Bharati Vidyapeeth (Deemed to be University), Pune
Faculty of Engineering and Technology
Programme: B. Tech. (Electronics & Communication) –CBCS 2021 Course

B. Tech. (Electronics & Communication) Sem VII

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
41		FTTH-Optical communication	3	2	0	60	40	25	25	0	150	3	1	0	4
42		Radar & Satellite Communication	4	0	1	60	40	0	0	0	100	4	0	1	5
43		AI and Data Mining*	4	2	0	60	40	50	0	0	150	4	1	0	5
44		Elective- I	3	2	0	60	40	00	50	0	150	3	1	0	4
45		Project Stage-I	0	2	0	0	0	50	50	0	100	0	3	0	3
46		Android App Development	0	2	0	0	0	50	0	0	50	0	1	0	1
47		Internship#	0	0	0	0	0	25	25	0	50	0	3	0	3
	Total		**14**	**10**	**1**	**240**	**160**	**200**	**150**	**0**	**750**	**14**	**10**	**1**	**25**

*Industry Taught Course- – V
Period- 60 days

Sr. No.	**Name of the Elective-I**
1	Augmented Reality & Virtual Reality
2	Data Centre Engineering
3	RF & Microwave Communication
4	Cyber Security & Forensics
5	Wireless Robots

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B. Tech. Electronics and Communication Engineering Sem VII **FTTH-OPTICAL COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	TW: 25 Marks, OR:25 Marks	Credits:01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Analog Circuits & Applications, Digital Communication, EM Waves & Propagation, Integrated Circuits& Amplifier Design.

Course Objectives:	
1	To understand the basic elements of optical fiber Communication & FTTH.
2	To enrich the knowledge about optical communication systems and networks
3	To learn about the various optical sources, detectors and transmission techniques,
4	To explore various idea about optical fiber measurements and various coupling techniques.
5.	To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM.

Course Outcomes: After learning this course students will be able to	
1	Identify and classify the structures of FTTH & Optical fiber.
2	Compare different optical sources and detectors and their principle.
3	Analyse the performance of various digital and analog fiber-optic access solutions.
4	Analyse various coupling losses and Design considerations of FTTH.
5	Compare the factors affecting the performance of different optical fibre communication systems.
6	Comprehend design, construction and testing of optical fiber communication system**.**

UNIT – I	**Introduction to FTTH-Optical Communication.**	**(06 Hrs)**
	Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication. FTTH, FTTH Components, optical fiber waveguides, Ray theory, Types of fiber, cutoff wavelength, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.	
UNIT – II	**Optical Transmitter and Receiver**	**(06 Hrs)**
	Optical Transmitter Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes,	

	comparison of photo detectors**.** drive circuits for digital and analog transmission. **Optical Receivers** Photodetector types and performance characteristics, PiN photodiodes, Direct detection receivers, Coherent receivers, Advanced measurement techniques for optical fiber links.	
UNIT– III	**Analog and Digital Links**	**(06 Hrs)**
	Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.	
UNIT– IV	**FTTH Technology and its network design**	**(06 Hrs)**
	FTTH technology & architectures, Passive Optical Network and types of splitting, GPON, EPON, Planning and Design issues, Link design and related considerations. ONT and its configurations, optical loss budget for a FTTx network, Testing FTTx Networks.	
UNIT – V	**Optical Components and Optical Networks:**	**(06 Hrs)**
	WDM concepts, overview of WDM operation principles, WDM standards, Types of Optical Amplifier and its applications, Amplifier Noise, Optical SNR, Raman Amplifier, Fiber optic splices, connectors & couplers & Coupling losses. Optical couplers, Isolators and Circulators. Network Concepts, network Topology, SONET/SDH.	
UNIT– VI	**Optical Fiber measurements and Applications**	**(06 Hrs)**
	Test Equipment, OTDR, Set ups for Measurement of Attenuation, Dispersion, NA and EYE pattern. Application in military, Industrial applications and applications in local area network.	

List of Practicals: The term work shall consist of record of minimum eight experiments
1. Optical Source Characteristics: Aim: To plot the electrical and optical characteristics of
different light sources.
2. Numerical Aperture of fiber: To estimate the numerical aperture of given fiber.
3. To measure the attenuation of given MMSI and SMSI fibers.
4. To measure the attenuation variation in length of optical cable.
5. To measure the attenuation due to bending of optical fiber.
4. Optical detector characteristics: To plot the frequency response of detectors with different
values of load resistor.
5. Fiber Bandwidth/Data rate: To estimate the bandwidth of given fiber.
6. Transmission of analog & Digital signal using a simple fiber optic link.
7. To test & study fiber optics connector & splicing of optical fibers
8. To perform Frequency modulation using optical fiber.

9. To perform PWM using optical fiber.
10. To find the optical power using “Optical Power Meter”.
11. To find the optical response using OTDR.
12. Determination of input, output and transfer characteristics of Optocoupler.
Content Delivery Methods: Chalk & talk, ICT Tools **Assessment Methods:** 1. Internal Assessment (IA)(Unit Test, PBL) 2. End-term Examination (UE)
Text Books:
1. Gerd Keiser, “Optical Fiber Communications”, Tata McGraw Hill, Fourth Edition. 2. John M. Senior, “Optical Fiber Communications-Principles and Practice”, Prentice Hall of India, second Edition. 3. “Fiber to the Home: The New Empowerment”, Wiley Survival Guides in Engineering and Science Book
Reference Books:
1. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, Tata McGraw-Hill International Edition.
2. Djafar K.Mynbaev and Lowell L.Scheiner, “Fiber optic communication Technology”, Pearson Education.
3. J.H. Franz and V. K. Jain, “Optical Communication - Components and systems”, Narosa Publishing house.
4. Bhattacharya, “Semiconductor Opto Electronic Devices”, PHI Learning, New Delhi.
5. Jim Hayes, “Fiber Optic Association Fiber to the Home-Handbook”
Project Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VII **RADAR AND SATELLITE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE):60 Marks	Credits: 04
	Internal Assessment (IA): 40 Marks	
Tutorial: 01 Hr/week		Credit:01
	Total:100 Marks	**Total Credits:05**

Course Pre-requisites:

Basic Communication Engineering

Course Objectives:

1	To give the knowledge about satellite communication.
2	To introduce the concept radar communication.
3	To make the student aware of the function of satellite transmitter and receiver.
4	To impart the mathematical concepts & types of radar.

Course Outcomes: After learning this course, students will be able to

CO1	Learn the basics of satellite communication.
CO2	Comprehend subsystem for satellite Communication.
CO3	Describe the design of satellite link.
CO4	Categorise the satellite navigations and GPS.
CO5	Interpret the working of the radar
CO6	Analyse the performance using the Radar Equations.

UNIT– I	**Introduction of Satellite Communication:**	**(08 Hrs)**
	A brief History of satellite communication, satellite frequency bands, satellite system, Application of satellite, orbital period and velocity, coverage and slant range, orbital perturbations, placement of satellite in geostationary orbit	
UNIT–II	**Satellite subsystems**:	**(08 Hrs)**
	Altitude and orbital control system, Telemetry Tracking and command system, Altitude control subsystem, power system, communication subsystem, Satellite antenna equipment.	
UNIT-III	**Satellite Link**:	**(08 Hrs)**
	Basic transmission theory, system noise temperature and G/T ratio, Basic link analysis, interference analysis, Design of satellite link for specified C/N Ratio, Link budget.	
UNIT–IV	**Earth Station Technology, Satellite Navigation and GPS:** Satellite transmitter, satellite receivers, satellite antenna, tracking system,	**(08 Hrs)**

	Radio and satellite navigations, GPS, position location principle, GPS receiver.	
UNIT–V	**Introduction of Radar**	**(08 Hrs)**
	Nature of RADAR, Maximum unambiguous range, Radar waveforms, simple form of radar equations, Radar block diagram, Radar frequencies and applications	
UNIT–VI	**Radar Equations and Types**:	**(08 Hrs)**
	Predications of radar performance, Minimum detectable signal, Receiver noise and SNR, Integration of Radar pulses, Radar cross section of target, transmitter power, system losses, Doppler effect	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Merrill I. skolnik "Introduction to radar system" third edition, Tata MGgraw Hill.
2. Dennis Roddy, "Satellite Communicatons" McGraw-Hill- 4th edition.
3. Giriraj Kumar Prajapati "Basic of RADAR and Its Applications in Wireless Communication" Scholar's Press.
4. Timothy Pratt , "Satellite communication", Wiley publication.
5. Dharma Raj Cheruku "Satellite Communication" I K International Publication House Pvt. Ltd.

