7th SEMESTER

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1.	ECEL	PECECE 701	**Program Elective-3** A. Embedded System B. Wireless Communication	3	0	0	3	3
2.	ECEL	PECECE 702	**Program Elective-4** A. Microwave Theory and Techniques B. Computer Architecture	3	0	0	3	3
3.	ECEL	PECECE 703	**Program Elective-5** A. Digital Image and Video Processing B. Satellite Communication C. Advanced Industrial Automation and Control	3	0	0	3	3
4.	OEC	OECECE 704	**Open Elective-3** A. Deep Learning B. Entrepreneurship C. Web technology	3	0	0	3	3
5.	GSC	ESP 702	ESP VII	1	0	0	1	0.5
6.	CC	PECECE792A	Microwave Laboratory	0	0	2	2	1
		PECECE792B	Computer Architecture Laboratory	0	0	2	2	
7	GSC	SDP 782	SDP VII	0	0	1	1	0.5
8.	ECP	PRJECE 781	Project Work - I	-	-	-	5	4
9	Mandatory	Internship I	Internship					4
10.	Mandatory Course	MAR 781	Mandatory Additional Requirement (MAR)	0	0	0	0	0
11.		IFC	Industry and Foreign Certification	0	0	0	0	0
							Total Credit Points =	**22**

INSTITUTE OF ENGINEERING & MANAGEMENT
(AUTONOMOUS INSTITUTION)
SUBJECT: MICROWAVE THEORY AND TECHNIQUE

SUBJECT CODE: PECECE702A

Subject Code: PECECE702A	**Category:** Program Elective-3
Subject Name: Microwave Theory and Technique	**Semester:** 7th
L-T-P: 3-0-0 (Total Contact Hrs. 40)	**Credit:** 3
Pre-Requisites: Mathematics, Electromagnetic Waves	

COURSE OUTCOMES:

At the end of the course, students will demonstrate the ability to:

- **CO1.** Understand various microwave system components and their properties.
- **CO2.** Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
- **CO3.** Design microwave systems for different practical application.
- **CO4.** To learn about microwave measurement techniques and microwave design principles.

COURSE CONTENT:

Module No.	Description	Hrs.
Module 1:	**Introduction to Microwaves:** History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. **Brief introduction of EM waves:** wave equations, solution of wave equation, time harmonic fields. Distortion and Condition for minimum attenuation	**8**
Module 2:	**Microwave Transmission Modes, Waveguides, Transmission Lines:** Concept of Mode, Features of TEM, TE and TM Modes, Brief introduction of transmission lines, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Coaxial line, Rectangular Waveguide, Cavity Resonator, Circular waveguide, Strip line, Micro strip line. **Microwave Passive Components and their S-matrix Representation:** Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters. Isolator, Circulator, Gyrator, Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator.	**12**
Module 3:	**Microwave Vacuum Tubes:** Klystron, Reflex Klystron, TWT, Magnetron, **Microwave Semiconductor Devices:** Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. **Microwave Design Principles:** Overview of Impedance Matching, Microwave Filter, RF and Microwave Amplifier, Microwave Power Amplifier, Low Noise Amplifier, Microwave Mixer, Microwave Oscillator.	**10**
Module 4:	**Microwave Measurements:** VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Power, Frequency and impedance measurement at microwave frequency. Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters. **Microwave Systems:** Introduction to EMI & EMC.	**10**

INSTITUTE OF ENGINEERING & MANAGEMENT
(AUTONOMOUS INSTITUTION)
SUBJECT: MICROWAVE THEORY AND TECHNIQUE
SUBJECT CODE: PECECE701A

Text/Reference Books:

1) **Samuel Y. Liao, Microwave Devices and Circuits, Pearson**
2) Monojit Mitra, Microwave Engineering, Publisher: Dhanpat Rai
3) R.E. Collins, Microwave Circuits, McGraw Hill
4) K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech House
5) Kulkarni M, Microwave and Radar Engineering, UMESH Publications
6) David, M. Pozar, Microwave Engineering, Wiley India

