C. U. SHAH UNIVERSITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Electronics & Communication Engineering
SEMESTER: - I **CODE**: - PGEC101
NAME – Information Theory & Coding (ITC)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			Total
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	
						Marks	Hours	Marks	Hours					
PGEC101	Information Theory & Coding (ITC)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- This course provides information about the basic processes of communications systems with detailed analysis in the mathematical domain. Information theory explores the fundamental limits of the representation and transmission of information. The students will learn the concepts of probability theory and random variables. We will focus on the definition and implications of (information) entropy, the source coding theorem, and the channel coding theorem. They also learn different random processes.

Prerequisites: -Basic concepts of probability, random variable and mathematics are essential.

Course Outlines:-

Sr. No.	Course Contents
1	**Probability:**Introduction, Review of probability, Conditional Probability, Total Probability, Independent Events
2	**Random Variables:**Introduction, Random Variables, Distribution Functions, Discrete Random Variables , Continuous Random Variables and Probability Density Functions, Mean and Variance, Some Special Distributions, Conditional Distributions
3	**Multiple Random Variables:**Introduction, Bivariate Random Variables, Joint Distribution Functions, Discrete Bivariate Random Variables, Continuous Bivariate Random Variables - Joint Probability Density Functions, Conditional Distributions, Covariance and Correlation Coefficient, Conditional Means and Conditional Variances.
4	**Random Processes:**Introduction, Random Processes, Characterization of Random Processes, Classification of Random Processes, wide sense stationary processes, cyclo-stationary processes, Ergodicity, Poisson Processes, Wiener Processes
5	**Basic concept of coding:**Source coding- Uniquely Decodable codes, Instantaneous codes, Constructing instantaneous codes, Krafts inequality &McMillans inequality, Shannon noiseless coding theorem.
6	**Entropy, Entropy of sources and their extension:** Definition of entropy, Average code

	length limit theorem, Shannons Lemma and Source coding theorem, Entropy of basic sources, Maximum and Minimum entropy, Properties of Entropy, Extensions of a Source.
7	**Introduction to Source coding:**Optimal Codes: Huffman codes, Construction of Binary Huffman Codes, Construction of Ternary and Quaternary Huffman Codes, Second Extension of Huffman codes, Third Extension of Huffman codes, Optimal Codes: ShannonsFano Code, Construction of Binary ShannonsFano Codes, Construction of Ternary ShannonsFano Codes, Arithmetic coding and decoding, Construction of Arithmetic codes
8	**Channel Coding:** Reliable Communication through Unreliable channels, Information rates Introduction to joint and conditional entropy, Introduction to mutual information, Introduction: Channel capacity, Relationship of channel capacity with mutual information, Channel capacity of binary symmetric channel, Channel capacity of binary Erasure channel.
9	**Linear block codes:** Hamming Distance, Hamming Bound, Correction and Detection of errors, Generator matrix, Parity check matrix, Syndrome, Detection and corrections of errors, Syndrome decoding on symmetric channels; Cyclic Codes- Generator polynomials, Encoding cyclic codes, Parity check polynomials, Decoding cyclic codes.
10	**Convolutional Codes:** Convolutional Encoder Representation, Connection Representation, State Representation and the State Diagram, The Tree Diagram, The Trellis Diagram, Maximum Likelihood Decoding, Channel Models: Hard versus Soft Decisions, The Viterbi Convolutional Decoding Algorithm, Decoder Implementation, Systematic and Non-systematic Convolutional Codes, Soft-Decision Viterbi Decoding, Sequential Decoding, Comparisons and Limitations of Viterbi and Sequential Decoding, Feedback Decoding.

Learning Outcomes:-

- Explain clearly concepts from probability and describe basic stochastic processes.
- Evaluate various quantities for probability distributions and random variables.
- Formulate and solve problems about stochastic processes.
- Apply the basics of information theory to calculate channel capacity and other measures.
- Design specific data compression techniques and calculate the compression achieved.