Reference Books:

1. Bruce R. Elbert, "Introduction to satellite communication" Artech House.
2. Michal "Satellite Communication Engineering" , CRC press.

Project Based Learning:

Students are expected to perform a project (in group) based on the course and prepare report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering SemVII **ITC-V:ARTIFICIAL INTELLIGENCE AND DATA MINING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks	Credits: 04
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	TW- 50 marks	Credit: 01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
1	Essentials of data science
2	Fuzzy Logic, Neural Networks, and Genetic Algorithms

Course Objectives:	
1	Introduce a relatively new computing paradigm for creating intelligent machines
2	Utilize data mining as a cutting-edge business intelligence tool.
3	Develop and apply critical thinking, problem solving and decision-making skills.
4	Describe and demonstrate basic data mining algorithms, methods, tools

Course Outcomes: After learning this course students will be able to	
CO1	Evaluate various problem-solving agents in AI
CO2	Design and analyse search techniques and game playing techniques
CO3	Implement the various expert systems in AI
CO4	Apply the basic concept of data mining and its functionality
CO5	Apply the concept of association rules, different techniques and implementation details
CO6	Design and implement the various the ML based algorithm.

UNIT – I	**Introduction to Artificial Intelligence**	**(05 Hrs)**
	AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	
UNIT – II	**Search Techniques and Game Playing**	**(07 Hrs)**
	Defining The Problems as a state space search, Production Systems, Production Characteristics, Production System Characteristics, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. Game Playing-Adversial search, Games, mini-max algorithm, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.	

UNIT – III	**Expert System**	**(8 Hrs)**
	Introduction, Structure of expert systems, the human element in expert systems, problem areas addressed by expert systems, expert systems success factors, types of expert systems, Internet interacts web, knowledge engineering, methods, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty	
UNIT – IV	**Introduction to Data mining**	**(08 Hrs)**
	Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocess-ing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction: -Data Cube Aggregation, Data 35 Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.	
UNIT – V	**Data mining various aspects**	**(10 Hrs)**
	Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining, Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases.	
UNIT – VI	**Classification and Predictions**	**(10 Hrs)**
	What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm. Cluster Analysis: Data types in cluster analysis, Clustering methods, Partitioning methods. Hierarchical Clustering-CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method – Statistical Approach, Neural Network approach, Outlier Analysis.	
Content Delivery Methods: Chalk & talk, ICT Tools **Assessment Methods:** 1. Internal Assessment (IA)(Unit Test, PBL)		

2. End-term Examination (UE)

List of Experiments: The term work shall consist of record of minimum eight experiments

1. Write a program to implement Tic-Tac-Toe game problem
2. Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem) .
3. Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem)
4. Write a program to implement Single Player Game (Using Heuristic Function)
5. Write a program to implement Back propagation
6. Write a program to implement K-nearest neighbor classifiers
7. Write a program to implement Hierarchical Clustering
8. Write a program to implement Density Based Methods- DBSCAN
9. Write a program to implement Grid Based Method- STING
10. Write a program to implement Grid Based Method- CLIQUE
11. Write a program to implement Outlier Analysis
12. Write a program to implement Neural Network based approach

Text Books:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel" , Computational Intelligence: a logical approach", Oxford University Press.
3. H.Dunham,"Data Mining: Introductory and Advanced Topics" , Pearson Education.
4. J. Han and M. Kamber Morgan Kaufmann , "Data Mining Concepts and Techniques", 2006, ISBN 1-55860- 901-6
5. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education (Addison Wesley), 0-321-32136-

Reference Books:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
3. Elaine Rich, Kevin Knight "Artificial Intelligence" -2nd Edition, Tata Mcgraw-Hill.
4. Jiawei Han, Micheline Kamber," Data Mining Concepts & Techniques" Elsevier.
5. Anand Rajaram, Jure Leskovec and Jeff Ullman, "Mining Massive data sets" , Cambridge University Press.

Project Based Learning:

Students are expected prepare report on any one topic related to this subject, write its definition, applications and illustrate with few examples. Also, write pseudo code/proof for it, wherever applicable. Use python for implementation

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B. Tech. Electronics & Communication Engineering Sem VII **ELECTIVE-I: AUGMENTED REALITY & VIRTUAL REALITY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credits:01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Computer Graphics

Course Objectives:	
1	To introduce AR VR technology, its principles and Human-Computer interaction techniques related to VR/AR.
2	To familiarise the student with various types of hardware and software in Virtual Reality systems.
3	To introduce Virtual/ reality and Augmented Reality to variety of applications.

Course Outcomes: After learning this course, students will be able to	
CO1	Describe how Virtual reality systems work and list the applications of VR.
CO2	Identify various geometric modelling techniques.
CO3	Comprehend the hardware and sensors used in Virtual Environment.
CO4	Understand the concepts of Augmented Reality and related technologies.
CO5	Apply various types of hardware and software in virtual reality systems.
CO6	Apply the acquired knowledge for analysis Virtual/Augmented Reality Applications

UNIT – I	**Introduction to Virtual Reality (VR)**	**(05 Hrs)**
	Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR.	
UNIT–II	**Computer Graphics and Geometric Modelling**	**(08 Hrs)**
	The virtual world space, positioning the virtual observer, human vision, stereo perspective projection, colour theory, 2D to 3D conversion, 3D space curves, 3D boundary representation, Simple 3D modelling, Illumination models, Reflection models, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations.	
UNIT-III	**Virtual Environment**	**(06 Hrs)**
	Input/Output devices: Input (Tracker, Sensor, Digital gloves, movement capture, video-based Input, 3D Menus & 3D Scanner, etc.), Output	

	(Visual/Auditory/Haptic Devices) Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment	
UNIT–IV	**Introduction to Augmented Reality (AR)**	**(05 Hrs)**
	History of augmented reality, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments.	
UNIT – V	**Development Tools and Frameworks**	**(06 Hrs)**
	Human factors: Introduction, the eye, the ear, the somatic senses Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML.	
UNIT–VI	**AR / VR Applications**	**(06 Hrs)**
	Applications of VR/AR in medical, manufacturing, education, entertainment, Science, game development, etc. future of VR/AR	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:
1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Textbooks:

1. Coiffet, P., Burdea, G. C., "Virtual Reality Technology," Wiley-IEEE Press.
2. Schmalstieg, D., Höllerer, T. "Augmented Reality: Principles & Practice," Pearson.
3. Norman, K., Kirakowski, J., "Wiley Handbook of Human Computer Interaction," Wiley-Blackwell.
4. John Vince, J., "Virtual Reality Systems", Pearson.

