SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category: DC	Subject Code: EC-701	Subject Name: **Optical Communication**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assign.	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Introduction to communication system, Electromagnetic Theory

Course Objective:

The objective of course is to familiarize students with various optical fiber modes, configurations and various signal losses occur in optical fiber and to study about various optical sources and optical receivers and their use in the optical communication system.

Course Outcomes:

CO1: Develop basic understanding of concepts of optical communication, understand and measure signal degradation.: Apply the knowledge for measuring and comparing the performance of different optical systems. (BL1, BL2, BL3)
CO2: Analyse different optical signals, optical communication systems and networks.(BL3, BL4)
CO3: Design optical systems like sources, couplers, various types of receivers and splices based on required specifications of application.(BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Element of an Optical Fiber Transmission link, Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers- Modes, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fibre materials. Multi Mode Fibers, Linearly Polarized Modes , V-number, Mode coupling, Step Index fibers, Graded Index fibers.	11	CO1, CO2
II	Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -RI profile and cut-off wavelength.	8	CO1, CO2
III	lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effect, Laser operation – Semi conductor laser diode – Spatial Emission pattern of Laser – operation – Semi conductor laser diode – Spatial Emission pattern of Laser, Power Launching and coupling.	8	CO2, CO3
IV	Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss. Fibre -to- Fibre joints, Fibre splicing. Fiber Splicing- Splicing techniques, Splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints, Optical amplifiers, EDFA.	10	CO2, CO3
V	Point-to-Point links System considerations -Link Power budget -Rise - time budget -Noise Effects on System Performance	3	CO2, CO3
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Optical Power Measurements.-CO2
2. The HeNe Laser Intensity Profile: Experimental Verification-CO2
3. Light Polarization and Focal Length measurement of of Thin Lenses.-CO2
4. Determination of the Acceptance Angle and Numerical Aperture of Optical Fibers-C02
5. Light Coupling to Multimode Graded Index Fiberr.-CO2
6. OTDR Measurement of Fiber Length, Attenuation and Splice Loss..-CO2
7. Setting up fiber optic analog and digital link.-CO3
8. Intensity modulation system using analog and digital input signal.-CO2
9. Frequency modulation and pulse modulation system.-CO2
10. Measurement of optical power and propagation losses using Optical power meter–CO2

Note: Some experiments can be performed through simulation using a Virtual Lab.

Text Book-

- J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.
- Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
- Text Book on Optical Fibre Communication and its Applications – S. C. Gupta, PHI, 2005.

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category : **DE**	Subject Code: **EC 702**	Subject Name: **Elective - IV (A) Digital Image Processing**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

• Mathematics • Signal & Systems • Communication Systems

Course Objective:

The objective of this course is to provide fundamental knowledge of Image Processing Techniques.

Course Outcomes:

On successful completion of this course student should be able to:

CO1: Understand how images are formed, acquired, and stored, along with an appreciation for the limitations of images in terms of characteristics such as resolution, object visibility, contrast, and so on. (BL1, BL2)

CO2: Understand how to manipulate digital images in the spatial domain and in the frequency domain to achieve a desired result, such as image enhancement or image restoration. (BL3, BL4)

CO3: Design and implement various spatial and frequency domain methods for enhancement, restoration and compression of images. (BL3, BL6)

UNITs	Descriptions	Hrs.	CO's
I	Digital Image Processing (DIP): Introduction, Examples of fields that use DIP, fundamental steps in DIP, components of an image processing system. Digital Image Fundamentals: elements of visual perception, image sensing and acquisition, Image Digitization Process, Image sampling and quantization, Matrix Representation, Basic relationships between pixels, Neighborhood, Distance Measures.	8	1
II	Image Transforms: Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), Aliasing, Lloyd max Quantizer, Properties of 2D DFT. Other transforms and their properties: Cosine transform, Sine transform, Walsh transform, Hadamard transform, Performance Comparison of 2D FT, DCT, WT etc.	10	1, 2
III	Image Enhancement: Spatial domain methods: Image Enhancement using point processing techniques, basic intensity transformation functions, Negative Transformation, Contrast Stretching, Gray Level Slicing, Histogram based processing-Equalization-specification, Image Subtraction, Image Averaging, Mask Processing Techniques, Fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters Frequency domain methods: basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters)	8	1,2,3
IV	Image Restoration: Image degradation/restoration, Image Formation Process, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, Constrained Least Square Filter.	7	2,3
V	Image Compression: Fundamentals of data compression: basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding. Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG Digital Image Watermarking	7	1,3
Guest Lectures (if any)			
Total Hours		40	