INSTITUTE OF ENGINEERING & MANAGEMENT
(AUTONOMOUS INSTITUTION)
SUBJECT: SATELLITE COMMUNICATION
SUBJECT CODE: PECECE703B

Subject Code: PECECE703B	**Category:** Program Elective-5
Subject Name: Satellite Communication	**Semester:** 7th
L-T-P: 3-0-0 (Total 30 Hrs.)	**Credit:** 3
Pre-Requisites: Mathematics, Communication	

COURSE OUTCOMES:

At the end of the course, students will demonstrate the ability to:

CO1. Introduction to Satellite Communication and concepts of various modulation techniques and multiple access schemes like CDMA, TDMA, FDMA etc.

CO2. Working principles of satellite communication, orbital mechanics, various launch vehicles, satellite sub-systems, satellite links, various phenomena of satellite communications and satellite communication network.

CO3. Typical Phenomena in Satellite Communication and knowledge on Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

CO4. Link Design for Satellites and C/N ratio calculations in clear air and rainy conditions, Calculation of System noise temperature for satellite receiver, noise power calculation.

INSTITUTE OF ENGINEERING & MANAGEMENT
(AUTONOMOUS INSTITUTION)
SUBJECT: SATELLITE COMMUNICATION
SUBJECT CODE: PECECE703B

Module No.	Description	Hours
Module 1:	**Introduction to Satellite Communication:** Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. **Modulation and Multiple Access Schemes:** Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.	**8**
Module 2:	**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day. **Satellite Networks:** Low Earth Orbit (LEO) Satellite Networks, Geostationary (GEO) Satellite Networks	**5**
Module 3:	**Launch Vehicles**: Launch Vehicles- principles of Rocket propulsion, powered flight, Launch vehicles for communication satellite. **Satellite sub-systems:** Satellite sub-systems, redundancy of subsystem, Bathtub curve and satellite link design- AOCS, TT&C, power system, spacecraft antenna, transponder.	**6**
Module 4:	**Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	**5**
Module 5:	**Link Design for Satellites:** RF Link, Friis transmission equation, G/T ratio of earth station Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Calculation of System noise temperature for satellite receiver, noise power calculation.	**6**

Text Book:

1. T. Pratt, C. Bostian and J. Allnutt, "*Satellite Communications," 2nd Edition*, Wiley India, 2006.
2. W. L. Pritchart, H. G. Suyderhoud and R. A. Nelson, "*Satellite Communication Systems Engineering," 2nd Edition*, Pearson Education, 2012.
3. G. Gordon and W. Morgan, "*Principles of Communications Satellites*,"
4. D. I. Dalgleish "*An Introduction to Satellite Communications*," IET Publisher, ISBN: 0863411320, 9780863411328
5. D. Roddy, " *Satellite Communication*," Tata McGraw-Hill Education, ISBN: 0070077851, 9780070077850

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech. Admission Batch 2022

SUBJECT: DEEP LEARNING
SUBJECT CODE: OECEC704A

Subject Code: OEC-EC704A	Category : Professional Core courses
Subject Name : DEEP LEARNING	**Semester** : **7**
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites: (1) Machine Learning (OEC-EC604B); (2) Data Structures and Algorithms; (3) Mathematics & Statistics (Linear Algebra, and Statistics and Probability)	

Course Objectives: The primary objectives of this course are:

1. Introduce the fundamental principles and mathematical foundations of artificial neural networks and deep learning.
2. Equip students with practical skills to design, implement, and train deep neural network models using modern frameworks such as TensorFlow and PyTorch.
3. Explore convolutional neural networks (CNNs) and their applications in computer vision, object detection, and transfer learning.
4. Enable understanding of sequence modelling using RNN, LSTM, GRU, and their use in natural language processing tasks.
5. Provide conceptual and practical exposure to generative models like GANs and VAEs, and their applications in image generation, anomaly detection, and data synthesis. Encourage ethical thinking by addressing issues such as hallucination, bias, and fairness in generative AI systems
6. Introduce deep reinforcement learning and Q-learning as tools for intelligent decision-making in dynamic environments.