Reference Books:

1. Craig, A. B., "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann.
2. Craig, A. B., Sherman, W. R., Will, J. D., "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann.
3. Anand, R., "Augmented and Virtual Reality," Khanna Publishing House.
4. Fowler, A., "Beginning iOS AR Game Development: Developing Augmented Reality Apps with Unity and C#," Apress

List of Experiments:- The term work shall consist of record of minimum eight experiments

1. Installation of Unity and Visual Studio, setting up Unity for VR development.
2. Demonstration of the working of HTC Vive, Google Cardboard, Google daydream.
3. Develop a scene in Unity that includes a cube, plane and sphere

4. Apply transformations on the 3 game objects.
5. Add a video and audio source.
6. Develop a scene in Unity that includes a cube, plane and sphere.
7. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene.
8. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click
9. Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects.
10. Write a C# program to grab and throw the sphere using VR controller.
11. Develop a simple UI (User interface) menu with images, canvas, sprites and button.
12. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction displays a score on scene
Project-Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VII **ELECTIVE-I: DATA CENTER ENGINEERING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credits: 01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Digital Communication, Computer Communication Networks
Course Objectives:	
1	To introduce the fundamental knowledge of data centers, architecture, software-defined networks (SDN) and virtualization technologies.
2	To familiarise the student with datacenter infrastructure, operations and management best practices.
3	To educate the student about networking in data center.
Course Outcomes: After learning this course, students will be able to	
CO1	Describe data centres , its types and priorities.
CO2	Classify the various types of data centers.
CO3	Understand the concept of network visualisation
CO4	Identify the networking features in data center
CO5	Interpret the IT of data center
CO6	Justify the need of security systems in data center

UNIT – I	**Introduction to Data Center**	**(05 Hrs)**
	History of data centers & Engineering importance, evolving to modern facilities; Concepts of redundancy, availability & reliability; Data center types & sizes, Data Center Components, Data Center Key players, Tools and Techniques.	
UNIT–II	**Data Center Engineering Process & Classification**	**(08 Hrs)**

	Data Center Engineering Process: The Data Center EPS, Phased Process, Adaptive Need Conversion, Understanding Application, App Architecture, ETT, TPS, Load and Complexity Factor. **Data Center Classification:** Data Center Tiers and Classes, Data Center Grade Levels, Data Center Definitions and Options, The Infinity Paradigm Review, Standard Requirements, Designing with Limitations.	
UNIT-III	**Network Virtualization**	**(06 Hrs)**
	Network virtualization - Uses of Network virtualization in the Data Center - Network virtualization Models- Network Tunnels - Network virtualization solutions for the Data Center - Practical limits on the number of Virtual networks - Packet forwarding control protocol for Network virtualization.	
UNIT–IV	**Networking for a Data Center**	**(05 Hrs)**
	Data Center Telecommunications Cabling, Virtualization, Cloud, SDN, and Software-defined data center (SDDC) in Data Centers Data Center Layer 2 Interconnect - Overview of high availability clusters - Data center interconnect.	
UNIT – V	**Information Technology**	**(07 Hrs)**
	Load Balancing Types & Methods, 6-Pack Architecture, Firewalls and Intrusion Detection, Virtual Private Networks, VPN Protocols: IPsec, L2TP, PPTP, SSL, Virtualization Types & Methods, Cloud Infrastructure, OpenStack.	
UNIT–VI	**Data Center Safety & Security Systems**	**(05 Hrs)**
	Safety Principle , CCTV, DVR, NVR, etc., Access Control Systems, Mantraps & Airlocks, Tracking & Tracing, IT Security,	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:
1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Samee U Khan, Albert Y. Zomaya, “Handbook of data centers”, Springer.
2. Hwaiyu Geng P.E, “Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center”, Wiley Publication.

Reference Books:

1. Mauricio Arregoces, : Data Center Fundamentals”.
2. Lui zhang, Le chen, “Cloud Data Center Network Architectures and Technologies”.

List of Assignments

Students are expected to submit eight assignments based on the above syllabus.

Project-Based Learning:

Students are expected to perform a project (in a group) based on the course and prepare a report. for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VII **ELECTIVE-I : RF & MICROWAVE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credit:1
	Total: 150 Marks	**Total Credits: 04**

Course Pre-requisites:	
The students should have knowledge of	
	Maxwells Equations, EM waves propagation, Transmission lines, Waveguides.
Course Objectives:	
1	To make the student learn RF circuit fundamentals for designing various circuit building blocks in a typical RF transceiver.
2	To lay the foundation for microwave engineering.
3	To introduce the applications of microwave engineering.
4	To make the student learn the microwave network analysis.
Course Outcomes: After learning this course, students will be able to	
CO1	Perceive the importance of RF amplifier & RF Oscillator designs
CO2	Design amplifier using appropriate components
CO3	Understand the working principles of all the microwave tubes
CO4	Identify the various microwave components.
CO5	Choose a suitable microwave tube and solid state device for a particular application.
CO6	Illustrate the microwave bench set up and conduct measurements of different parameters.

UNIT – I	**Introduction to RF**	**(06 Hrs)**
	Importance of RF Design, RF Behavior of Passive Components: High Frequency Resistors, High-Frequency Capacitors, High-Frequency Inductors. Chip Components and Circuit Board Considerations: Chip Resistors, Chip Capacitors, Surface-Mounted Inductors. RF Filter Design, Basic Resonator, Filter Realizations.	
UNIT–II	**RF Transistor Amplifier Design**	**(06 Hrs)**
	Characteristics of Amplifiers, Amplifier Power Relations, Constant Gain: Unilateral Design, Unilateral Figure of Merit, Bilateral Design, Operating and Available Power Gain Circles, Constant VSWR Circles, broadband, High Power and Multistage Amplifiers. RF Oscillators and Mixers, Oscillator Model, Feedback Oscillator Design, Quartz Oscillators. High Frequency Oscillator Configuration, Basic Characteristics of Mixers, Frequency Domain Considerations.	
UNIT-III	**Introduction to Microwaves engineering**	**(06 Hrs)**
	History of Microwaves, Microwave Frequency bands. Applications of Microwave. General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide. Wave guide parameters. Introduction to coaxial line, rectangular waveguide cavity resonators, Circular waveguide cavity resonators	
UNIT–IV	**Microwave Components:**	**(06 Hrs)**
	Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. Ferrites components, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator, Impedance and Admittance matrices, Scattering Matrix: -Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator.	
UNIT – V	**Microwave Tubes:**	**(06 Hrs)**
	Limitations of conventional tubes, O and M type classification of microwave tube cavity, velocity modulation. O type tubes, Two cavity Klystron, Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, M-type tubes Magnetron: 8 cavity cylindrical travelling wave magnetron, hull cut-off condition, Slow	

	wave devices, Helix TWT: Construction and principle of operation, Applications.	
UNIT–VI	**Microwave Solid State Devices:**	**(06 Hrs)**
	Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Microwave Measurements: Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, Measurements: S-parameter, frequency, Power, attenuation, Phase shift, VSWR impedance, Q of cavity resonator measurement.	

Content Delivery Methods: Chalk & talk, Collaborative Learning,
Assessment Methods:
1. Continuous Assessment (Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. M. Kulkarni, “Microwave and Radar engineering”, 3rd edition, Umesh Publications
2. M L Sisodia& GS Raghuvamshi, “Microwave Circuits and Passive Devices”Wiley.
3. M L Sisodia& G S Raghuvanshi, “Basic Microwave Techniques and Laboratory Manual”, New Age International (P) Limited, Publishers.

Reference Books:

1. RF Circuit Design Theory and Application, Reinhold Ludwig and Pavel Bretchko, Ed. 2004, Pearson Education Kaufmann.
2. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson
3. David M. Pozar, “Microwave Engineering", Fourth edition, Wiley.