Text Book-

- Gonzalez and Woods: Digital Image Processing, Pearson Education.
- Anil Jain: Fundamentals of Digital Image Processing, PHI Learning.
- Annadurai: Fundamentals of Digital Image Processing, Pearson Education.
- Chanda and Majumder: Digital Image Processing and Analysis, PHI Learning.
- Jayaraman, Esakkirajan and Veerakumar: Digital Image Processing, TMH.

Reference Books- William K. Pratt, Digital Image Processing, Wiley India.

Modes of Evaluation and Rubric

Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance

Recommendation by Board of studies on	
Compiled and designed by	Dr. D K Shakya

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category : **DE**	Subject Code: **EC-702**	Subject Name: Elective-IV (B) **OFDM & MIMO**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-		100	3	-	-	3

Prerequisites:

- Probability & Stochastic process
- Wireless Communications

Course Objective:

The fundamental concepts and design principles in "multiple-input multiple-output".this course is intended to impart to the students the principles of (MIMO) wireless communications –channel capacity, antenna diversity, space-time the fundamental concepts in "orthogonal frequency-division multiplexing" (OFDM)coding communications – transmission, synchronization, peak-to-average power ratio (PAPR) reduction.

Course Outcomes:

After completion of the course, the student is able to:

CO1: Describe and understand the channel performance using Information theory issues in OFDM systems, MIMO systems, and Space-Time Modulation and Coding. (BL1, BL2)

CO2: Analyse OFDM & MIMO systems for its performance, issues, and implement various modulation and coding algorithms. (BL3, BL4)

CO3: Design and improve OFDM and MIMO Systems-(BL3, BL6).

UNITs	Descriptions	Hrs.	CO's
I	OFDM Basics: Multi-carrier transmission- Data Transmission using Multiple Carriers-Multicarrier Modulation with Overlapping Sub channels, OFDM modulation & demodulation, BER; coded-OFDM; Orthogonal frequency-division multiple-access (OFDMA).	10	1,2,3
II	OFDM Synchronization: Effect/estimation of symbol-time offset (STO); Effect/estimation of carrier-frequency offset (CFO); Effect/compensation of Sampling clock offset (SCO), Frequency and Timing Offset Issues.	9	1,2,3
III	OFDM Issues: Peak-to-Average Power Ratio Reduction (PAPRR): Distribution of OFDM-signal amplitude, PAPR & oversampling; Frequency and Timing Offset Issues - Mitigation methods, SNR performance.	9	1,2,3
IV	Introduction to MIMO: MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing. MIMO Diversity Gain: Beam forming Antennas, Diversity: Receive- antenna diversity; Transmit-antenna diversity, MIMO Diversity and applications	9	1,2,3
V	Space-Time Modulation and Coding: ML detection, rank and determinant criteria, Space-time trellis and block codes, Detection for Spatially Multiplexed MIMO Systems - MIMO - OFDM.	8	1,2,3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- MIMO-OFDM Wireless Communications with MATLAB Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G. Kang John Wiley & Sons (2010)

Reference Books-

- MIMO-OFDM for LTE, WiFi and WiMAX Li Wang, Ming Jiang, Lajos L. Hanzo, Yosef AkhtmanWeily 2011.
- OFDM for Wireless Communications Systems Ramjee Prasad, Artech House Publishers (2004).
- MIMO Wireless Communications Ezio Biglieri Robert Calderbank Anthony Constantinides Andrea Goldsmith Arogyaswami Paulraj H. Vincent Cambridge University Press (2007).

Modes of Evaluation and Rubric	
Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. M L Jatav

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIIth Semester

Subject Category: DE	Subject Code: EC 702	Subject Name: Elective-IV (C) Neural Network and Fuzzy Logic

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

Matlab Programming

Course Objective:

The objective of course is to familiarize students with the concepts and application of Neural Network (NN). NN is an information processing system that is inspired by the way such as biological nervous systems e.g., brain. Neural network is trained to perform complex functions in various fields, including pattern recognition, `, classification, speech and vision.

