.

UNIT 4. ELLULAR SYSTEM DESIGN FUNDAMENTALS:

Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity.

UNIT 5. MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION:

Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access, packet ratio, capacity of a cellular systems.

UNIT 6. WIRELESS NETWORKING:

Difference between wireless and fixed telephone networks, development of wireless networks, fixed network transmission hierarchy, traffic routing in wireless networks, wireless data services, common channel signaling, ISDN (Integrated Services digital Networks), advanced intelligent networks.

UNIT 7. INTELLIGENT CELL CONCEPT AND APPLICATION:

Intelligent cell concept, applications of intelligent micro-cell Systems, in-Building Communication, CDMA cellular Radio Networks.

TEXT BOOKS:

1. Wireless Communications: Theodore S. Rappaport; Pearsons.
2. Mobile Cellular Telecommunication: W.C.Y.Lee; McGraw Hill

REFERENCE BOOK:

1. Mobile Communications: Jochen Schiller; Pearson

NOTE: Eight questions are to be set -one question from each unit. Students have to attempt any five question.

EE-404-E **SATELLITE COMMUNICATION**

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT1. PRINCIPLES OF SATELLITE COMMUNICATION :
Evolution & growth of communication satellite, Synchronous satellite, Satellite frequency allocation & Band spectrum, Advantages of satellite communication, Active & Passive satellite, Modem & Codec. Applications of satellite communication.

UNIT2. COMMUNICATION SATELLITE LINK DESIGN:
Introduction, General link design equations, System noise temperature, C/N & G/T ratio, Atmospheric & Ionospheric effects on link design, Complete link design, Earth station parameters.

UNIT3. ANALOG SATELLITE COMMUNICATION :
Introduction, Baseband analog(Voice) signal, FDM techniques, S/N & C/N ratio in frequency modulation in satellite link, S/N ratio in FM with multiplexed telephone signal in satellite link, Single channel per carrier(SCPC) systems, Companded single sideband (CSSB) systems, Analog FM/FDM TV satellite link, Intermodulation products & their effects in FM/FDM systems, Energy disposal in FM/FDM systems.

UNIT4. DIGITAL SATELLITE COMMUNICATION :
Advantages of digital communication, Elements of digital satellite communication systems, Digital baseband signals, Digital modulation techniques, Satellite digital link design, Time Division Multiplexing.

UNIT5. MULTIPLE ACCESS TECHNIQUES: Introduction, TDMA, TDMA-Frame structure, TDMA-Burst structure, TDMA-Frame efficiency, TDMA-superframe, TDMA-Frame acquisition & Synchronization, TDMA compared to FDMA, TDMA Burst Time Plan, Multiple Beam (Satellite switched) TDMA satellite system, Beam Hopping(Transponder Hopping) TDMA, CDMA & hybrid access techniques.

UNIT6. SATELLITE ORBITS:
Introduction, Synchronous orbit, Orbital parameters, Satellite location with respect to earth, Look angles, Earth coverage & slant range, Eclipse effect, Satellite placement in geostationary orbit, station keeping, Satellite stabilization.

UNIT7. SPECIAL PURPOSE COMMUNICATION SATELLITES :
BDS, INMARSAT, INTELSAT, VSAT(data broadband satellite), MSAT(Mobile Satellite Communication technique), Sarsat(Search & Rescue satellite) & LEOs (Lower earth orbit satellite), Satellite communication with respect to Fiber Optic Communication, LANDSAT, Defense satellite.

UNIT8. LASER SATELLITE COMMUNICATION:
Introduction, Link analysis, Optical satellite link transmitter, Optical satellite link receiver, Satellite Beam Acquisition, Tracking & Positioning, Deep Space Optical Communication Link.

TEXT BOOK:
1. Satellite Communication : D.C. Aggarwal ; Khanna.

REFERENCE BOOK :
1. Satellite Communication :Gagliardi ; CBS

NOTE: Eight questions are to be set - one question from each unit. Students have to attempt any five question.