List of Experiments:

1. Frequency & Wavelength measurement of Klystron tube.
2. Study of directional Couplers, Isolators,
3. I-V characteristics of Gunn diode.
4. Microwave Frequency, S-parameter, power Measurement
5. Study of E-plane, H-plane tees.
6. Design of RF Oscillators & Mixer

7. Design of RF amplifier.
Project-Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. (Electronics & Communication Engineering) Sem VII **ELECTIVE-I: CYBER SECURITY AND FORENSICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	End Semester Examination (ESE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 50 Marks	Credit: 01
	Total:150 Marks	**Total Credits: 04**

Course Pre-requisites:	
The students should have knowledge of	
	Basic understanding of IT

Course Objectives:	
1	To introduce the foundations of Cyber security and threat landscape.
2	Familiarise the student with technical knowledge and abilities necessary for protecting and defending against cyber and computer crimes and vulnerabilities.
3	Develop skills to plan, execute, and monitor cyber security mechanisms of social media.
4	To expose students to e-commerce, digital payments and computer forensics
5	To create awareness among students effectively use Computer Forensics and data retrieval with responsibility.

Course Outcomes: After learning this course, students will be able to	
CO1	Understand the cyber security landscape.
CO2	Develop a deeper understanding and familiarity with various types of cyber and computer crimes and vulnerabilities.
CO3	Distinguish and review of the security aspects of social media platforms.
CO4	Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds.
CO5	Define and cite appropriate instances for the application of computer forensics.
CO6	Identify the essential tools, and methodology of Computer Forensics and data retrieval.

UNIT – I	**Introduction to Cyber security**	**(06 Hrs)**
	Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	

UNIT– II	**Cyber and computer crime**	**(06 Hrs)**
	Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, financial frauds, social engineering attacks, malware and ransomware attacks, case study	
UNIT –III	**Social Media Overview and Security**	**(06 Hrs)**
	Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Case studies.	
UNIT –IV	**E - Commerce and Digital Payments**	**(06 Hrs)**
	Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment, Modes of digital payments- Banking Cards, Unified Payment Interface(UPI), Aadhar enabled payments.	
UNIT – V	**Computer Forensics**	**(06 Hrs)**
	Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems - FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications.	
UNIT –VI	**Forensic tools and data retrieval**	**(06 Hrs)**
	Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

List of Tutorials/Experiments: The students should perform a minimum of eight experiments

1. Checklist for reporting cyber crime at Cyber crime Police Station.
2. Reporting phishing emails.
3. Demonstration of email phishing attack and preventive measures.
4. Basic checklist, privacy and security settings for popular Social media platforms.
5. Reporting and redressal mechanism for violations and misuse of Social media platforms.
6. Setting and configuring two factor authentication in the Mobile phone.
7. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
8. Security patch management and updates in Computer and Mobiles.

9. Retrieving information from Mobile phone.
10. Installation and configuration of FAT and NTFS file system
11. Artifacts identification
Text Books/ Reference Books:
1. Sumit Belapure and Nina Godbole , "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" , Wiley India Pvt. Ltd.
2. Dorothy F. Denning, "Information Warfare and Security", Addison Wesley.
3. Henry A. Oliver, "Security in the Digital Age: Social Media Security Threats and Vulnerabilities , Create Space Independent Publishing Platform.
4. Natraj Venkataramanan and Ashwin Shriram, "Data Privacy Principles and Practice" , CRC Press.
5. W. KragBrothy, "Information Security Governance, Guidance for Information Security Managers" 1st Edition, Wiley Publication.
6. C. Altheide & H. Carvey, "Digital Forensics with Open-Source Tools",Syngress, 2011.
Project-Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines

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B. Tech. Electronics & Communication Engineering Sem VII
ELECTIVE-I: WIRELESS ROBOTS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral-50 Marks	Credit: 01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:

Basic Communication Engineering, Control system engineering, Wireless communication mechanical and automobile Engineering

Course Objectives:

1	To introduce the concept of wireless locomotion
2	To familiarise the student with wireless robot kinematics and dynamics
3	To expose the localization and mapping techniques
4	To acquaint the student about motion control in wireless robots.

Course Outcomes: After learning this course students will be able to

CO1	Describe working principle of advanced wireless robot.
CO2	Perceive the concept of kinematics & dynamics of wireless robots
CO3	Understand the localisation & mapping parameters.
CO4	Explain the motion control involved in wireless robots
CO5	Classify the different types of robots.
CO6	Distinguish the performance of various robot applications.

UNIT – I	**Introduction To Wireless Robot**: Introduction to wireless robot and wireless manipulators, Principles of locomotion and types of locomotion, Types of wireless robots, ground robots (wheeled and legged robots), Aerial robots, underwater robots, water surface robots	**(06 Hrs)**
UNIT – II	**Kinematics and Dynamics:** Kinematics of wheeled wireless robots, degree of freedom and maneuverability, generalized wheel model,different wheel configuration, holonomicand nonholonomic robots, Dynamics of wireless robot. Lagrange -Euler and Netwon-Euler metods, Computer based dynamics simulation of different wheeled wireless robots	**(06 Hrs)**
UNIT –III	**Localization And Mapping:** Magnetic and optical position sensor, gyroscope, accelometer, magnetic compass, inclinometer, tactile and proximity sensor, ultrasound rangefinder, laser scanner, infrared rangefinder, visual and motion sensing	**(06 Hrs)**

	system, localization, Map based localization, Markov localization, Kalman filter localization, Error propagation model, Probabilistic map-based localization, Autonomous map building.	
UNIT– IV	**Motion Control**: Collision free planning and sensor-based obstacle avoidance, Motion controlling methods, Kinematics control, dynamics control and cascaded control	**(06 Hrs)**
UNIT –V	**Modern Wireless Robots**: Introduction, Swarm robots, cooperative robots, wireless manipulators, autonomous wireless robots	**(06 Hrs)**
UNIT –VI	**Classification and Application of Robots:** Classification of different types of robots, control related robots, wireless behind robots, automobile related to robots, communication related to robots and different application of different robots	**(06 Hrs)**

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books

1. Kelly, **"**Mobile robotics: Mathematics, Model, Methods**" ,** Cambridge University Press, USA**.**
2. Dudek, M Jenkin**, "**Computational principles of mobile robotics", Cambridge University, USA.

Reference Books:

1. Thrun, W. Burgard, D. Fox, Probabilistic robots, MIT Press , USA.
2. Siegwart, R.Hourbaksh and Scara Muzza, "Introduction to autonomous mobile robots", MIT press, USA.

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B. Tech. Electronics & Communication Engineering Sem VII **PROJECT STAGE-I**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 02 Hrs/week	Internal Assessment (IA): -NA	
	TW :50 Marks OR:50 Marks	Credits:03
	Total:100 Marks	**Total Credits:03**

Course Objectives:	
1	To familiarize the students with the product development cycle.
2	To impart the importance of working as a team. .
3	To introduce the student to literature survey and documentation process.
4	To encourage the students to visualize & formulate a viable solution to practical engineering problems.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for projects.
CO2	Understand the process to make reports and presentation.
CO3	Apply engineering knowledge to solve industrial problems.
CO4	Analyze ethical practices and tools used in different technologies for projects.
CO5	Justify the performance on parameters such as communication skills, technical knowledge.
CO6	Develop the skills to use software/hardware related to industrial projects

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B. Tech. Electronics & Communication Engineering Sem VII **ANDROID APPLICATION DEVELOPMENT**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 02 Hrs/week	Internal Assessment (IA): -NA	
	TW :50 Marks	Credits:01
	Total:50 Marks	**Total Credits:01**

Course Pre-requisites:	
The students should have knowledge of	
1	Java programming

Course Objectives:	
1	To create robust mobile applications and learn how to integrate them with other services.
2	To Create intuitive, reliable mobile apps using android services and components.
3	To simulate and apply seamless user interface that works with different mobile screens.

