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M.Phil in Electronic Science

1. Objective of the course:

1. To provide academic progression to students obtaining MSc degree willing to pursue an academic career
2. To provide academic progression to professionals engaged in academic fileds
3. To provide a bridge course for an MSc student so as to encourage him / her for research.
4. To introduce emerging areas as discourses of study for promoting academic activities and research in related fields.

2. **Course Methodology:**

- A detailed treatment of each topic will be presented in class but a major portion of each class session will involve interaction and discussion. It is essential, therefore, that each student has a reading of the topic to be taken up in a class prior to attending the session.
- Written / presentation assignments will explore the issues and their logical consequences.
- Programming assignments will offer both programming experience and an opportunity to experiment with ideas.
- Dissertation work will involve students individually carry out a detail study on a topic and implement a related system.

3. Course Introduced from: January 2008

4. **Intake:** 4

5. **Structure:** 2 Semester (1 Academic Year)

Semester	Paper	Marks
Semester-1	Paper-1 (Theory): Group A: Nano Science & Technology; Group B: Photonics & Fiber Optics Technology	100
	Paper-2 (Theory): Group A: Digital Image Processing & Pattern Classification; Group B: Advanced Communication System	100
Semester-2	Dissertation	300

- Internal: 60 %
- External: 40 % of the marks scored in the End Semester Examination
- Lab Courses and Project Works should lay stress on continuous monitoring

5. **Elligibility:** MSc Degree holders form subjects like Electronics Science, Physics, Instrumentation

M Phil in Electronic Science

Detailed Syllabus:

Paper I: Nano Science & Technology and Photonics & Fiber Optics Technology
Marks-100

Group A: Nano Science & Technology

Unit 01: Introduction to thin films Two dimensional material, various methods of thin films growth, Molecular Beam Epitaxy (MBE)- Controlled deposition of single Atomic Layer. Liquid Phase Epitaxy (LPE) and Vapour Phase Epitaxy (VPE) Characterization of thin Film. Application of thin film.

Unit 02: Introduction: History, Core concepts

Unit 03: Nanoelectronic Devices - Resonant tunneling Devices, Single Electron Transistors & Quantum Dots

Unit 04: Fabrication & characterization techniques of Semiconductor. Quantum Dots.

Unit 05: Application spectrum of nanoelectronic devices, Technologies, Recent developments. Future of Nanoscience & Technology.

Books:

(1). Nanostructures: Theory & Modelling by C. Delerue & M. Lannoo (Springer)
(2) Nanoelectronic -Diwan & Bharadwaj (Pcntagon Press)
(3) Nanoelectronic & Nanosystems -- Goser, Glosekotter & Dien stuhl (springer)
(4) Semiconductor Quantum Dots – Banyai & Koch (World Scientific)
(5) Optical properties of Semiconductor of Nanocrystals SV Gaponenko (Cambridge University Press)"
(6) Core Concept of Nanotechnology with Application Spectrum - Rakesh Rathi (SBS Publishers & Distributors Pvt. Ltd. New Delhi)

Group B: Photonics &, Fiber Optics Technology. . '

Uuil I: Laser sources; display devices LEDs and LCDs Photon detector: Photodiodes: Pin Avalanche, Photo transistors Photonic band gap material. Photonic crystal fiber.

Unit II: Fiber optic communication system: TDM, WDM, DWDM communication, ITU grid, Add/drop problem in WDM communication. Communication Repeaters and amplifier. Fiber optic network component. Transceivers for fiber optic network: transmitter requirement receiver's requirements.

Unit III: Optical amplifier: Semiconductor optical amplifier, erbium doped fiber amplifier, Amplified spontaneous emission. .

Unit IV: Components switches & functional modules of fiber optic network. Couplers splitters wavelength division multiplexer demultiplexer filters, isolators, circulators and attenceators optical switches & functional modules. .

Unit V: Fiber optic instrumentation & sensors: Intensity modulated & phase modulated fiber optic sensors. Components requirement for fiber optic sensors. Fiber optic sensor Multiplexing.