Course Outcomes:

On successful completion of this course student should be able to:

CO1: Acquire knowledge and understand the basics of NN and various learning mechanisms, single layer perceptron's, feedforward NN, Radial Basis Function Networks, Support Vector machines, Competitive Learning and Self organizing NN and Fuzzy Logic. (BL1, BL2)

CO2: Apply knowledge and Analyse the NN structures and various learning mechanisms, single layer perceptron's, feedforward NN, Radial Basis Function Networks, Support Vector machines, Competitive Learning and Self organizing NN and Fuzzy Logic. (BL3, BL4, BL5)

CO3: Design and implementation of NN and various learning mechanisms, single layer perceptron's, feedforward NN, Radial Basis Function Networks, Support Vector machines, Competitive Learning and Self organizing NN and Fuzzy Logic. (BL5, BL6)

UNITs	Descriptions	Hrs.	CO's
I	Introduction and NN Structure Biological neurons and artificial neurons, Model of an NN, Activation functions used in NNs. Typical classes of network architectures. Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning.	9	1,2,3
II	Single layer perceptron's: Structure and learning of perceptron's, Pattern classifier - introduction and Bayes' Classifiers, Perceptron as a pattern classifier, Perceptron convergence, Limitations of a perceptron's.	9	1,2,3
III	Feed forward NN: Structures of Multi-layer feedforward networks, Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation, Practical and design issues of back propagation learning.	9	1,2,3
IV	Radial Basis Function Networks: Pattern reparability and interpolation, Regularization Theory, Regularization and RBF networks, RBF network design and training, Approximation properties of RBF.	9	1,2,3
V	Support Vector machines: Linear reparability and optimal hyperplane, Determination of optimal hyperplane. Optimal hyperplane for non-separable patterns, Design of an SVM, Examples of SVM.	9	1,2,3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- S.N. Sivanandan, S. Sumathi, S. N. Deepa,"Introduction to Neural Networks using MATLAB 6.0"
- Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
- Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.
- Neural Networks & Fuzzy Logic by Bart Kosko

Reference Books-

- Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997
- Fuzzy logic with engineering application by ROSS J.T (Tata Mc)

Modes of Evaluation and Rubric

Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Sheena Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category :**DE**	Subject Code: **EC 703**	Subject Name: Elective-V (A) **Artificial Intelligence**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Engineering Mathematics
- Signals & Systems
- Digital Signal Processing.

Course Objective:

Search methods. Knowledge representation, resolution and Question – Answering, conceptual dependency, frames and scripts. AI languages like PROLOG and LISP. Expert systems Design and ANN's.

Course Outcomes:

On successful completion of this course student should be able to:
CO1: Identify with and understand to the search methods associated with solving of AI problems (BL1, BL2, BL3)
CO2: Analyse and Apply the machine learning for developing algorithms and the structure of Expert System. (BL3, BL4)
CO3: Design and develop classification method based for modify existing System or developing them own. (BL3, BL6)
CO4: Evaluate the performance or parameters of different searching methods (BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Basic Problem-solving methods: Production systems-state space search, control strategies, Heuristic search, forward and backward reasoning, Hill climbing techniques, Breadth first search, Depth first search, best search, staged search.	8	1, 2
II	Knowledge Representation: Predicate logic, Resolution question Answering, Nonmonotonic Reasoning, statistical and probabilistic reasoning, Semantic Nets, Conceptual Dependency, frames and scripts	8	1, 2
III	Introduction to Expert Systems: Structure of an Expert system interaction with an expert, Design of an Expert system.	7	1,3
IV	Introduction to ML; Problems, data, and tools; Visualization; Overfitting and complexity; training, validation, test data, Classification problems; decision boundaries; nearest neighbour methods, Probability and classification, Bayes optimal decisions, Naive Bayes and Bayes' Rule and Naive Bayes Model, Logistic regression.	9	1,2,3
V	Linear classifiers, (SVM) Support vector machines and large-margin classifiers, Ensemble methods: Bagging, random forests, Unsupervised learning: clustering, k-means, support vector regression, Time series; Markov models; autoregressive models.	8	3,4
Guest Lectures (if any)			
Total Hours		40	

Text Book-

- Adaptive Filter Theory", S. Haykin, Pearson Education 2003

Reference Books-

- Adaptive Signal Processing" B. Widrow, and S. D. Sterns, Pearson Education 2005.
- "Statistical and Adaptive Signal Processing" Manolakis, Ingle, and Kogon, McGraw Hill International Edition.