Course Outcomes: After learning this course, students will be able to	
CO1	Understand how the process of developing software.
CO2	Install and configure Android application development tools
CO3	Design and develop user Interfaces for the Android platform.
CO4	Understand the basic concept such Drag and Drop.
CO5	Apply Java programming concepts to Android application development.
CO6	Create any application on the Android Platform.
***	**Tool required and use:** Java Programming

Unit-I	**Overview of Java:** What Are Variables? Basic Output in java, Basic Input, Comments in Java, Data Types, Type Conversion & Type Casting, Stack & Heap, Arrays	
Unit-II	**Android Basics**: Architecture, application components, resources, activities, services broadcast receivers, content, providers, fragments, intents/filters, Kotlin	
Unit- III	**Android User Interface Matching**: UI Layouts, UI Controls, event handling styles and themes, custom components,	
Unit- IV	**Android Advanced Concepts**:	

	Drag and Drop, Notifications, Location Based Services, Sending Email, Sending SMS, Phone Calls, Publication Android application.	
Unit-V	**Android applications-I:** Android - Alert Dialoges, animations. audio capture, audio manager, autocomplete, Bluetooth, camera, clipboard, custom fonts, data backup, developer tools, emulator, Facebook integration, gestures, Google maps, image effects, image switcher, JetPlayer, JSON parser, NFC guide, PHP/MySQL, ProgressBar , push notification, RenderScript, RSS reader, screencast, SDK manager, sensors, SIP protocol, spelling checker, SQLite database, support library, testing, text to speech, TextureView, twitter integration, UI design, UI patterns, UI testing, WebView layout, Wi-Fi, widgets, XML parsers.	
Unit-VI	**Android applications-II:** SDK manager, sensors, session management, shared preferences, SIP protocol, spelling checker, SQLite database, support library, testing, text to speech, TextureView, twitter integration, UI design, UI patterns, UI testing, WebView layout, Wi-Fi, widgets, XML parsers.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Dawn Griffiths, "Head First Android Development: A Brain-Friendly Guide Paperback," Shroff/O'Reilly; Second edition.
2. Michael Burton, "Android App Development for Dummies, 3ed Paperback," Wiley; Third edition.

Reference Books:

1. William Stallings , "Wireless Communications & Networks," Second Edition, Pearson.
2. Asoke K Telukder, Roopa R Yavaga, "Mobile Computing Technology, Applications and service creation," TMH.
3. Android Application Development Black Book, Pradeep Kothari, dreamtech press.
4. Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri, "Wireless and mobile networks", WILEY.
5. John Horton , "Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming language", Packt Publishing; 1st edition.

List of Experiments:

1. Installation of Android studio
2. Development of Hello world application
2. Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button
3. Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner)

and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)
4. Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity
5. Design an android application Send SMS using Intent
6. Design an android application Using Radiobuttons
7. Design an android application for menu.
8. Create a user registration application that stores the user details in a database table.

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B. Tech. Electronics & Communication Engineering Sem VII **INTERNSHIP**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
	Internal Assessment (IA): -NA	
	TW :25 Marks OR: 25 Marks	Credits:03
	Total:50 Marks	**Total Credits:03**

Course Objectives:	
1	To familiarize the students to industrial work processes.
2	To acquire practical knowledge and hands-on experience.
3	To work as an effective team member and solve managerial problems.
4	To introduce the student to work ethics in industry.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for practical training to enhance employability skills.
CO2	Apply various skills such as time management, positive attitude and communication skills during the performance of the tasks.
CO3	Explore career alternatives prior to graduation.
CO4	Understand the ability to adapt with the latest changes in the technological world.

Internship Training:

Every student has to undergo training on site or in office of some company for a period of 60 days to get the exposure and practical experience. He/ She has to submit the detail report of training on the basis of which the term work and oral marks should be awarded**.**

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Faculty of Engineering and Technology
Programme: B. Tech. (Electronics & Communication) –CBCS 2021 Course

B. Tech. (Electronics & Communication) Sem VIII

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
48		Light Wave Communication	3	0	1	60	40	0	0	0	100	3	0	1	4
49		5G Architecture	4	2	0	60	40	50	0	0	150	4	1	0	5
50		Elective-II	3	2	0	60	40	0	25	0	125	3	1	0	4
51		Blockchain Technology*	4	2	0	60	40	0	50	0	150	4	1	0	5
52		Project Stage-II	0	4	0	0	0	100	100	0	200	0	6	0	6
53		Cloud Computing	0	2	0	0	0	25	0	0	25	0	1	0	1
	Total		**14**	**12**	**1**	**240**	**160**	**175**	**175**	**0**	**750**	**14**	**10**	**1**	**25**
	Research Paper Publication**		-	-	-	-	-	-	-	-	-	-	-	-	2

*Industry Taught Course – VI
** Add on course

Sr. No.	Name of the Elective-I
1	Smart Cities
2	Image Processing & Computer Vision
3	Biomedical Electronics
4	Software Defined Networks
5	Software Testing

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B. Tech. Electronics & Communication Engineering Sem VIII **LIGHTWAVE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical:00	Internal Assessment (IA): 40 Marks	
Tutorial:1 Hr/week		Credit:01
	Total:100 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Basics of Communication, Optical Communication, Computer Networks
Course Objectives:	
1	To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs.
2	To enable the student to understand the differences in the design of data plane and the control plane, the routing, switching and the resource allocation methods.
3	To expose the student to the advances in network control and management.
Course Outcomes: After learning this course students will be able to	
CO1	Apply knowledge of basic optical network elements for realizing lightwave network.
CO2	Identify and formulate different optical networking topologies
CO3	Design Optical Network Routing Algorithms.
CO4	Apply the basic Networking knowledge to realize any sort of end-to-end communication
CO5	Analyse the various design parameters of optical network.
CO6	Manage the optical networks in its configuration, fault and performance.

UNIT – I	**Introduction to WDM Network Elements**	**(06 Hrs)**
	Operational principle of WDM, WDM network elements: Switches, Wavelength Converters, Optical Line Terminals, Optical Line Amplifiers, WDM Point to Point link, Wavelength Add/Drop Multiplexers, Optical Cross connects.	
UNIT – II	**Optical Networks Architecture**	**(06 Hrs)**
	SONET/SDH, Computer Interconnects, MANS, Layered architecture for SONET and Second Generation Networks, Broadcast and Select Networks – Topologies for Broadcast Networks, Wavelength Routed Networks, Linear Lightwave Networks, Media-Access Control Protocols.	
UNIT–III	**Packet Switching and Access Networks**	**(06 Hrs)**

	Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks. Access Networks – Network Architecture overview, Future Access Networks and OTDM networks.	
UNIT –IV	**Wavelength Routing Networks**	**(06 Hrs)**
	Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations. Optical Network Routing Principles - Impairment Aware Routing Optical Circuit Switching, Optical Packet Switching Optical Burst Switching.	
UNIT – V	**Design of Optical Networks**	**(06 Hrs)**
	Core Optical Networks, Metro Optical networks, Access Optical Networks Wavelength Routing and Assignment, Traffic Grooming and Protection, Multilayer Network Structure Transmission system model, power penalty-transmitter, receiver optical amplifiers, crosstalk, dispersion, wavelength stabilization	
UNIT– VI	**Network Control and Management**	**(06 Hrs)**
	Control and management, Network management configuration management, Performance management, fault management. Network management functions, Optical safety.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Kumar Sivarajan and Rajiv Ramaswamy, Morgan Kauffman, Optical Networks: A Practical Perspective, Elsevier Publication Elsevier India Pvt. Ltd, 3rd Edition, 2010.
2. Harry G. Parros, Communication Oriented Networks, Wiley
3. G. Agarwal, Fiber Optic Communication Systems, John Wiley and Sons, New York, 2014.