Books Recommended:-

1. Theory and Problems of Probability, Random Variables, and Random Processes, **Hwei P. Hsu**, Schaums Outline Series, McGraw Hill.
2. Foundations of Coding, Jiri Adamek, Wiley-Interscience Publication
3. Probability and Random Processes for Electrical Engineer, **Alberto Leon Gracia**, 2nd Ed
4. Modern Analogue and Digital communication, **B.P. Lathi**, Oxford Uni. Press.
5. Digital Communication, Haykins Simon Wiley Publ.

Research Reference:-

1. EURASIP Journal on Advances in Signal Processing
2. Journal of Signal and Information Processing
3. IET Signal Processing

C. U. SHAH UNIVERSITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - I **CODE**: -PGEC102
NAME – Wireless and Mobile Network Architectures (WMNA)

Teaching &Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	Total
						Marks	Hours	Marks	Hours					
PGEC102	Wireless and Mobile Network Architectures (WMNA)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives: -

- The objective of the subject is to provide detailed knowledge on basic mobile networks, Mobility management, GSM, VoIP, Mobile IP and various services offered by the mobile networks.
- The subject gives real time scenario and practical aspects of the actual mobile networks.

Prerequisites: Basic concepts of Wireless Communication are essentials.

Course Outlines: -

Sr. No.	Course Contents
1	**Introduction** PCS Architecture, Cellular Telephony AMPS, GSM, IS-136, IS-95, Cordless Telephony and Low-Tier PCS CT2, DECT, PHS, PACS, Unlicensed System, 3G wireless systems
2	**Mobility management** Handoff, Roaming management, Handoff Detection, Strategies for Handoff Detection, Channel Assignment, link transfer types, Hard handoff, Soft handoff
3	**PACS Network Signalling** PACS network elements, PACS network interfaces, AIN/ISDN Interworking, Registration, Call origination, Call termination, Intersystem handoff
4	**GSM** GSM architecture, Location tracking and call setup, Security, Data services, Unstructured Supplementary service data, Cellular Digital Packet data architecture, CDPD air interface, Radio Resource allocation, Roaming management, GSM MAP service framework, The MAP protocol and dialogue, SMS architecture, SMS protocol hierarchy, Mobile originated and terminate messaging, the DTE-DCE interface, Fixed network number portability, Number portability for mobile network
5	**VOIP Service for Mobile Networks** GSM on the net, the iGSM wireless VOIP solution, iGSM procedures and message flows,

	Implementation issues,	
6	**General Packet Radio Service(GPRS)** GPRS functional groups, GPRS architecture, GPRS network nodes, GPRS interfaces, GPRS procedures, GPRS billing, Evolving from GSM to GPRS	
7	**Wireless application Protocol (WAP)** WAP model, WAP gateway, WAP protocols, WAP UAProf and caching, Wireless bearers for WAP	
8	**3G Mobile services and Wireless Local Loop (WLL)** Paradigm shifts in third generation systems, W-CDMA and CDMA 2000, improvements on core network, QoS, wireless OS, system and field trials, Other trial systems	
9	**Mobile IP** Introduction ,Mobility requirements and constraints in an IP environment,Mobile IP Protocol Overview, Route Optimization, Mobility Support for IPv6,Connectivity with 3G Networks	

Learning Outcomes: -

- After successful completion of the course students will be able to:
- Understand the basics of Concepts of Mobile technologies, mobility management, various mobile services and protocols.
- Understand 3G, WLL, and Mobile IP Services.

Books Recommended:-

1. Wireless and Mobile network Architectures, **Yi-Bang Lin and Imrich Chlamtac,** Wiley-India Edition.
2. Mobile and Personal Communication Systems and Services, **Raj Pandya,** PHI, 2001.
3. Wireless Communications & Networks, **William Stallings,** 2/e, Pearson,Prentice Hall, 2009.
4. Handbook of Wireless Networks and Mobile Computing ,**Ivan Stojmenivic**, Wileyindia Edition,2009
5. Mobile IP: Design Principles and Practice, **Charles E. Perkins** Addition Wesley Wireless Communication Series

Research Reference:-

1. Advances in Wireless and Mobile Communications (AWMC), ISSN 0973-6972
2. International Journal of Wireless Communication and Simulation (IJWCS),ISSN 2231-1254
3. Wireless Communications, IEEE Transaction on
4. Antennas and Propagation, IEEE Transactions on
5. Selected Areas in Communications, IEEE Journal on
6. Smart Grid, IEEE Transactions on

C. U. SHAH UNIVERSITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Electronics & Communication Engineering
SEMESTER: - I **CODE**: - PGEC103
NAME – Advance Image Processing (AIP)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	Total
						Marks	Hours	Marks	Hours					
PGEC103	Advance Image Processing (AIP)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- To impart the knowledge on 2-dimensional signals (image) and its processing in an interactive manner.
- Involve students in analytical studies of advanced image processing.

