Indian Institute of Information Technology Bhagalpur

Electronics and Communication Engineering (ECE)

B.Tech. Curricula and Syllabus

Semester-VI

Curricula:

Course Code	Course name	L	T	P	C
EC305	Antenna & Microwave Engineering	3	0	0	3
EC306	Optical Communication & Networks	3	0	0	3
EC307	Computer Vision and Image Processing	3	0	0	3
EC308	Recent Trends in Wireless Communication	3	0	0	3
ME306	**Environmental Sciences & Green Technology**	**2**	**0**	**0**	**2**
	Elective-I	**3**	**1**	**0**	**4**
EC314	Antenna & Microwave Engineering LAB	0	0	3	2
EC315	Optical Communication LAB	0	0	3	2
EC316	Computer Vision and Image Processing LAB	0	0	3	2

Syllabus:

Course Code	Course name	L	T	P	C	Year	Semester
EC305	Antenna & Microwave Engineering	3	0	0	3	3rd	6th

Course objective: The main objective of the course is to provide the participants an insight into various aspects of the RF, microwave, mm-wave and Terahertz imaging techniques for biomedical, industrial and security applications.

Topic	Contents	No. of Lectures
Module-I	Distributed elements concept, Telegrapher's equations, Lossless and lossy lines, Line impedance and junction, Smith chart, TEM, TE and TM Waves, Coaxial cable, Rectangular and circular waveguides.	**09**
Module-II	L-section impedance matching, single and double stub matching, Quarter wave transformer, Theory of small reflections, Multi section matching transformer, Tapered lines.	**08**
Module-III	N-port microwave networks, Impedance, admittance, transmission and scattering matrix representations, Reciprocal and lossless networks, Network matrices transformations, Equivalent circuit extraction.	**08**
Module-IV	Microwave Passive Circuits: RLC, Microstrip and waveguide cavity resonators; Periodic structures and microwave filters; Hybrid junctions, directional couplers and power dividers; Ferrite devices and circulators. Microwave Integrated Circuits: Characteristics of microwave integrated circuits; design of single stage amplifier and oscillator; PIN diode based control circuits.	**09**

Module-V	Microwave Tubes: Limitations of conventional tubes, Klystron amplifier, Reflex klystron oscillator, Magnetrons, Travelling wave tubes; Microwave solid-state devices: Characteristics of microwave bipolar transistors and FET, Transferred electron devices, avalanche diode oscillators.	**08**
	Total	**42**
Text	1. David M. Pozar, *Microwave Engineering*; Wiley-IEEE Press, 4th edition, 2011. 2. A. Das and S. K. Das, *Microwave Engineering*, Tata McGraw-Hill, 3rd edition, 2015.	
Reference	1. R. E. Collin, *Foundations for Microwave Engineering*; Wiley-IEEE Press, 2nd edition, 2005.	

Course Code	**Course name**	**L**	**T**	**P**	**C**	**Year**	**Semester**
EC306	Optical Communication & Networks	3	0	0	3	3rd	6th
Course objective: The objective of this course is to have exposure to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.							
Topic	**Contents**						**No. of Lectures**
Module-I	Optical spectral bands, basic optical laws and definitions, optical fiber modes and configurations, fiber materials, photonic crystal fibers, fiber fabrication, Fiber optic cables; LEDs and Laser Diodes: Quantum efficiency, LED power, modulation of an LED; Laser diodes: modes, external quantum efficiency, resonant frequencies, structure and radiation patterns, single mode lasers, modulation of laser diodes; Power launching and coupling, Fiber splicing, optical fiber connectors;						**08**
Module-II	Noises and Sensitivity and System Performance: Photo detectors, detector response time, avalanche multiplication noise; Signal degradation, Attenuation, absorption, scattering losses, bending losses, core and cladding losses; Distortion in Fibers: Modal delay, group delay, material dispersion, waveguide dispersion, polarization-mode dispersion; Characteristics of single mode fibers						**09**
Module-III	Fundamental receiver operation, digital receiver performance, eye diagrams; coherent detection, burst mode receiver, analog receivers; Digital links, power penalties; Analog links, multi-channel transmission techniques; operational principles of WDM, DWDM, SONET, passive optical star coupler, isolators, circulators,						**09**
Module-IV	Variable optical attenuators, tuneable optical filters, dynamic gain equalizers, polarization controller, chromatic dispersion compensators; Optical amplifiers; Erbium Doped Fiber Amplifiers (EDFA): Amplifier noise, optical SNR, system applications:						**08**
Module-V	Performance Measurement and Monitoring: Measurement standards, basic test equipment, optical power measurements, optical fiber characterization, eye diagram tests, optical time-domain reflectometer, optical performance monitoring, optical coupler and switches.						**08**
	Total						**42**
Text	1. G. Keiser, *Optical Fiber Communications*; Tata McGraw Hill, 4th edition, 2010. 2. J. C. Palais, *Fiber Optic Communications*; Pearson, 5th edition, 2009.						

Reference	1. J. M. Senior, *Optical Fiber Communications Principles and Practice*; Pearson, 3rd edition, 2011.

Course Code	Course name	L	T	P	C	Year	Semester
EC307	Computer Vision and Image Processing	3	0	0	3	3rd	6th

Course objective: To introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving. Lab exercises will familiarize the student with typical hardware as well as software development tools. Students will use the C programming language or M-files in MATLAB to implement computer vision algorithms.