Reference Books:

1. C. Siva Ram Moorthy and Mohan Gurusamy, WDM Optical Networks: Concept, Design and Algorithms, Prentice Hall of India.
2. Biswajit Mukherjee, Optical Communication Networks, TMG.
3. Jane M. Simoons, Optical Network Design and Planning, Second Edition, Springer
4. John M. Senior, "Optical Fiber Communications Principles and Practice", Prentice Hall.
5. Ulysees Black, Optical Networks, Pearson education.
6. Cvijetic, Ivan B. Djordjevic, Advanced Optical Communication Systems and Networks, Artech House Applied Photonics.

Project-Based Learning (PBL):

Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VIII **5G ARCHITECTURE**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks Internal Assessment (IA): 40 Marks	Credits: 04
Practical: 02 Hrs/week	TW:50 Marks	Credit:01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
1	Basic understanding of telecommunications.
2	Basic understanding of computer networks and wireless communications

Course Objectives:	
1	To introduce the student to 5G architecture.
2	To familiarise the student to various radio access technologies in 5G
3	Tomake the student learn the various cases of 5G communication

Course Outcomes: After learning this course students will be able to	
CO1	Design & simulate the use cases for 5G.
CO2	Draw and explain 5G architecture, its components and functional criteria.
CO3	Identify the 5G radio-access technologies.
CO4	Implement the 5G wireless propagation channel models and MIMO.
CO5	Evaluate device to device (D2D) and mmWave communication.
CO6	Design application of various 5 G wireless Technologies using WiFi, Zigbee and WiMax.

UNIT – I	**Introduction, 5G Use Cases and System Concept**	**(08 Hrs)**
	Industrial and technological revolution: Mobile communications generations: from 1G to 4G, IoT: relation to 5G. Standardization activities: ITU-R , 3GPP & IEEE Use cases and requirements: Use cases, Requirements and key performance indicators , 5G system concept, Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication, Dynamic radio access network , Lean system control plane, Localized contents and traffic flows, Spectrum toolbox, RF cell planning for 5G.	
UNIT –II	**The 5G architecture, Spectrum**	**(08 Hrs)**
	Introduction: NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture.Cell structure for 5G.	

	Functional architecture and 5G flexibility: Functional split criteria, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, 5G spectrum landscape and requirements, 5G spectrum technologies	
UNIT -III	**The 5G Radio-Access Technologies**	**(10 Hrs)**
	Access design principles for multi-user communications:- Orthogonal multiple-access systems, Capacity limits of multiple-access methods. Multi-carrier with filtering:- Filter-bank based multi-carrier, Universal filtered OFDM. Non-orthogonal schemes for efficient multiple access:- Sparse code multiple access (SCMA), Interleave division multiple access (IDMA). Radio access for dense deployments:- OFDM numerology for small-cell deployments.	
UNIT– IV	**The 5G wireless propagation channel models and Massive multiple-input multiple-output (MIMO) systems.**	**(08 Hrs)**
	Introduction, Modeling requirements and scenarios: Channel model requirements, Propagation scenarios**.** METIS channel models: Map-based model, Stochastic model.MIMO in LTE, Theoretical background: Single user MIMO, Multi-user MIMO. Pilot design for massive MIMO. Resource allocation and transceiver algorithms for massive MIMO. RF field measurement parameter for 5G.	
UNIT –V	**Enabling Technologies for 5G**	**(07 Hrs)**
	Device-to-device (D2D) communications from 4G to 5G. Radio resource management for mobile broadband D2D. Multi-hop D2D communications for proximity and emergency services. Multi-operator D2D communication, Milimeter wave Communication: Hardware technologies for mmW systems Antennas Beamforming architecture Deployment scenarios, Architecture and mobility.	
UNIT –VI	**5 G Wireless Technologies**	**(07 Hrs)**
	IEEE802Std: 802.11 (WiFi), 802.15.1 (Bluetooth), 802.15.4 (Zigbee), 802.16 (WiMax), BLE, 4G/5G: Frame Structures and applications.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Andrea Goldsmith , "Wireless Communications ", Cambridge University Press, 2nd edition, March 3, 2020
2. Afif Osseiran & Jose F. Monserrat, "5G Mobile and Wireless Communications Technology", Cambridge University Press 2016

3.Sassan Ahmadi , "5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards" , Elsevier-Science, 2019
Reference Books:
1. Erik Dahlman, Stefan Parkvall, Johan Skold, " 5G NR:The Next Generation Wireless Access Technology," Academic Press, 2018.
2. J. Rodriguez, "Fundamentals of 5G Mobile Networks," John Wiley & Sons, 2015
List of Experiments: The students must perform a minimum of eight experiments
1. 5G Communications Link Analysis with Ray Tracing using MATLAB
2. Wireless Connectivity in the 5G Era for WLAN using MATLAB
3. MIMO Wireless System Design for 5G using MATLAB
4. 5G Waveforms generation using MATLAB
5. 5G Beamforming Design
6. Numerology in 5G
7. Frame Structure of 5G technology
8. MIMO System Implementation with Perfect CSI
9. Recent developments in 5G
10. Case Study: Factors affecting deployment of 5G in Indian scenario
Project-Based Learning (PBL):
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE II: SMART CITIES**		
TEACHING SCHEME	**EXAMINATION SCHEME**	**CREDITS ALLOTTED**
Theory: 03 Hrs/Week	Examination (UE): 60 Marks Internal Assessment: 40 Marks	Credits: 03
Practical: 02 Hrs/Week	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisite:	
	Knowledge of IoT and Wireless protocols

Course Objectives :	
1.	To introduce the concept of smart city and challenges.
2.	To familiarize students with smart objects and devices.
3.	To introduce the wireless protocols needed for smart city.
4.	To familiarize students about the impact of ICT on quality life.

Course Outcomes: After learning this course, students will be able to

CO1	Summarize the philosophy of smart city and the challenges	
CO2	Apply the concept of IoT for smart systems.	
CO3	Classify the objects in IoT system.	
CO4	Explain the planning on interplay between the human and smart devices.	
CO5	Determine the wireless protocols needed for smart system.	
CO6	Paraphrase the impact of smart technologies on urbanization, human quality life and environment.	
Unit -I	**Smart City**	**(06 Hrs)**
	Necessity of SMART CITY The Smart City Philosophy, Development of Asian Cities, Megacities of India: Current Challenges, The India Story of Smart Cities, Conceptual Basis of a Smart City, Global Smart City Programs, Recommendations for Smart City Framework in GCC	

Unit -II	**IOT Applications in Smart City**	**(06 Hrs)**
	IoT applications in smart city: smart environment, smart streetlight and smart water management, smart waste management and smart energy management system.	
Unit- III	**Smart Objects**	**(06 Hrs)**
	Smart objects, Wired – Cables, hubs, etc., Wireless – RFID, WiFi, Bluetooth, etc. Different functional building blocks of IOT architecture	
Unit -IV	**Distributed Intelligence and Central Planning**	**(06 Hrs)**
	Central Planning on the Interplay between Humans and Smart Devices, BIM in smart cities, Artificial Intelligence (Machine Intelligence), Information Dynamics, Synergetic, Information Dynamics and Allometry in Smart Cities.	
Unit-V	**Wireless Protocols for Smart Cities**	**(06 Hrs)**
	Wireless Networking Basics, Wireless Networking Assumptions, Protocols: Message Queue Telemetry Protocol. RPL, REST, AMQP, CoAP	
Unit-VI	**ICT and Smart City**	**(06 Hrs)**
	Using technologies to improve the citizens quality of life, Smart city goals: The impact on citizens well-being and quality of life, Critical dimensions: Urbanization, local climate change, and energy poverty, Environmental issues: Role of local and global climate change.	