Prerequisites: -

- Basic knowledge of digital signal processing.
- 1-D sampling and Quantization of continuous signal.
- Basic knowledge of linear convolution and correlation operation.
- Basic knowledge of Discrete Fourier transform, Fast Fourier transform, discrete cosine transform

Course Outlines:-

Sr. No.	Course Contents
1	**Digital Image Fundamentals** Image representation – Gray scale and Colour images, image sampling and quantization, Neighbourhood Operators
2	**IMAGE IMPROVEMENT:** Image enhancement in Spatial domain & Frequency Domain- Basic gray level Transformations, Histogram Processing, Image Smoothing, Sharpening Spatial & Frequency Filtering, Homomorphic filtering
3	**Image Restoration and Reconstruction:** Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering
4	**IMAGE ANALYSIS:** Image Segmentation: discontinuity Based & Similarity Based Technique ,Morphological Operation: Binary Image Connectivity, Binary Image Hit or Miss Transformations, Binary , Thinning, Skeletonizing, and Thickening, Binary Image Generalized Dilation and Erosion, Binary Image Close and Open Operations, Image Compression
5	**Motion:**

	Introduction ,Basics: flow and correspondence ,Optical flow-based motion estimation ,Quadrature filter techniques , Correlation and matching
6	**Three-Dimensional Imaging Techniques:** Human visual system, 2D and 3D Vision Formation, Stereo-pair Images and Depth Perception ,3D Vision Systems,3D Vision Applications Characteristics of 3-D sensors ,Triangulation, Time-of-flight (TOF) of modulated light ,Optical Interferometry (OF), Stereopsis ,Depth-from-focus
7	**Image Warping Procedures:** Architecture of the Warping System, Coordinate Transformation Module, Projective and Affine Transformations of a Plane, Polynomial Transformations, Generic Coordinates Mapping, Interpolation of Pixel Values, Bilinear Interpolation, Interpolation of Nonscalar-Valued Pixels, The Warp Engine

Learning Outcomes:-

- Upon successful completion of this subject, students should:
  * be able to identify a variety of image processing techniques.
  * be able to explain the purpose of each process and underlying principles.
  * be able to select appropriate image processing and analysis techniques to achieve predetermined objectives in application areas.
  * be able to implement well-defined new methods for image processing and analysis with the use programming language.
  * be able to integrate image processing and analysis techniques into applications.

Books Recommended:-

1. Digital Image Processing, **Rafael C. Gonzalez and Richard E. Woods,** Third Edition,Pearson Education.
2. Digital Image Processing Using MATLAB, **Rafael C. Gonzalez, Richard E. Woods,and Steven L. Eddins,** Second Edition, Tata McGraw Hill Publication.
3. Digital Image Processing, **S Jayaraman, S Esakkirajan, T Veerakumar,** Tata McGraw Hill Publication
4. Digital Image Processing, **S Sridhar**, Oxford University Press..
5. Digital Image Processing, **William K. Pratt,** Third Edition A Wiley-Interscience Publication,John Wiley & Sons, Inc
6. An Introduction To 3d Computer Vision Techniques And Algorithms, **Bogusław Cyganek,J. Paul Siebert,** A Wiley-Interscience Publication,John Wiley & Sons, Inc

Research Reference:-

1. Image Processing, IEEE Transactions on
2. Circuits and Systems II: Analog and Digital Signal Processing, IEEE Transactions on
3. Signal Processing Magazine, IEEE

FACULTY OF: -Engineering & Technology
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: -__I__ **CODE**: -PGEC104
NAME –ASIC Design (ASICD)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			Total
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	
						Marks	Hours	Marks	Hours					
PGEC104	ASIC Design (ASICD)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- To enable the students to understand the basic concepts of implementation of digital circuits as a part of application specific IC, by means of basic theoretical concepts along with the implementation in various designing tools.