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Course Modules:

Module & Topics	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours
1 **AI, ML and DL and their applications and Limitations of Machine Learning**	Introduction to Artificial Intelligence, Machine Learning and Deep Learning **Research Domains and Industry Applications** a) Healthcare b) Manufacturing c) Retail d) Virtual Assistants e) Self-Driving Cars **Major Limitations of Machine Learning versus Deep Learning:** a) Over-Dependency on Data Quality and Quantity b) Over-Dependency on Model Selection c) Automatic feature selection (no manual feature engineering required) d) Scaling up to Data Volume **Why Deep Learning?**	**IIT Madras syllabus (CS6910: Deep Learning):** https://www.cse.iitm.ac.in/~miteshk/CS6910.html **International Academia:** **Stanford University:** *https://www.coursera.org/specializations/deep-learning* international curriculum of Stanford CS231n **MIT:** https://ocw.mit.edu/courses/6-s191-introduction-to-deep-learning-january-iap-2020/	**2**
2 **Fundamentals of Neural Network**	Understanding the Biological Neuron Exploring the Artificial Neuron **Early Implementations of ANN:** a) McCulloch-Pitts Model of Neuron b) Rosenblatt's Perceptron		**5**

	Types of Activation Functions: a) Linear Function b) Non-linear Function c) Softmax Function d) Thumb Rule for Selecting Activation Function **Architectures of Neural Network:** a) Single Layer Feedforward Network b) Multi-Layer Feedforward ANN c) Convolution Network d) Recurrent Network **Learning Process in ANN:** a) Weight of Interconnection between Neurons b) Gradient Descent and Backpropagation **Deep Neural Network**	*Industry Mapping:* TensorFlow, Keras, PyTorch	
3 **Training Deep Neural Networks**	**Mathematics Behind Backpropagation** **Deep L-Layer Neural Network:** Stochastic Gradient Descent **Other Optimization Algorithms** Gradient Descent with Momentum **Regularization** a) L1/L2 Regularization b) Early Stopping c) Dropout Regularization d) Data Augmentation **Normalization of Inputs** a) Batch Normalization b) Group Normalization	**IIT Madras syllabus (CS6910: Deep Learning):** https://www.cse.iitm.ac.in/~miteshk/CS6910.html **International Academia:** **Stanford University:** *https://www.coursera.org/specializations/deep-learning* international curriculum of Stanford CS231n **MIT:** https://ocw.mit.edu/courses/6-s191-introduction-to-deep-learning-january-iap-2020/ *Industry Mapping:* TensorFlow, Keras, PyTorch	**6**
4 **Convolutional Neural Networks (CNNs) and its application in Computer Vision**	**Introduction to Computer Vision** a) Healthcare b) Manufacturing c) Agriculture How the computer sees the world Challenges faced by Traditional ANN to work with Image Data **Building blocks of Convolution Neural Network** a) Kernel/Filter b) Image Convolution c) Pooling **Building a Convolution Neural Network** a) Going under the hood of CNN b) Comparing CNN with traditional ANN **Popular CNN Architectures** LeNet AlexNet VGGNet ResNet Inception Network/GoogLeNet U-Net **Object Detection** a) Bounding Box b) Sliding Window based Object Detection c) YOLO Algorithm d) Landmark Detection Transfer Learning		**8**

	Essential Pre-processing Task in Computer Vision a) Image Scaling b) Data Augmentation		
5 **Sequence Based Models**	**Introduction to Sequence Data** a) Different types of tasks in Sequence b) Neural Networks: A Brief Revisit **Recurrent Neural Network (RNN)** a) Data Preparation for RNN b) Vanishing Gradient Problem and RNN **Long-Short Term Memory (LSTM)** **Gated-Recurrent Units (GRU)** **Bi-directional Models – e.g., Bi-LSTM** Language Modelling and Sequence Models **--- Large Language Models (LLMs)** **Encoder-Decoder Architecture** **Transformers & Attention Mechanism** **Transformer Architectures** **Generative Artificial Intelligence (Gen AI) -** **Variational Autoencoders (VAE)** **Generative Adversial Networks (GAN)** a) Adversial Examples b) Basic Concepts of GAN c) Few popular variants of GAN d) Application of GAN	**IIT Madras syllabus (CS6910: Deep Learning):** https://www.cse.iitm.ac.in/~miteshk/CS6910.html **International Academia:** **Stanford University:** *https://www.coursera.org/specializations/deep-learning* international curriculum of Stanford CS231n **MIT:** https://ocw.mit.edu/courses/6-s191-introduction-to-deep-learning-january-iap-2020/ *Industry Mapping:* TensorFlow, Keras, PyTorch	**15**
6	**Deep Reinforcement Learning:** Policy Gradients Markov Decision Process Q-learning in simulated environments. Implementation of Deep Q-Learning Overview of some popular Deep RL Algorithms		**4**