EE-424-E **SATELLITE COMMUNICATION LAB**

L T P			
0 0 2	CLASS WORK	:	50
	EXAM	:	50
	TOTAL	:	100
	DURATION OF EXAM	:	3 HRS

LIST OF EXPERIMENTS:

1. To set up a active and passive satellite communication link and study their difference.
2. To measure the base-band analog (voice) signal parameters in the satellite link.
3. To measure C/N ratio.
4. To transmit and receive the function generator waveforms through a Sat.Com. link.
5. To measure the digital baseband signal parameters in Sat.Com. link.
6. To send telecommand and receive the telemetry data.
7. To set a PC to PC Sat. Com. Link using RS-232 ports.
8. To measure the propagation delay of signal in a Sat. Com. Link.
9. To measure fading of a received signal.
10. To measure the parameters in an analog FM/FDM TV Sat.Com. link.
11. To measure the S/N ratio.
12. To calculate the figure of merit and FM deviation.

NOTE: At least ten experiments are to be performed , atleast seven experiments are to be taken from the above list and the remaining three based on the syllabus of EE-404-C (Satellite Communication Engineering) be developed at the institution level. The students will be required to perform at least eight experiments in the semester.

DEPT. ELECTIVE-I

EE-432E	Mobile Communication
EE-317E	Power Electronics
IC-404E	Fuzzy Control System (Common with EI, IC main paper in VIIIth sem)

DEPT. ELECTIVE-II

EE-462-E	Genetic Algorithms & Applications
EE-454-E	Radar and Sonar Engg.
EE-406-E	Advance Control System

MOBILE COMMUNICATION

EE-432-E

L T P		
3 1 0	Class Work	: 50
	Exam.	: 100
	Total	: 150
	Duration of Exam.	: 3 hrs.

UNIT 1 MOBILE RADIO SYSTEM:
A reference model, Frequencies for radio transnussion, Signals, Antennas, Signal Propagation, Multiplexing. Modulation

UNIT 2 CHARACTERISTICS OF RADIO WAVES:
Multipath Characteristics of radio waves signal fading, time dispersion, Doppler spread, coherence time, LCR. fading statistics. Diversty techniques

UNIT 3 MOBILE RADIO PROPAGATION:
Mechanism, free space path loss, long distance path loss model, Okumara model, Hata model, PCS model, wideband PCS, Microcell model, Indoor propagation model, Jake's channel model.

UNIT 4 WIRELESS SYSTEMS:
Standards – GSM, signaling & call control, mobility management, location racking wireless data services IS-95, GPRS.

UNIT 5 WIRELESS DATA NETWORKING:
IEEE Standards, Models Different layers, wireless LAN, Hypes LAN, Blue tooth. Performance analysis of link & transport layer protocols over wireless channels.

UNIT 6 MOBILE NETWORK LAYER:
Mobile IP: Goals, assumptions & requirements, IP packet delivery, Agent discovery, Registration, tunneling and en capsulation, optimization, Reverse tunneling, IP-V6, Mobile ad-hoc networks.

UNIT 7 MOBILE TRANSPORT LAYS:
Tradition TCP, Classical TCP improvement, TCP over 2.5G/3G wireless networks. Performance enhancing proxies.

TEXT BOOKS:
Mobile Communication: II nd edition Jochen Schiller Pearson Education

REFERENCES:

1. Mobile Cellular Telecommunications: 2nd Edition: William, C Y Lee Mc Graw Hill
2. Wireless and Digital Communication: Dr. Kamilo Feher (PHI)
3. T.S. Rappaport, "Wireless Communication, Principles & Practice", PHI 2001.

Note: Eight questions are to be set – at least one from each unit. Students have to attempt five questions.

EE-317-E **POWER ELECTRONICS**

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT1. INTRODUCTION :
Role of power electronics, review of construction and characteristics of power diode, Shottky diode, power transistor, power MOSFET, SCR, DIAC, Triac, GTO, IGBT & SIT.

UNIT2. SCR:
Ratings and protections, series and parallel connections, R, RC and UJT firing circuit and other firing circuits based on ICs and microprocessors; pulse transformer and opto-coupler, commutation techniques.

UNIT3. AC REGULATORS:
Types of regulator, equation of load current, calculation of extinction angle, output voltage equation, harmonics in load voltage and synchronous tap changer, three phase regulator.