Reference:

1. Introduction to Fiber Optics, By – Ghatak, K. Thyagaeajan. Cambridge 1999
2. Fiber Optic Communication Technologgy By- Maynbaev & Scheiner, Pearson Education 2004
3. Optics Communication, By G. Keiser, Mc Graw Hil 2nd Edition.
4. Fundamental of fiber optics in telecommunication & sensors application. By- BP Pal. New Age International 1993.
5. Fiber Optic Sensing and Signal Processing B. Culshow, Peter peregrunus Sterenage (1984)

Paper 2: Digital Image Processing and Pattern Classification and Advanced Communication System

Marks:100

Group A: **Digital Image Processing and Pattern Classification**

Course Objectives:

- To develop the student understands of the issues involved in Digital Image Processing
- To give the student an exposure to different Image Processing methods and issues involved
- To familiarize the student with specific, well known Pattern Classification methods, algorithms and results
- To make the student aware about Pattern recognition and the application of Artificial Neural Networks

Course Methodology:

- A detailed treatment of each topic will be presented in class but a major portion of each class session will involve interaction and discussion. It is essential, therefore, that each student has a reading of the topic to be taken up in a class prior to attending the session.
- Written assignment will explore the issues and their logical consequences.
- Programming assignment will offer both programming experience and an opportunity to experiment with ideas

Evaluation:

Take home assignment	10%
Programming Assignment	20%
Quiz	40%
Semester Examination	30%

Unit 1: Introduction- Steps in Digital Image Processing, Components of an Image Processing system, Applications. Human Eye and Image Formation; Sampling and Quantization, Basic Relationship among pixels-neighbor, connectivity, regions, boundaries, distance measures. Image Enhancement: Spatial Domain-Gray Level transformations, Histogram" Arithmetic/Logical Operations, Spatial filtering, Smoothing & Sharpening Spatial Fillers; Frequency Domain- 2-D Fourier transform, ~)jll()ottlll111 a III I Sharpening Frequency Domain Filtering; Convolution and Correlation Theorems; Image Restoration Inverse filtering, Wiener filtering; Image Compression- Redundancies-

Coding, Interpixel, Psycho visual. Fidelity, Source and Channel Encoding, Elements of Information Theory, Loss Less and Lossy Compression, Image Compression Standards;

Unit2: Introduction- Machine Perception, Pattern Classification Systems, Design Cycle, Learning and Adaptation; Bayesian Decision theory-Continuous & Discrete features, Minimum En or-Rate Classification, Classifiers; Parameter Estimation- Maximum Likelihood Estimation, Bayesian Estimation, Hidden Markov Model; Nonparametric Methods- Density Estimation, Parzen Windows, k-Nearest Neighbour Estimation; Introduction to fuzzy set & fuzzy classification; Linear Discriminant Functions;

Unit 3: Neural Networks- Introduction, Biological Neurons, Artificial Neurons - various models, transfer functions; Learning methods, Stability and Convergence, Functional units for Pattern Recognition tasks; Single Layered Perceptrons- LMS algorithm, Relation between perceptrons and Bayes Classifier for a Gaussian Environment;

Unit 4: Multilayered Perceptrons- Feed-Forward and Feed-Backward Networks, Back Propagation Algorithm, Feature Detection, Network pruning, Supervised learning as an Optimization problem. Convolution Networks, Radial Basis Function Networks; Introduction to SVM-application for aPattern Recognition Task & Non Linear Regression;

Unit 5: Self-Organizing Maps- Principles of Self-Organization, PCA, Two basic feature-Mapping Models, SOM Algorithm, Learning Vector Quantization; Introduction to neuro-hardware'

Reference /Text

1. A. K. Jain, Fundamentals of Digital Image processing, Pearson Education, 1989.
2 R. C. Gonzalez and R. E. Woods: Digital Image Processing, Pearson Education, 2001
3 R. C. Gonzalez, R. E. Woods and S. L Eddins: Digital Image Processing using MATLAB, Pearson Education, 2004.
4. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification; 2nd Edition, John Wiley, 2001
5. S.' Haykin: Neural Networks, 2nd Edition, Pearson Education, 2003
6. B. Yegnanarayana: Artificial Neural Networks, PHI, 2003,
7. S. N. Sivannndam, S. Sumalhi, S. N. Deepa: Neural Networks using Mallab 6.0, TMGH, 2003.
8. D A. Forsy1h & J. Ponce: Computer Vision, Pearson Education, 2003.

Group B: ADVANCED COMMUNICATION SYSTEMS

Unit I :

Introduction to electronic communications, communication Receiving and Transmitting systems, Noises in communication system, Review of modulation and demodulation, Amplitude modulation (AM), DSB, SSB and VSB transmission, Principle of Balanced modulator for side band generation, Filter method of SS13 transmission. Modulator and demodulator circuits, Balanced Modulators, Superheterodyne receivers, Quadrature Amplitude Modulations (QAM).

Frequency and phase modulation (FM), Basic principle of angle modulation, Frequency und phase modulation, modulators and demodulators, frequency discriminator and phase locked loop; Factoral-N frequency synthesizer.