Content Delivery Methods: Chalk & talk, PowerPoint presentation

Assessment Methods:

1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

Text Books:

1.	Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols‖", Wiley Publications.
2.	Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

References Books:

1.	Carlo Ratti and Matthew Claudel, "The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life (The Future Series)", Yale University Press.
2.	Stephen Goldsmith, Susan Crawford, "The Responsive City: Engaging Communities Through Data-Smart Governance", 1st Edition Jossey Bass – Wiley.

3.	Michale Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, Pearson Education.
List of Experiments: Case studies based on following:	
1.	Water waste management system.
2.	Smart street light management system.
3.	GIS based management Information System
4.	Smart RFID based traffic monitoring system.
5.	GIFT smart city
6.	Planning process for smart cities.
7.	Smart energy management system.
8.	Smart grid system
9.	Wireless protocols for Smart city
10.	Smart air quality monitoring system
Project-Based Learning:	
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.	

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B. Tech. (Electronics & Communication Engineering) Sem VIII **ELECTIVE-II: IMAGE PROCESSING AND COMPUTER VISION**		
TEACHING SCHEME	**EXAMINATION SCHEME**	**CREDITS ALLOTTED**
Theory: 03 Hrs/week	End Semester Examination (ESE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have the knowledge of	
1	Engineering Mathematics
2	Basics of Image processing
Course Objectives:	
1	To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2	To familiarize students with image enhancement and restoration techniques.
3	To introduce different image segmentation techniques.
4	To make student aware of various techniques to implement computer vision algorithms efficiently.
Course Outcomes: After learning this course students will be able to	
CO1	Explain the fundamentals of digital image and its processing and perform image enhancement techniques.
CO2	Compare various geometric camera models and multiple view geometry.
CO3	Implement different feature extraction techniques for image analysis.
CO4	Apply the concept of Image segmentation.
CO5	Identify a suitable classifier to address a desired pattern recognition problem.
CO6	Apply three-dimensional image analysis techniques & motion analysis algorithms

UNIT – I	**Introduction to Image Processing**	**(05 Hrs)**
	Overview and State-of-the-art, Fundamentals of Image formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image enhancement, Restoration, Histogram processing	
UNIT – II	**Depth Estimation and Multi-camera views**	**(06 Hrs)**

	Perspective, Binocular stereopsis: Camera and Epipolar geometry; Homography, rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration	
UNIT –III	**Feature Extraction**	**(06 Hrs)**
	Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	
UNIT –IV	**Image Segmentation**	**(05 Hrs)**
	Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	
UNIT –V	**Pattern Analysis**	**(06Hrs)**
	Clustering: K-Means, Supervised, Un-supervised, Semi-supervised; Classifiers, Introduction to Bayes, KNN, ANN models.	
UNIT– VI	**Motion Analysis**	**(08 Hrs)**
	Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal analysis, Dynamic Stereo; Motion parameter estimation. Shape from X: Light at surfaces; Phong model; Reflectance map; Albedo estimation. Photometric stereo; Use of surface smoothness Constraint; Shape from texture, colour, motion and edges.	

Textbooks /Reference Books:

1. Rafael C. Gonzalez and R.E. Woods, "Digital Image Processing", Addison- Wesley.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited.
3. D.A. Forsyth, "Computer Vision: A modern approach", Pearson Education
4. Richard Hartely & Andrew Zisserman, "Multiple View Geometry in Computer vision", Second Edition, Cambridge University Press.
5. Milan Soanka, Vaclav Hlavac and Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning.

List of Experiments: The students should perform a minimum of eight experiments

1. Perform basic Image Handling and Processing operations on the image.
2. Study of Geometric Transformation
3. Object detection in target domain using weakly supervised, semi supervised
4. Face recognition using face images obtained from internet.
5. Monocular 3D object detection for indoor objects.
6. Scene segmentation of indoor panorama
7. Joint Image Deblurring/Super-Resolution and Low-light Image Enhancement
8. Image to Image transformation (few samples) using VAE, GANs etc
9. Object-Goal Navigation task by learning from environment
10. Real (True) depth estimation from indoor scenes, given a model (DL tool) for virtual depth estimation

11. Project based on Computer Vision Applications
Project-Based Learning (PBL)
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE-II: BIOMEDICAL ELECTRONICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
1	Electrodes, Sensors and transducers, Electronic Circuits and Applications

Course Objectives:	
1	To introduce various biopotentials, their measurements and interpretations associated with human body.
2	To familiarize the student with different medical equipments.
3	To expose the student to clinical laboratory equipments.
4	To imbibe the importance of patient's safety

Course Outcomes: After learning this course, students will be able to	
CO1	Classify systems in human body and identify bio-potentials
CO2	Correlate the parameters like B.P., ECG and PCG with the functioning of Heart.
CO3	Categorize life saving devices such as cardiac and respiratory equipments.
CO4	Identify equipments present in ICU/NICU.
CO5	Categorize blood tests and clinical laboratory instruments
CO6	Recognize surgical diathermy and radiology equipments.

UNIT – I	**Human body & Origin of Bio-potentials**	**(06 Hrs)**
	Human body: cell structure, overview of different systems in the body: cardiovascular system, respiratory system, nervous system, musculoskeletal system, gastrointestinal system, endocrine system and lymphatic system, Origin of Bio-potentials: action potential, bio-potentials such as ECG, EEG, EMG.	
UNIT – II	**Electrocardiograph, Phonocardiograph and Blood pressure measurements**	**(06 Hrs)**
	Electrocardiography: ECG lead configurations, ECG machine, ECG electrodes, Phonocardiograph: heart sounds and heart murmurs, microphones used in Phonocardiograph, recording set up of PCG,Blood pressure measurement techniques: direct and indirect method, relationship between ECG, PCG and Blood pressure.	

UNIT - III	**Cardiac and Respiratory Equipments**	**(06 Hrs)**
	Fibrillation, need of defibrillator, Types of defibrillator and electrodes, natural pacemaker, need of external pacemaker, types of pacemaker and batteries, mechanical ventilation, need of ventilator, ventilator block schematic and modes of ventilator, spirometry	
UNIT – IV	**ICU and NICU-Architecture and monitoring systems**	**(06 Hrs)**
	Architecture of ICU and NICU**,** patient monitoring system, central monitoring system**,** holter monitor, Basics of telemetry and Multi-channel telemetry, Baby incubator and Phototherapy unit	
UNIT – V	**Clinical Laboratory Instruments and hemodialysis**	**(06 Hrs)**
	Colorimeter, spectrophotometer, centrifuge, auto analyzer, blood cell counter, Basic principle of dialysis, Artificial kindney, different types of dialyzer membranes, typical setup of hemodialysis	
UNIT – VI	**Electrosurgical and Radiographic Instruments**	**(06 Hrs)**
	Basic principle of electrosurgery, Electrosurgical unit, Basic principle and working of X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Ultrasound, Digital X-Ray, Positron Emission Tomography (PET)	

Content Delivery Methods: Chalk & talk, Powerpoint presentation

Assessment Methods:

1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

Text Book:

1. R. S. Khandpur, "Hand book of Biomedical Instrumentation", Tata McGraw Hill Publishing Company limited, New Delhi.
2. Leslie Cromwell, Fred J. Weibel, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Second Edition, PHI.

Reference Books:

1. John G. Webster, "Medical Instrumentation- Application and Design", Third Edition, John Wiely and Sons Inc., New York.
2. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", Forth Edition, PHI.
3. Richard Aston, "Principles of Biomedical Instrumentation and Measurement", Merrill Macmillan Publishing Company, New York.

List of Experiments:

1. Measurement of blood pressure using Sphygmomanometer.
2. Simulation of ECG waveform and heart rate measurement using ECG system.