Topic	Contents	No. of Lectures
Module-I	Image representation-Gray scale and colour Images, image sampling and quantization.; Two dimensional orthogonal transforms - DFT, FFT, WHT, Haar transform, KLT, DCT.; Image enhancement - filters in spatial and frequency domains, histogram-based processing, homomorphic filtering.; Edge detection-non parametric and model based approaches, LOG filters, localisation problem	**09**
Module-II	Image Restoration - PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.	**07**
Module-III	Mathematical morphology - binary morphology, dilation, erosion, opening and closing, duality relations, gray scale morphology, applications such as hit-and-miss transform, thinning and shape decomposition.	**08**
Module-IV	Computer tomography - parallel beam projection, Radon transform, and its inverse, Back-projection operator, Fourier-slice theorem, CBP and FBP methods, ART, Fan beam projection.; Image communication - JPEG, MPEGs and H.26x standards, packet video, error concealment.	**08**
Module-V	Image texture analysis - co- occurrence matrix, measures of textures, statistical models for textures. Misc. topics such as - Hough Transform, boundary detection, chain coding, and segmentation, thresholding methods.	**08**
	Total	**40**
Text	1. A. K. Jain, *Fundamentals of digital image processing*, Prentice Hall, 1989. 2. R.M. Haralick, and L.G. Shapiro, *Computer and Robot Vision*, Vol-1, Addison Wesley, 1992.	
Reference:	1. R. Jain, R. Kasturi and B.G. Schunck, *Machine Vision*, Tata McGraw-Hill International Edition, 1995.	

Course Code	Course name	L	T	P	C	Year	Semester
EC308	Recent Trends in Wireless Communication	3	0	0	3	3rd	6th

Course objective: To expose the students to understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.

Topic	Contents	No. of Lectures

Module-I	Introduction: Diversity-multiplexing trade-off, transmit diversity schemes, advantages and applications of MIMO systems	**06**
Module-II	Analytical MIMO channel models: Uncorrelated, fully correlated, separately correlated and keyhole MIMO fading models, parallel decomposition of MIMO channel. Power allocation in MIMO systems: Uniform, adaptive and near optimal power allocation.	**09**
Module-III	MIMO channel capacity: Capacity for deterministic and random MIMO channels, Capacity of i.i.d., separately correlated and keyhole Rayleigh fading MIMO channels.	**07**
Module-IV	Space-Time codes: Advantages, code design criteria, Alamouti space-time codes, SER analysis of Alamouti space-time code over fading channels, Space-time block codes, Space-time trellis codes, Performance analysis of Space-time codes over separately correlated MIMO channel, Space-time turbo codes. MIMO detection: ML, ZF, MMSE, ZF-SIC, MMSE-SIC, LR based detection.	**09**
Module-V	Advances in MIMO wireless communications: Spatial modulation, MIMO based cooperative communication and cognitive radio, multiuser MIMO, cognitive-femtocells and large MIMO systems for 5G wireless.	**09**
	Total	**40**
Text	1. B. Clerckx and C. Oestges, *MIMO wireless networks*, Elsevier Academic Press, 2nd edition, 2013. 2. N. Costa and S. Haykin, *Multiple-input multiple-output channel models*, John Wiley & Sons, 2010.	
Reference:	1. T. M. Duman and A. Ghrayeb, *Coding for MIMO communication systems*, John Wiley and Sons, 2007. 2. A. Chokhalingam and B. S. Rajan, *Large MIMO systems*, Cambridge University Press, 2014.	

Course Code	Course name	L	T	P	C	Year	Semester
ME306	Environmental Sciences & Green Technology	2	0	0	2	3rd	6th

Course objective: To bring in the importance and the underlying principles of green and sustainable technology.

Topic	Contents	No. of Lectures
Module-I	Introduction to Environmental Pollution: Environmental Awareness, Concept of an ecosystem, structure and function of an ecosystem, energy and nutrient flow, biogeochemical cycles, sources, pathways and fate of environmental pollutants.	**05**
Module-II	Air pollution- Introduction, Segments of environment, Layers of atmosphere and their significance; Mechanism, Causative factors, Consequences and Preventive measures – Ozone depletion, Greenhouse effect and Global warming; Earth's radiation budget, Classification of air pollutants, Indoor air pollution, Smog-photochemical and sulphurous, Acid rain, Air Quality Standards, Human health effects-Bhopal gas tragedy.	**05**

Module-III	Water Resource; Water Pollution : Definition, Classification , Sources of Contamination, Pollutants & their Detrimental Effects; Water Quality: Portability limit – WHO and PHED Specification; Water Quality Monitoring, Municipal Water Treatment: Slow and Rapid Sand Filter, Disinfection – Methods, Advantages & Disadvantages, Sterilization	**05**
Module-IV	Soil and Noise pollution: Lithosphere and Soil profile, Soil contamination, sources of soil contamination, Important environmental properties of soil contaminants, Ecological & Health effects, Exposure & Risk Assessment; Noise pollution: Brief introduction to noise pollution, source, measurement and prevention of noise pollution	**05**
Module-V	Radioactive Pollution & Solid Waste Management: Radioactive pollutant: units of radiation and instruments for their measurements, types of radioactive pollutants and risk factor associated with these radiations Radioactive waste and their disposal, accidental leakage of radiation from nuclear reactors (discuss Chernobyl and Fukushima) Solid waste management different types of solid waste, composting, biological methods of detoxification of hazardous waste Onsite handling and composting, integrated solid waste management,	**05**
	Total	**42**
Text	1. Miller, T. G. Jr., *Environmental Science*, Wadsworth Publishing House, USA. 2. Masters, G.M, *Introduction to Environmental Engineering*.	