Unit II:

Sampling theorem, pulse analog modulations (PAM), Shaping of the transmitted signals spectrum, Equalization, pulse Width Modulation (PWM) and Pulse Position

Modulation (PPM), Quantization, Pulse Code Modulation (PCM) and detection Differential pulse code modulation, Delta modulation, Amplitude shift keying (ASK). Frequency Shift Keying (FSK), phase shift keying (PSK), Dual Phase Shift Keying (DPSK) schemes, Comparison of digital modulation schemes, M -array signaling scheme. Time - Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM)

Unit III:

Line of sight (LOS) microwave communication link, -'round Reflection '0- efficient, Received field strength, variation of received field strength with antenna height, variation with distance, Effect of curvature of earth, Radio horizon, Effective antenna height divergence factor, in LOS communication link.

Propagation Effects for microwave links, Troposcatter Communication link. Fading of Tropospheric signals, Tropopath calculation, propagation impairments at microwave bands; Frequency management, System planning; Link design for LOS and Earth-space paths. Different transmission medium, Microwave repeaters, two wire and four wire repeaters, Microwave receivers and R.F. repeaters, Noise consideration. Measurement of system performance.

Satellite Communication: General principle of Satellite communication, Energy consideration, Active and Passive satellites, Global satellite communication, ground to ground, ground to space, space to ground communication system, Ground station, Transponder design systems, LEO, MEO, GEO Systems, Design of a typical satellite communication system.

Unit IV:

Basic Radar principle, Operating characteristic or Radar, Radar Indicators, Radar Range equation, Pulsed Radar systems. Duplexer, C.W. and frequency modulated radars.

Unit V:

Cellular Concept, Cell Clusters Frequency, re-use, Mobile Station (MS), Base Station (BS), Mobile Switching Center, (MSC), Different Cellular Standards, Digital Cellular system, TDMA and CDMA System, Global System for Mobile Communications (GSM) Standards, GSM Network, Control Functions, Call Setup, Call Handling, Mobility Management

Mobile Data Communications: Circuit and packet switched systems; General Packet Radio Service (GPRS); II' Based Mobile Systems.

Unit VI:

Concept of networks, Different types of networks, Internet technology, Different protocols for internet service, dial up internet connectivity, connection through microwave link, concept of VSAT technology, Satellites Interactive terminal, Received only terminal, World Wide Web (WWW) Communication System, concept of URL, Brief idea about the web design and implementation techniques, Concept of web based distributed coml11unication system with special reference legacy hardware.

Suggested Readings:

1. Electronic' Communication System by George Kennedy & Bernard Davis, Tata McGraw Hill.
2. Communication System Engineering by Johhn G. Proakis and Masound Salehi, 2nd Edition, Pearson Education.
3. Communication Systems by S. Haykins, 411tEdition, John Wiley.
4. Modern Communication System by Miller & Beasley, Prentice Hall of India.
5. Principles of Communication Theory by H.Taub and D.L. S. Schilling, McGraw Hill.
6. Information Transmission, Modulation and Noise by M. Schwartz, McGraw Hill.
7. Modern Analog and Digital Communication) Systems, B. P. Lathi, PHI

8. Foundations for Microwave Engineering,' Collin, McGraw Hill. .•..
9. Microwave Engineering by Annapurna Das & Sisir K. Das, Tata McGraw Hill.
10. Radio Frequency & Microwave Electronics by Matthew M. Radmanesh, Pearsoll Education Asia.
11. Telecommunication Engineering vol.1 &Vol.2 by N.N. Deb, New Age.
12. Telecommunication and Computers by J.Martin, Prentice Hall of India.
13. Mobile Communication. Schiller – Addison .Welsley
14. Wireless Communications and Networks-W. Stallings- Pearson Education
15. Mobile and Wireless Networks - U. Black--Prentice Hall, New Jersey.

Semester 2.

Dissertation- **Marks: 300**

Students individually will carry out a detail study on a topic and implement a related system. The study must include literature survey, methodology and proposed work, experimental details and results, modifications to be included and future directions, applications etc. A report is to be prepared and submitted under the guidance of a supervisor. The report should contain design, implementation and experimental details. The topics involved in the work should be related to the courses undertaken by the student till this portion of progression under the programme and have contemporary relevance. It can involve research and development oriented works and be carried out with an eye on the needs of the industry. The work must be defended through a presentation in front of a panel constituted by selected experts. The quality of the work should be reflected by atleast one publication in conference proceedings/ journals etc.

Evaluation:

- Internal: 60 %
- External: 40 % of the marks scored in the End Semester Examination
- Continuous monitoring