Modes of Evaluation and Rubric

Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Snehlata Sahu

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category: **DE**	Subject Code: **EC-703**	Subject Name : Elective-V (B) **Satellite Communication**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Analog Communication, Digital Communication.

Course Objective:

The objective of this course is to provide knowledge to the students about the basics of satellite communications and their applications in various fields. This course aims to provide basic technical knowledge of orbital dynamics, different subsystems used in space segment and ground segment, power and bandwidth requirement, and effect of the transmission medium on the quality of transmission.

Course Outcomes:

At the end of the course, the student should be able to:

CO1: Understand the basic principle behind satellite communication, different orbital elements and parameters and their importance in satellite communication.

CO2: Understand working and operation of various sub systems of satellite as well as the earth station.

CO3: Analyze different parameters used in designing satellite communication link

CO4: Learn advanced multiple access techniques used in satellite communication

CO5: Understand role of satellite in various applications

UNITs	Descriptions	Hrs.	CO's
I	Orbit and Description: Introduction, A brief History of Satellite Communication, Satellite Frequency bands, Satellite Systems, Kepler's Law, Definitions of Terms for Earth-Orbiting Satellites, types of orbit, Orbital Elements, Apogee and Perigee Heights, Orbital Period and Velocity, Effects of Orbital inclination, Azimuth and Elevation, Coverage and Slant range, Orbital perturbations . Placement of a Satellite in a Geo-Stationary Orbit	9	1
II	Satellite Sub-Systems: The Power Systems, Altitude and orbit control system, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Sub-System, Altitude control Sub-System, Power, Communication Subsystems, Satellite antenna Equipment.	8	2
III	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, Carrier-to-Noise Ratio, The Uplink, Saturation flux density, Input backoff, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio	10	3
IV	Satellite Access: Introduction, Frequency Division Multiple Access(FDMA), Preassigned FDMA, Demand Assigned FDMA, Time Division Multiple Access(TDMA) TDMA, Frame structure, Burst structure, Satellite Switched TDMA Onboard processing, frame efficiency, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code Division Multiple Access , Spread Spectrum Transmission and Reception, Spade System.	8	4
V	Earth Station Technology and Satellite Applications: Transmitters, Receivers, Antennas, Tracking systems, Terrestrial Interface, Lower Orbit Considerations, Satellite Applications in different fields, Direct Broadcast Satellite, VSATs, Global Positioning System (GPS) and other navigation system etc.	10	2,5
Guest Lectures (if any)			
Total Hours		45	

Text Book- Satellite Communications, by Dennis Roddy(Fourth edition),McGraw Hill.

Reference Books-

1. Satellite Communications, by Dennis Roddy(Fourth edition),McGraw Hill.
2. Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (Second Edition), Pearson

3. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt(Second Edition), John Wiley & Sons. 4. Satellite Technology, Principles and Applications, by Anil K. Maini, Varsha Agarwal (Second Edition), Wiley	
Modes of Evaluation and Rubric	
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Neelesh Mehra

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category :**DE**	Subject Code: **EC 703**	Subject Name: Elective-V(C) **FPGA Architecture& Applications**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	150	3	-	-	3

Prerequisites:

- Digital circuits and systems, Understanding of XILINX IDE, Fundamentals of VHDL Language. Understanding of FSMs

Course Objective:

The objective of this course is to provide knowledge on digital hardware realization, and prototyping on FPGA.