Course Outcome:

1) Understand the foundational concepts of neural networks, perceptron, and the architecture of deep neural models.

2) Analyze and implement deep learning training algorithms including backpropagation, optimization, and regularization techniques.

3) Design and evaluate convolutional neural networks (CNNs) for visual data processing, including object detection and segmentation.

4) Apply sequence-based models such as RNN, LSTM, GRU, and bidirectional architectures for tasks involving sequential data and language modeling.

5) Develop and utilize generative models such as GANs and VAEs for creative tasks, anomaly detection, and data augmentation.

6) Demonstrate basic applications of deep reinforcement learning and Q-learning in simulated environments.

Textbooks:

1. **AURELIEN : Aurelien Geron** - Hands-On Machine Learning with Scikit-Learn, Keras, and Tensorflow Concepts, Tools – 3rd edition (O'REILLY – Shroff Publishers and Distributors India, July 2022)
2. **BUDUMA: Nithin Buduma, Nikhil Budhuma & Joe Pappa**: "Fundamentals of Deep Learning" (O'REILLY, Shroff Publishers and Distributors, India, 2nd edition)
   *(**NOTE**: Both the authors are MIT educated AI professionals based in California, USA)*
3. **AGGARWAL : Charu C. Aggarwal:** "Neural Networks and Deep Learning" (Springer, 2nd edition, June 2023)
   *(**NOTE**: Dr. Charu C. Aggarwal is a distinguished US-NRI - a PhD from MIT and an award-winning Distinguished Senior Research Scientist at IBM T.J.Watson Research Center, Yorktown Heights, New York, USA)*

Reference Books:

1. **RUSSELL : Stuart Russell and Peter Norvig:** "Artificial Intelligence - A Modern Approach", (Pearson,4th edition, 2022), Ch.21 onwards
2. **PRINCE: Simon J.D. Prince:** "Understanding Deep Learning" (MIT Press, July_02_2024)
3. **IAN: Ian Goodfellow, Yoshua Bengio and Aaron Courville**: "Deep Learning", (MIT Press,2016). Also available online at: http://www.deeplearningbook.org.
4. **BISHOP: C.M. Bishop with H.Bishop:** "Deep Learning – Foundations and Concepts", (Springer, November, 2023)
5. **AMIT : Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra and Amlan Chakrabarti**: "Deep Learning" (Pearson)

University of Engineering and Management, Kolkata
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech (Admission Batch 2022)

Subject Name: Wireless Communication **Credit: 3** **Lecture Hours: 36**

Subject Code: PECECE701B

Pre-requisite: Signals and Systems, Analog and Digital Communication, Mathematics.

Coursera link LinkedIn link NPTEL link

COURSE OBJECTIVE:

1. An understanding on functioning of different mobile communication system and evolution of different mobile communication systems and of different mobile communication systems and standards.
2. An ability to explain the architecture, functioning, protocols, capabilities and applications of various mobile communication networks.

COURSE OUTCOMES:

1. Demonstrate their understanding on functioning of wireless mobile communication system and evolution of different mobile communication systems and standards.
2. Explain the architecture and application of various mobile communication networks.
3. Demonstrate an ability to evaluate design challenges, constraints and security issues associated with wireless networks. Demonstrate an ability to explain multiple access techniques for Wireless mobile communication.
   Apply the concept of GSM in real time applications
4. Explain the wireless communication protocols and their application.