Prerequisites: -Basic knowledge of Digital logic and Digital circuit particularly at the Gate level is essential. Some experience in programming will be helpful.

Course Outlines:-

Sr. No.	Course Contents
1	**Introduction:** What is VHDL?, History, Capabilities, Hardware abstractions, Basic terminology, Entity declaration, Architecture body: structural, dataflow, behavioural and mixed style of modelling, Configuration declaration, Package declaration, Package body,
2	**Basic Language Elements:** Identifiers, Data objects, Data types: subtypes, scalar types, composite types, Operators: logical, relational, shift, adding, multiplying and miscellaneous operators.
3	**BehaviouralModelling:** Entity declaration, Architecture body, Process statement, Variable assignment statement, Signal assignment statement, wait statement, if statement, case statement, Null statement, Loop statement, Exit statement, Next statement, Assertion statement, Report statement, More on signal assignment statement: Inertial delay model, Transport delay model, Creating signal waveforms, Signal drivers, Multiple processes
4	**Dataflow Modelling:** Concurrent signal assignment statement, Concurrent versus sequential signal assignment, Delta delay, Multiple drivers, Conditional signal assignment statement, Selected signal

	assignment statement, The unaffected value, Concurrent assertion statement, Value of a signal
5	**Structural Modelling:** Example, Component declaration, Component instantiation, Examples, Resolving signal values
6	**Generics andSubprograms:** Generics, Why configuration? Configuration specification, Configuration declaration, Default rules, Direct instantiation, Incremental binding,Subprograms:Functions, Procedures, Declarations, Conversion functions, Subprogram overloading, Operator Overloading.
7	**Packages, Libraries& Advanced Features:** Package declaration, Package body, Design file, Design libraries, Order of analysis, Implicit visibility, Explicit visibility: Library clause, use clause, Entity statements, Block statement, Generate statement, For generation scheme, If generation scheme, Binding component instances, Aliases, Attributes: User defined attributes, Predefined attributes, More on block statements, More on ports.
8	**Test Bench:** Writing a test bench, Waveform generation, Monitoring behavior, File types, Dumping results into a text file, Reading vectors from a text file, Test bench example, Initializing memory,
10	**State Machine Modelling:** State diagram, state minimization, state assignments, Basics of Moore and Mealy machine, Modelling a Moore FSM, Modelling a Mealy FSM (synchronous and asynchronous), Interacting state machines
11	**Designing with Programmable Logic Devices:** Programmable Logic Design, Basics of Programmable logic devices: Structures; PAL Characteristics ROM, PLA, PAL, PLD,

Learning Outcomes:-

- Create a variety of simplified low level schematics of Digital Circuits.
- Students will work more closely with the programming aspects of various designing tools.

Books Recommended:-

1 VHDL Primer, **J. Bhasker**, Pearson Education Asia, Low Price Edition
2 Digital Systems Design Using VHDL, **Charles H Roth, Jr.**, Brooks/Cole Thompson Learning
3 Circuit Design with VHDL, **Volnei A. Pedroni**, MIT press, Cambridge
4 CMOS Digital Integrated Circuits, **Sung- Mo Kang and Yusuf Leblebici**, Tata Mc-GrawHill

Research Reference:-

1. Emerging and Selected Topics in Circuits and Systems, IEEE Journal on
2. Industrial Electronics, IEEE Transactions on
3. Solid-State Circuits, IEEE Journal of

C. U. SHAH UNIVERSITY

FACULTY OF: -Technology & Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - I **CODE**: -PGEC105
NAME – Satellite Communication (SATCOM)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			Total
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	
						Marks	Hours	Marks	Hours					
PGEC105	Satellite Communication (SATCOM)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- The objective of this course is to provide focus on modern concepts of satellite communication. Satellite communication is moving from large ground station type application to direct consumer type application. It is very important in the curriculum to provide a course with focus on these topics

Prerequisites:-

- Understanding of basic electromagnetic wave propagation and characteristics.
- Understanding of basic communications theory.
- Understanding of basic concepts of mechanics and gravitation