Course Outcomes:

On successful completion of this course student should be able to:
CO1: Understand and describe the architecture, functioning of Programmable Devices. — (BL1, BL2)
CO2: Analyse FPGA Board, and different algorithms-(BL3, BL4).
CO3: Develop and implement algorithms on SOC devices for various applications-(BL3, BL6)

UNITs	Descriptions	Hrs.	CO's
I	Revision of basic Digital systems: Combinational Circuits. Sequential Circuits Timing. Electrical Characteristics. Power Dissipation. Digital system Design. Top-down Approach to Design, Case study. Data Path, Control Path. Controller behaviour and Design. Case study Mealy & Moore Machines. Timing of sequential circuits. Pipelining, Resource sharing. FSM issues (Starring state, Power on Reset, State diagram optimization, State Assignment, Asynchronous Inputs, Output Races, fault Tolerance).	9	1
II	Programmable Logic Devices: Introduction. Evolution: PROM, PLA, PAL. Architecture of PAL's. Applications. Programming PLD's. Design Flow. Programmable Interconnections. Complex PLD's (MAX - 7000, APEX). Architecture, Resources, Applications, Tools and Demonstration of the tool.	7	1
III	FPGA: Introduction. Logic Block Architecture. Routing Architecture. Programmable Interconnections. Design Flow. Xilinx Virtex-II (Architecture). Altera Stratix, Actel 54SX Architecture. Boundary Scan Programming FPGA's. Constraint Editor, Static Timing Analysis. Applications. Tools. Case Study. Xilinx Virtex II Pro, Embedded System on Programmable Chip. Hardware-software co-simulation, Bus function models, BFM Simulation. Debugging FPGA Design.	08	2
IV	VHDL for Synthesis: Introduction. Behavioural, Data flow, Structural Models. Simulation Cycles. Process. Concurrent Statements. Sequential Statements. Loops. Delay Models. Sequential Circuits. FSM Coding. Library, Packages. Functions, Procedures. Operator Inferencing. Test bench.	11	3
V	Current state of the field: Applications: SoC, IP Design. SoPC. Design methodology, System Modelling. Hardware-Software Co-design. Device Technology. Application Domains.	5	3
Guest Lectures (if any)			
Total Hours		40	

Text Book-

- J. Bhaskar, A Vhdl Primer, Prentice Hall
- Web Resource-http://nptel.ac.in/courses/117108040/ by Prof. KuruvillaVarghese,IISC Bangalore.

Reference Books-

- Charles H Roth Jr "Digital systems design using VHDL",2nd edition, 2008.
- J. Old Field, R.Dorf, "Field Programmable Gate Arrays",John Wiley & Sons, New York, 1995.
- S.Trimberger, Edr. "Field Programmable Gate ArrayTechnology", Kluwer Academic Publications, 1994.PLD, FPGA data sheets.

Suggestive list of experiments: NIL

Modes of Evaluation and Rubric

Intermediate tests/Assignments Test, Midsem, Lab Works, Quiz, End Sem Viva and Theory Exams

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Niraj Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category: DE	Subject Code: EC 704	Subject Name: Elective -VI (A) Internet of Things

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Digital Circuit Systems.
- Microprocessor & Embedded Systems Design

Course Objective:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identify sensor techn. for sensing real world entities and understand the role of IoT in various domains of Industry.

Course Outcomes:

On successful completion of this course student should be able to:

CO1: grasp an understating of what is IOT and its applications, and working of devices and systems functioning as part of a Network

CO2: analyse the performance of various sensors, actuators, smart networks, and optimize the performance transport layers and applications

CO3: Apply the knowledge, analyse and design various IOT networks for developing and monitoring smart infrastructures.

UNITs	Descriptions	Hrs.	CO's
I	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	5	1
II	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	9	1,2
III	IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods	8	1,2,3
IV	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary,	12	1,2,3
V	Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	11	1,2,3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Case for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743).

Reference Books-

- Dr. Rajkamal "IOT Architecture and design principles" by Mc Graw Hill Education Private Limited.
- Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
- Adrian Mcewen, Hakin Cassimally, "Designing The Internet of Things" Wiley.
- Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications.
- Charalampos Doukas, Building The Internet of Things with the Arduino: V.10, 2012.
- Hakima Chaouchi (Ed.), The Internet Of Things: Connecting Objects, Wiley, 2010.
- Dubey Rahul "Internet of Things", CENGAGE Leaning India, 2019

Modes of Evaluation and Rubric	
Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Neelesh Mehra

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category :DE	Subject Code: EC 704	Subject Name: Elective -VI (B) Robotics

Maximum Marks Allotted											Total Credits
Theory				Practical			Total Marks	Contact Hours			
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Digital Circuit Systems.
- Basic Electronics.
- Microprocessor
- Embedded Systems Design

Course Objective:

- To acquire the knowledge on advanced algebraic tools for the description of motion.
- To develop the ability to analyze and design the motion for articulated systems.
- To develop an ability to use software tools for analysis and design of robotic systems.