Module number	Topic	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Assignments	Text Books/ Study Material
1	**Introduction**	Cellular Mobile Wireless Networks: Systems and Design Fundamentals: Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences,	***International Academia:https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/, https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-%20Mobile%20Communication%20Systems***	5	1. Design, Simulation and implementation of wireless networks using MATLAB/NS2. 2. Design, Simulation and implementation of various modulation and demodulation using MATLAB.	Ref: Rappaport "Wireless communications-principles and practice", 2nd edition, Pearson pub: Chapter 1 and 2

		Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff.	***AICTE-prescribed syllabus:*** (https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/ Simulink applications designs and real time implementation.		3. Evaluation of co-channel interference using MATLAB.	
2	**Propagation Channel modelling**	Characteristics of wireless channel and propagation path loss models: Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell	***International Academia*: *https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/*, *https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-%20Mobile%20Communication%20Systems*** ***AICTE prescribed syllabus:***	4	Study of SNR calculation over various channel using MATLAB.	Ref: Rappaport "Wireless communications-principles and practice", 2nd edition, Pearson pub: Chapter 3, 4 and 6.

		propagation models, types of base stations and mobile station antennas.	(https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/ Simulink applications designs and real time implementation of various channels.			
3	**Generation-wise evolution**	Path of evolution of cellular communication system architecture-1G, 2G, 3G, 4G and 4G beyond.	***International Academia*: *https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/*, *https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-***	6	Design, Simulation and implementation of various network architectures with the objective to realize the speed, reliability etc.	Ref: Rappaport "Wireless communications-principles and practice", 2nd edition, Pearson pub: Chapter 1, 9 and 10.

			%20Mobile%20Communication%20Systems ***AICTE prescribed syllabus:*** (https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs and real time implementation to realize various impact of different generations.			

4	**Multiple access Techniques**	Multiple Access Technologies in cellular communication Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies: Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-CDMA system	***International Academia*: *https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/*, *https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-%20Mobile%20Communication%20Systems*** ***AICTE prescribed syllabus:*** (https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs to realize multiple access techniques.	7	Study of Modulation and Demodulation various Keying techniques along with various multiple access approach using MATLAB.	Ref: Rappaport "Wireless communications-principles and practice", 2nd edition, Pearson pub: Chapter 8.

5	**Mobile communication network architecture**	Cellular Communication Networks and Systems Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Super frames and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber.	***International Academia*: *https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/*, *https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-%20Mobile%20Communication%20Systems*** ***AICTE prescribed syllabus:*** (https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs for transmitter and receivers.	8	Detailed study of frequency of operation, call establishment, channel strength, channel condition, spectrum access etc. through MATLAB/NS2.	Ref: Rappaport "Wireless communications-principles and practice", 2nd edition, Pearson pub: Chapter 1, 9 and 10.

6	**Wireless LAN**	Wireless Local Area Networks (WLAN): IEEE 802.11 Standards and Protocols IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA collision avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11.	***International Academia*: *https://ocw.mit.edu/courses/6-452-principles-of-wireless-communications-spring-2006/pages/syllabus/*, *https://www.mit.edu.au/study-with-us/units/ME602/ME602%20-%20Mobile%20Communication%20Systems*** ***AICTE prescribed syllabus:*** (https://www.aicte.gov.in/sites/default/files/Final_ECE.pdf) ***Industry Mapping:*** MATLAB/Simulink applications designs for 802.11 based architectures.	6	Detailed study of WLAN and VoWLAN network performance through MATLAB/NS2.	Ref: J. Schiller, "Mobile communications", Addison-Wesley 2nd edition, Pearson pub: Chapter 7.

Text Books:

1. Theodore S. Rappaport, Wireless communications: principles and practice, PHI/Pearson education.
2. J. Schiller, Mobile communications, Addison-Wesley.

Reference Books:

1. William C. Y. Lee, Mobile cellular telecommunication–analog and digital systems, Mc Graw Hill, 2nd ed.
2. Wang, Wireless communication System, Pearson Education
3. Talukdar, Mobile computing, TMH
4. J. W. Mark, W. Zhuang, Wireless Communication and Networking, PHI
5. Stallings, Wireless Communication & Networks, Pearson Education
6. K. Feher, Wireless digital communications, Prentice Hall of India.
7. Roy Blake, Wireless communication technology, Thomson Delmer.