Course Outlines:-

Sr. No.	Course Contents
1	**Introduction:**Introduction, Frequency Allocations for Satellite Services, Polar Orbiting Satellites, INTELSAT, U.S. Domsats, Polar Orbiting Satellites
2	**Orbits and Launching Methods**:Introduction, Keplers Laws, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, Effects of a nonspherical earth, Atmospheric drag, Inclined Orbits, Calendars, Universal time, Julian dates, Sidereal time, The Orbital Plane.
3	**The Geostationary Orbit**:Introduction, Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits
4	**The Space Segment:**Introduction, The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem
5	**The Earth Segment**:Introduction, Receive-Only Home TV Systems, The outdoor unit, the indoor unit for analog (FM) TV, Master Antenna TV System, Community Antenna

	TV System, Transmit-Receive Earth Stations
6	**The Space Link**:Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Antenna noise, Amplifier noise temperature, Amplifiers in cascade, Noise factor, Noise temperature of absorptive networks, Overall system noise temperature, Carrier-to-Noise Ratio, The Uplink: Saturation flux density, Input backoff , The earth station HPA, Downlink: Output back-off , Satellite TWTA output, Effects of Rain, Uplink rain-fade margin, Downlink rain-fade margin, Combined Uplink and Downlink C/N Ratio, Intermodulation Noise, Inter-Satellite Links
7	**Direct Broadcast Satellite (DBS) Television**:Orbital Spacing, Power Rating and Number of Transponders, Frequencies and Polarization, Transponder Capacity, Bit Rates for Digital Television, MPEG Compression Standards, Forward Error Correction (FEC), The Home Receiver Outdoor Unit (ODU), The Home Receiver Indoor Unit, Downlink Analysis Uplink, High Definition Television, HDTV displays, Video Frequency Bandwidth
8	**Satellite Mobile and Specialized Services**:Introduction, Satellite Mobile Services, VSATs, Radarsat, Global Positioning Satellite System, Orbcomm

Learning Outcomes:-

This course provides an introduction to Satellite communications theory, and the science of mechanics towards the provision of communications and other services using Earth-orbiting satellites. Students completing this course will be able to:

- Identify the fundamentals of orbital mechanics, the characteristics of common orbits used byCommunications and other satellites, and be able to discuss launch methods and technologies.
- Understand the radio propagation channel for Earth station to satellite and satellite to satelliteCommunications links and the basics of designing antenna systems to accommodate the needs of a particular satellite system.
- Be able to calculate an accurate link budget for a satellite or other wireless communications link

Books Recommended:-

1. Satellite Communication,**Dennis Roddy**, TataMcGraw Hill
2. Satellite Communication,**Timothy Pratt, Charles Bostian, Jeremy Allnutt**, Willey Student edition, second edition
3. Communication Satellite Systems,**James Martyn**, Prentice Hall
4. Satellite communication,**Wilbur L. Pritchard &Josheph,**Sciulli-PHI

Research Reference:-

1. Antennas and Propagation, IEEE Transactions on
2. Communications, IEEE Transactions on
3. Aerospace and Electronic Systems, IEEE Transactions on

C. U. SHAH UNIVERSITY

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: - I **CODE**: -PGEC106
NAME – Wireless Sensor Networks (WSN)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	Total
						Marks	Hours	Marks	Hours					
PGEC106	Wireless Sensor Networks (WSN)	3	0	2	5	30	1.5	70	2.5	100	30	20	50	150

Objectives: -

- The objective of the subject is to provide thorough understanding of the Wireless sensor networks, its architecture, networking of sensors and various tools for the wireless sensor networks. The subject also deals with the various platforms of wireless sensors.

Perquisites: Basic Concepts of Wireless networks, computer networks and sensors are essential.