Course Outcomes:

On successful completion of this course student should be able to:
CO1: Be able to use matrix algebra and Linear algebra for computing the kinematics of robots.
CO2: Be able to calculate the forward kinematics and inverse kinematics of serial and parallel robots.
CO3: Be able to calculate the Jacobian for serial and parallel robot.
CO4: Be able to do the path planning for a robotic system.
CO5: Be proficient in the use of Maple or Matlab for the simulation of robots.

UNITs	Descriptions	Hrs.	CO's
I	Robots: Introduction, anatomy, Robot specifications, Robot characteristics, Areas of application, classification of robots. Robotic arm, Sensors, Encoders, Tachometers, Robotic drive systems and actuators, Specification.	8	1,2,3
II	Principle of operation and areas of application of: DC motor, Stepper motor, Servo motor and brushless DC motor, Microprocessor control of electric motors, speed control using PWM and direction control using H- Bridge.	12	1,2,3,4
III	Robotic vision systems, Image processing techniques, kinematics, inverse kinematics, Velocity kinematics, Application of velocity kinematics for all serial manipulators.	8	1,2,3,4
IV	Digital and Programmable Logic (PLC) controllers. Robot Programming.	6	1,2,3,4,5
V	Industrial applications of Robots, Mobile robots, Micro robots, Recent developments in Robotics.	6	1,2,3,4,5
Guest Lectures (if any)			
Total Hours		40	

Text Book-

- Mikell and Groover, Industrial Robotics – Technology, Programming and Applications, McGraw Hill, 2/e, 2012.

Reference Books-

- Saeed B. Niku Introduction to Robotics. Analysis and control, applications- Wiley student edition, 2010 3. Spong and Vidyasagar, Robot Dynamics and Control, John Wiley & Sons, 1990.

Modes of Evaluation and Rubric

Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. Ankita Srivastava

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Programme: B.Tech. Electronics and Communication Engineering, VII[th] Semester

Subject Category: DE	Subject Code: EC 704	Subject Name: Elective-VI (C) Wireless Sensor Network

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Digital Circuit Systems.
- Basic Electronics.
- Instrumentation and Measurement

Course Objective:

The course is aimed both at students who wish to do research in the sensor networks area, as well as at students from related disciplines, such as signal processing, wireless communications, databases, algorithms, etc., who wish to understand what new challenges sensor networks pose for their own discipline.

Course Outcomes:

On successful completion of this course student should be able to:

CO 1: Acquire knowledge and understand sensor networks and its various types, enabling technologies, single node architecture, routing protocols and execution environments. (BL1, BL2)

CO 2: Apply knowledge and Analyse sensor networks and its various types, enabling technologies, single node architecture, routing protocols. (BL3, BL4, BL5)

CO 3: Design and implementation of various concepts of sensor networks and its various types, enabling technologies and single node architecture. (BL5,BL6)

UNITs	Descriptions	Hrs.	CO's
I	Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks.	9	1,2,3
II	Single-node architecture, Hardware components & design constraints.	9	1,2,3
III	Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.	9	1,2,3
IV	Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, Internet to WSN Communication.	9	1,2,3
V	Operating systems and execution environments, introduction to TinyOS and nesC.	9	1,2,3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- WaltenegusDargie , Christian Poellabauer, Fundamentals Of Wireless Sensor Networks Theory And Practice By John Wiley & Sons Publications

Reference Books-

- SabrieSoloman, SENSORS HANDBOOK by Mc Graw Hill publication.
- Feng Zhao, Leonidas Guibas, Wireless Sensor Networks, Elsevier Publications.
- Kazem Sohrby, Daniel Minoli, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley-Inderscience
- Philip Levis, And David Gay Tinyos Programming by Cambridge University Press.

Modes of Evaluation and Rubric	
Quiz/Assignment, Mid Semester Exam, End Semester Exam, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Sheena Kumar