University of Engineering and Management

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Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2022

Subject Name: Embedded System **Credit: 3** **Lecture Hours: 36**

Subject Code: PECECE701A

Pre-requisites:

Digital Electronics, Microprocessors and Microcontrollers, C and C++ Programming.

Course Objectives:

1. To introduce the fundamental concepts and architecture of embedded systems, including microcontrollers and processors.
2. To develop the ability to design and implement embedded hardware and software systems for real-world applications.
3. To provide knowledge of real-time operating systems (RTOS) and their role in embedded system development.
4. To foster analytical skills to evaluate design trade-offs in hardware-software co-design and system optimization.

Course Outcomes:

1. Understand advanced concepts of Embedded System Architecture.
2. Design systems for various embedded applications.
3. Design software systems such as RTOS using embedded controllers.
4. Analyze Hardware Software co-design trade-off.

Relevant Links:

Coursera: https://www.coursera.org/learn/introduction-embedded-systems
NPTEL: https://nptel.ac.in/courses/108102045
Linkedin Learning: https://www.linkedin.com/learning/c-programming-for-embedded-applications-14537235
Infosys Springboard: https://infyspringboard.onwingspan.com/web/en/login
Study Material: https://drive.google.com/drive/folders/1HLaNGtv3XoIp46j32LbMwh43PeStc9Xl?usp=sharing

Module Number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Introduction to Embedded Systems**	Definition of Embedded System and its features, Embedded Systems vs General Computing Systems, Classification of Embedded Systems, Embedded Hardware Units, Embedded Software, Applications and examples of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1* ***AICTE-prescribed syllabus*:** *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf* ***Industry Mapping:*** *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design*	6	-

2	**Embedded Processors**	Generic structure and features, choice of microcontroller, ARM microcontroller Structure, Instruction Set (ARM, THUMB), exceptions, digital signal processors with examples, field-programmable gate arrays (FPGAs), and application-specific integrated circuits (ASICs). Embedded memories Choosing the appropriate embedded hardware platform.	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1* ***AICTE prescribed syllabus:*** *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf* ***Industry Mapping:*** *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design*	5	-
3	**Interfacing**	Understanding serial peripheral interface (SPI), inter-integrated circuits (I2C), RS-232C series, Universal Serial Bus (USB), infrared communication (IrDA), and Controller Area Network (CAN). Bluetooth, ADCs and DACs. subsystem interfacing. User interfaces.	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1* *AICTE prescribed syllabus:* *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf*	6	-

			Industry Mapping: *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design*		
4	**Real-Time System Design and RTOS**	Real-time task periodicity, scheduling, and scheduling algorithms, Resource sharing and priority inheritance protocols, Examples of Real Time Operating Systems (RTOS).	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1* ***AICTE prescribed syllabus:*** *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf* ***Industry Mapping:*** *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design/*	6	-
5	**Embedded programming**	Features of embedded programming languages, comparison between such languages, Choosing a language, Embedded C overview.	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1*	5	-

			AICTE prescribed syllabus: *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf* ***Industry Mapping:*** *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design*		
6	**Hardware-Software Co-Design**	Co-simulation and partitioning techniques. Optimization methods such as integer linear programming, Kernighan-Lin heuristic, genetic algorithms, and particle swarm optimization. Power-aware partitioning and functional partitioning.	***International Standards:*** *https://web.stanford.edu/class/cs240e/* *https://pll.harvard.edu/subject/embedded-systems-1* ***AICTE prescribed syllabus:*** *https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf* ***Industry Mapping:*** *https://www.intel.com/content/www/us/en/software/programmable/soc-eds/overview.html* *https://mu.microchip.com/page/embedded-system-design*	8	-

Text Books:

1. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Second Edition, Tata McGraw-Hill.
2. Shibu, K. V. “Introduction to embedded systems”, Second Edition, Tata McGraw-Hill Education.