Course Outlines: -

Sr. No.	Course Contents
1	**Overview Of Wireless Sensor Networks** Challenges For Wireless Sensor Networks-Characteristics Requirements-Required Mechanisms, Difference Between Mobile Ad-Hoc And Sensor Networks, Applications Of Sensor Networks- Enabling Technologies For Wireless Sensor Networks.
2	**Architectures** Single-Node Architecture - Hardware Components, Energy Consumption Of Sensor Nodes , Operating Systems And Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals And Figures Of Merit, Gateway Concepts.
3	**Networking Of Sensors** Physical Layer And Transceiver Design Considerations, MAC Protocols For Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address And Name Management, Assignment Of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.
4	**Infrastructure Establishment** Topology Control, Clustering, Time Synchronization, Localization And Positioning, Sensor Tasking And Control.
5	**Sensor Network Platforms And Tools** Operating Systems For Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-Level Software Platforms, Node-Level Simulators,

Learning Outcome: -

- After successful completion of the course:
- Students will be introduced to some existing applications of wireless sensor actuator networks
- Students will be introduced to elements of distributed computing and network protocol design and will learn to apply these principles in the context of wireless sensor networks
- Students will learn the various hardware, software platforms that exist for sensor networks
- Students will get an overview of the various network level protocols for MAC, routing, time synchronization, aggregation, and consensus and distributed tracking.

Books Recommended:-

1. Protocols and Architectures for Wireless Sensor Networks, **Holger Karl & Andreas WilligJohn Wiley**, 2005.
2. Wireless Sensor Networks- An Information Processing Approach, **Feng Zhao & Leonidas J. Guibas,** Elsevier, 2007.
3. Wireless Sensor Networks- Technology, Protocols, and Applications, **KazemSohraby, Daniel Minoli, &TaiebZnati,** John Wiley, 2007.
4. Wireless Sensor Network Designs, **Anna Hac,** John Wiley, 2003.
5. Networking Wireless Sensors, **Bhaskar Krishnamachari,**Cambridge Press, 2005.
6. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, **Mohammad Ilyas and ImadMahgaob,** CRC Press, 2005.
7. Introduction to Data Communication and Networking, **Wayne Tomasi,** Pearson Education, 2007.

Research Reference:-

1. Signal Processing, IEEE Transactions on
2. Sensors Journal, IEEE
3. Industrial Informatics, IEEE Transactions on
4. Wireless Communications, IEEE

FACULTY OF: -Engineering & Technology
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: -__I__ **CODE**: -PGEC107
NAME –Non-Linear Fiber Optics (NLFO)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			Total
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	
						Marks	Hours	Marks	Hours					
PGEC107	Non-Linear Fiber Optics (NLFO)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- In this course, we will study review of Nonlinear Effects in Optical Fibers. Stimulated Raman Scattering (SRS), Stimulated Brillouin Scattering (SBS), Self-Phase Modulation (SPM), Cross-Phase Modulation (XPM), Four-Wave Mixing (FWM), Origin of Nonlinear Effects in Optical Fibers, Ultra-fast third-order susceptibility, Real part leads to SPM, XPM, and FWM, Imaginary part leads to SBS and SRS.

Prerequisites: -Knowledge of Electric field, power, and intensity of EM fields in linear materials. Working knowledge of quantum mechanics; in particular, time-dependent perturbation theory.

Course Outlines:-

Sr. No.	Course Contents
1	**Fiber Nonlinearities** Introduction - Nonlinear Refraction - Maxwells Equations - Fiber Modes - Eigen Value Equations - Single Mode Condition - Nonlinear Pulse Propagation - Higher Order Nonlinear Effects.
2	**Group Velocity Dispersion And Phase Modulation** Gaussian Pulse - Chirped Gaussian Pulse - Higher Order Dispersions - Changes In Pulse Shape – Self Phase Modulation (SPM) Induced Spectral Broadening - Non-Linear Phase Shift - Effect Of Group Velocity Dispersion - Self Steepening - Application Of SPM Cross Phase Modulation (XPM) - Coupling Between Waves Of Different Frequencies - Non-Linear Birefringence - Optical Kerr Effect - Pulse Shaping.