UNIT4. CONVERTERS :
One, two, three, six and twelve pulse converters, fully and half controlled converters, load voltage waveforms, output voltage equation, continuous and discontinuous modes of operation, input power factor of converter, reactive power demand, effect of source inductance, introduction to four quadrant / dual converter, power factor improvement techniques, forced commutated converter, MOSFET and transistor based converters.

UNIT5. INVERTERS :
Basic circuit, 120 degree mode and 180 degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and bridge inverters, brief description of parallel and series inverters, current source inverter (CSI), transistor and MOSFET based inverters.

UNIT6. CHOPPERS :
Basic scheme, output voltage control techniques, one, two, and four quadrant choppers, step up chopper, voltage commutated chopper, current commutated chopper, MOSFET and transistor based choppers.

UNIT7. CYCLOCONVERTERS :
Basic principle of frequency conversion, types of cycloconverter, non-circulating and circulating types of cycloconverters.

UNIT8. DRIVES:
Introduction to electric drives: DC drives – converter and chopper fed dc drives, ac drives - stator voltage control, V/f control, rotor resistance control, static Scherbius system and static Kramer systems.

TEXT BOOK:

1. Power Electronics : MH Rashid; PHI

REFERENCE BOOKS :

1. Power Electronics : PC Sen; TMH
2. Power Electronics : HC Rai; Galgotia
3. Thyristorised Power Controllers : GK Dubey, PHI
4. Power Electronics and Introduction to Drives : A.K.Gupta and L.P.Singh;Dhanpat Rai
5. Power Electronics: P.S Bhimra.

NOTE : Eight questions are to be set –one from each unit. Students have to attempt any five questions.

IC-404-E **FUZZZY CONTROL SYSTEM**

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT 1 INTRODUCTION:
Fuzzy control from an industrial perspective, knowledge-based controllers, knowledge representation in KBC's.

UNIT 2 THE MATHEMATICS OF FUZZY CONTROL:
Vagueness, fuzzy logic versus probability theory, fuzzy sets, their properties & operations on fuzzy sets, fuzzy relations & operations on fuzzy relations, the Extension Principle, Fuzzy propositions, The Compositional Rule of Inference, Different implications, Representing a set of rules.

UNIT 3 FKBC DESIGN PARAMETERS:
The PKBC architecture, choice of variables & content of rules, Derivation of rules, choice of membership functions, choice of scaling factors, choice of fuzzification procedure, choice of defuzzification procedure, comparison and evaluation of defuzzification methods.

UNIT 4 NONLINEAR FUZZY CONTROL:
The Control Problem, The FKBC as a Non-Linear Transfer Element, Types of FKBC such as PID-like FKBC, Sliding Mode FKBC, Sugeno FKBC.

UNIT 5 ADAPTIVE FUZZY CONTROL:
Design & Performance Evaluation, Approaches to Design such as membership function tuning using gradient descent, membership function tuning using performance criteria, the self-organizing controller, model based controller.

UNIT 6 STABILITY OF FUZZY CONTROL SYSTEMS:
The State space approach, Stability and robustness indices, input-output stability, circle criterion, the conicity criterion.

TEXT BOOK:
An Introduction to Fuzzy Control: D.,Driankov, H.Hellendoorn and M.Reinfrank.; Narosa.

REFERENCE BOOKS:
Fuzzy Control Systems : Abraham Kandel and Gideon Imngholz; Narosa

NOTE : Eight question are to be set at least one from each unit. Students have to attempt five questions in all.

EE– 462-E GENETIC ALGORITHMS & APPLICATIONS

L T P		
4 - -	Theory	: 100
	Class work	: 50
	Total	:150
	Duration of exam.	: 3 hours

1. **Introduction:** Overview, History of evolutionary computation: Search spaces & fitness landscapes, elements of genetic algorithms, comparison of Gas and tradition search methods.

2. **Fundamental Concepts of Gas:** Typical examples to illustrate how Gas work. Simple computer exercises.

3. **Problem Solving Using Gas:** Evolving computer programs, data analysis & prediction, evolving neural networks, simple computer exercises.

4. **Implementation of Gas:** Suitability of GA for typical problems, encoding a problem for a GA, adapting the encoding, selection methods, Genetic operators, Parameters for Gas.