3	**Optical Solitons And Dispersion Management** Soliton Characteristics - Soliton Stability - Dark Solitons – Other Kinds Of Solitons – Effect Of Birefringence In Solitons - Solitons Based Fiber Optic Communication System (Qualitative Treatment) – Demerits - Dispersion Managed Solitons (DMS).
4	**Soliton Lasers** Non-Linear Fiber Loop Mirrors - Soliton Lasers - Fiber Raman Lasers - Fiber Raman Amplifiers - Fiber Raman Solitons - Erbium Doped Fiber Amplifiers.
5	**Applications Of Solitons** DMS For Single Channel Transmission – WDM Transmission - Fiber Gratings- Fiber Couplers – Fiber Interferometers – Pulse Compression – Soliton Switching – Soliton Light Wave Systems.

Learning Outcomes:-

- This course will enable you to :prepare yourself to understand any nonlinear optics presentation at this conference, understand and manipulate the Slowly-Varying Envelope Approximation SVEA), recognize what nonlinear events come into play in different effects, appreciate the intimate relationship between nonlinear events which at first appear quite different, and how they affect the propagation of light, understand how wave matching, phase-matching, and index matching are related, understand how self-phase modulation impresses chirping on pulses, develop an appreciation for the extremely broad variety of ways in which fiber-optic communications materials exhibit nonlinear behaviour.

Books Recommended:-

1. Nonlinear Fiber Optics, **Govind P.Agrawal**, Academic Press, New York (1995).
2. Optical Solitons in Fibers, **Hasegawa and M. Matsumoto**, Springer, Berlin (2003).
3. Applications of Nonlinear Fiber Optics, **Govind P. Agrawal**, Academic Press, New York (2001).
4. Nonlinear Dynamics: Integrability, Chaos and Patterns, **M. Lakshmanan and S. Rajasekar**, Springer, Berlin (2003).
5. Optical Solitons: From Fibers to Photonic Crystals, **Y. S. Kivshar and Given Agrawal**, Academic Press, New York (2003).

Research Reference:-

1. Lightwave Technology, Journal of
2. Photonics Technology Letters, IEEE
3. Selected Topics in Quantum Electronics, IEEE Journal of

FACULTY OF: -Engineering & Technology
DEPARTMENT OF: -Electronics & Communication Engineering
SEMESTER: -__I__ **CODE**: -PGEC108
NAME –Ad-Hoc Network (AHN)

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Evaluation Scheme								
						Theory					Practical (Marks)			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Total	Pr/Viva	TW	Total	Total
						Marks	Hours	Marks	Hours					
PGEC108	Ad-Hoc Network (AHN)	4	0	2	6	30	1.5	70	2.5	100	30	20	50	150

Objectives:-

- To know the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor networks, protocols, and applications; To understand MAC, Routing protocols that have been proposed for ad hoc and sensor networksTo understand the energy issues in sensor networks and how they can be addressed using scheduling, media access control, and special hardware; To explain various security threats to ad hoc networks and describe proposed solutions

Prerequisites: -Detailed knowledge of Data computer networks is essential.
Course Outlines:-

Sr. No.	Course Contents
1	**Ad-Hoc Mac** Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi-channel MAC & Power control MAC protocol.
2	**Ad-Hoc Network Routing & TCP** Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, Ad Hoc TCP, and Split TCP.
3	**WSN -MAC** Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.
4	**WSN Routing, Localization & QoS** Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.
5	**Mesh Networks**

	Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

Learning Outcomes:-

- Students to identify the major issues associated with ad-hoc/sensor networks
- Students will explore current ad-hoc/sensor technologies by researching key areas such as algorithms, protocols, hardware, and applications.
- At the end of this course students will gain hands-on experience through real-world programming projects on ad-hoc/sensor hardware and be able to implement or develop algorithms involved in ad-hoc/sensor systems

Books Recommended:-

1 Ad Hoc Wireless Networks – Architectures and Protocols, **C.Siva Ram Murthy and B.Smanoj**, Pearson Education, 2004.
2 Wireless Sensor Networks, **Feng Zhao and Leonidas Guibas**, Morgan Kaufman Publishers, 2004.
3 Ad Hoc Mobile Wireless Networks, **C.K.Toh**, Pearson Education, 2002.
4 Wireless Mesh Networking,**Thomas Krag and SebastinBuettrich,** OReilly Publishers, 2007.

Research Reference:-

1. Communications Letters, IEEE
2. Parallel and Distributed Systems, IEEE Transactions on
3. Selected Areas in Communications, IEEE Journal on