Text Books: 1. Davis L,"Handbook of Genetic Algorithms
2**.** Goldberg D.E.,"Genetic Algorithms in Search optimization & Machine Learning."
3. Michalewiez, Z.,"Genetic Algorithms & Data Structures = Evolution Programs

Note: 8 questions are to be set –at least one from each unit. Students have to attempt any five questions in all .

EE-454-E **RADAR AND SONAR ENGINEERING**

L T P			
3 1 0	CLASS WORK	:	50
	EXAM	:	100
	TOTAL	:	150
	DURATION OF EXAM	:	3 HRS

UNIT 1. INTRODUCTION TO RADAR:
Radar Block Diagram & operation, Radar Frequencies, Radar development, Application of Radar.

UNIT 2. RADAR EQUATION:
Simple form of Radar Equation, Prediction of Range performance, Minimum detectable signal, Receiver noise, Signal to Noise ratio, Transmitter Power, Pulse repetition frequency & range ambiguities, System losses, Propagation effects.

UNIT 3. CW & FREQUENCY MODULATED RADAR:
The Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple Frequency CW Radar.

UNIT 4. MTI & PULSE DOPPLER RADAR:
Introduction, Delay Line Cancellors, Multiple or staggered, Pulse repetition frequencies, range-Gated Doppler Filters, Digital Signal Processing, Other MTI delay line, Limitation of MTI performance, Noncoherent MTI, Pulse Doppler Radar, MTI from a moving platform.

UNIT 5. TRACKING RADAR:
Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range, Acquisition.

UNIT 6. RECEIVERS, DISPLAYS & DUPLEXERS:
Radar Receivers, Noise Figure, Mixer, Low-noise Front ends, Displays, Duplexer, Receiver protectors.

UNIT 7. INTRODUCTION TO SONAR

TEXT BOOK:
1. Introduction to Radar Systems: Merrill I. Skolnik, ; MGH

REFERENCE BOOK:
1. Electronic Communication Systems : Kennedy; TMH

NOTE: 8 questions are to be set –at least one from each unit. Students have to attempt any five Questions.

EE-406-E **ADVANCED CONTROL SYSTEMS**

L T P		
3 1 -	Theory	: 100 marks
	Class work	: 50 marks
	Total	: 150 marks
	Duration of exam.	: 3 hours

UNIT 1. STATE VARIABLE TECHNIQUES: State variable representation of systems by various methods. Solution of state equations-state transition matrix. Transfer function from state variable model. Controllability & observability of state variable model.

UNIT 2. SECOND ORDER SYSTEMS & STATE PLANE: Phase portrait of linear second systems. Method of isoclines, phase portrait of second order system with non-linearities, limit cycle, singular points.

UNIT 3. DESCRIBING FUNCTION ANALYSIS: Definition, limitations, use of describing function for stability analysis , describing function of ideal relay, relay with hysteresis & dead zone, saturation/coulomb friction & backlash,

UNIT 4. LINEAR APPROXIMATION OF NONLINEAR SYSTEMS: Taylor series, Liapunov's 2^{nd} method.

UNIT 5. SAMPLED DATA SYSTEMS: Sampling process, impulse modulation, mathematical analysis of sampling process, application of Laplace transform, Shannon's theorem, reconstruction of sampled signal zero order & first order hold, Z-transform, definition, evaluation of Z-transform, Inverse Z-transform, pulse transfer function, limitations of Z-transform, state variable formulation of discrete time systems. Solution of discrete time state equations, stability, definition, the Schur-Cohn stability criterion, Jury's test of stability of extension of Routh-Hurwitz criterion to discrete time systems.

TEXT BOOKS:

1. Digital Control & State Variable Methods : M.Gopal ; TMH.

REFERENCE BOOKS :

1. Modern Control Theory : M.Gopal ; Wiley International.
2. Discrete Slotine & W.P.Li; Prentice Hall, USA,
5. Nonlinear Control Systems: Isidari ; Springer-Verlag.

NOTE : 8 questions are to be set –one from each unit. Students have to attempt five questions.time control system : K.Ogate ; PHI

3. Digital Control Systems : B.C.Kuo
4. Applied non-linear control : J.E.