3. Study of phonocardiograph for recognition of heart sound.
4. Detection of Apnea and Tachypnea using respiration rate simulator and monitor.
5. Detection of fibrillation condition and recovery using DC Defibrillator.
6. Observation and functioning of External Pacemaker over natural pacemaker.
7. To find out concentration of unknown samples uding Spectrophotometer.
8. Observation of cutting and coagulation operations using surgical diathermy unit.
Project-Based Learning (PBL)
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

B. Tech. Electronics & Communication Engineering Sem VIII
ELECTIVE –II: SOFTWARE DEFINED NETWORKS

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	Total Credits:04

Course Pre-requisites:

The students should have knowledge of

1	Cellular Technology and 4G
2	Computer Communication Network

Course Objectives:

1	To introduce the fundamentals of software defined networks.
2	To understand the separation of the data plane and the control plane.
3	To enable the studnt to work on SDN Programming
4	To impart the knowledge about the security issues in SDN
5	To familiarise the applications of SDN

Course Outcomes: After learning this course, students will be able to

CO1	Understand the components of software defined networks
CO2	Use the various components of SDN.
CO3	Explain the use of SDN in the current networking scenario
CO4	Evaluate the various security aspects in SDN
CO5	Design and simullate various applications of SDN
CO6	Use SDN features in the future networking scenario

UNIT – I	**Introducing SDN**	**(06 Hrs)**
	SDN Origins and Evolution – Introduction – Need of SDN- Centralized and Distributed Control and Data Planes - The Genesis of SDN ,SDN APIs, Virtualization of Network Functions (VNF) and NFV, Open Virtual Networking (OVN), Open Network Operating Systems (ONOS)	
UNIT – II	**SDN Abstractions**	**(06 Hrs)**
	Working principle of SDn - The Openflow Protocol - SDN Controllers: Introduction - General Concepts - VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK	
UNIT –III	**Programming SDN'S**	**(06 Hrs)**
	Network Programmability - Network FunctionVirtualization - NetApp Development, Northbound / southbound interfaces ,Application	

	Programming Interface, Current Languages and Tools, Composition of SDNs,Network Slicing , Mininet Environment and Implementation	
UNIT –IV	**SDN Applications in Security**	**(06 Hrs)**
	Switching and Load Balancers, Firewall and Access Control, Use cases in Legacy Networks security, Security in modern networks – Cloud, Fog, IoT, 5G, , Solutions, Fault Tolerance Designs, Debugging and Trouble Shooting.	
UNIT –V	**SDN Applications and Use Cases**	**(06 Hrs)**
	SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System	
UNIT –VI	**SDN'S future and perspectives**	**(06 Hrs)**
	SDN Open Source - SDN Futures - Final Thoughts and Conclusions	

List of Experiments: : The term work shall consist of record of minimum eight experiments.

1. Setting up the Environment and Implementation of Controllers in Mininet 3
2. To create Custom Topologies in POX, ODL
3. To set ONOS
4. To implement Northbound Interfacing
5. To implement Southbound Interfacing
6. To implement ONOS deployment ONOS
7. ONOS deployment ONOS – OPNFV – SDN Application development
8. ONOS, Northbound – Southbound Interfacing, ONOS deployment ONOS – OPNFV – SDN Application development
9. To measure network performance in Mininet
10. Use case of SDN in Network Virtualization
11. Use case of SDN in Traffic Engineering WAN
12. Use case of SDN in Network Telemetry

Text Books:

1. Thomas D. Nadeau ,"SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies" ,Ken Gray Publisher: O'Reilly Media, August 2013.
2. Vivek Tiwari , "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN:, 2013.
3. Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and futureof programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617-1634.
4. Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
5. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" – William Stallings.

6. Kreutz, Diego, et al. “Software-defined networking: A comprehensive survey.” Proceedings of the IEEE 103.1 (2015): 14-76.

Reference Books:

1. Paul Goransson and Chuck Black,”Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann Publications, 2014.
2. Lantz, Bob, Brandon Heller, and Nick McKeown. “A network in a laptop: rapid prototyping for software-defined networks.” Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010.
3. Siamak A zodolmolky, “Software Defined Networking with OpenFlow”, Packt Publishing, 2013.
4. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
5. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, OReilly Media, 2013.
6. Peterson, Cascone, O’Connor, Vachuska, and Davie.,”Software-Defined Networks: A Systems Approach ystems Approach LLC (Publisher),2022.

Project Based Learning:

Students are expected prepare report on any one topic related to this subject, write its definition, applications and illustrate with few examples.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE-II: SOFTWARE TESTING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 3
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
Tutorial: 00	Oral -25 Marks	Credit:1
	Total:125 Marks	**Total Credits:04**

Course Pre-requisite:	
The students should have knowledge of	
1	Knowledge of Software Engineering
2	Knowledge of UML
Course Objectives: -	
1	Familiarise the student with software testing, important concepts and the testing process
2	To make the student Learn about dynamic testing and Test case design techniques. How to do the testing after executing the program and how to design test cases with examples
3	To introduce the student to testing tools.
Course Outcomes: After learning the course, student will able to	
CO1	Perceive importance of testing techniques in software quality management and assurance
CO2	Categorize the different types of testing methodology.
CO3	Apply different testing methodologies used in industries for software testing
CO4	Identify various types of software risks and its impact on different software application.
CO5	Create test case Design scenarios for different application software s using various testing techniques.
CO6	Create test case execution scenarios for different application software s using various testing techniques.

Unit -I	**Introduction**	**(05 Hrs)**
	Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, V-Model, Test Case Generation, SDLC vs STLC, Software Testing Life Cycle-in detail.	
Unit -II	**Types of Testing:**	**(05 Hrs)**

	Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. Clean Room Software Engineering. Functional/Non-functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing	
Unit-III	**Software Testing Methodologies:**	**(08 Hrs)**
	Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI	
Unit -IV	**Software Testing Life Cycle:**	**(06 Hrs)**
	Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations, Entry & Exit Criteria, Test Automation, Deliverables.	
Unit- V	**Test Cases Design:**	**(06 Hrs)**
	Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, Understand the SRS, Hardware and software requirements, Test Data.	
Unit-VI	**Test Execution:**	**(06 Hrs)**
	Execute test cases, Error/Defect Detecting and Reporting, DRE (Defect Removal Efficiency), Object, Types of Bugs, Art of Debugging, Debugging Approaches, Reporting the Bugs, Severity and priority, Test Closure, Criteria for test closure, Test summary report.	

Content Delivery Methods: Chalk & talk, PowerPoint presentation, Animations
Assessment Methods:
1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

List of Experiments:

1	Implement all techniques of Black Box-Testing, White Box Testing taking your Mini Project as the Context System.
2	Write aprogram to find the roots of a quadratic equation and perform boundary value analysis
3	Write a program to find area of circle, square, triangle and rectangle and perform equivalence class testing.
4	Write a program to perform a raise to power b andperform decision table testing.
5	Write a program to compute previous date, given present date as input and perform decision table testing.
6	Write a program to read three sides of a triangle and determine whether they form scalene, isosceles or equivalent triangle and test it using cause – effect testing techniques.

7	Write aprogram to calculate total salary of an employee, given his salary. The slab is as follows HRA=30% of basic salary, DA=80% of basic salary, MA=100, TA=800, Income tax=700, Pf=780. Draw its path graph and finds its V(G) by all three methods.
8	Draw a DD path graph for the program written for experiment 6.
9	Write a program to read the marks of 10 students in 5 subjects calculate the average and assign grades. Now draw its graph matrix and find its V(G).
10	Perform Data Flow Testing on the program for quadratic equation program.
11	Case study on TestingTool-QTP.
Text books	
1	Roger S.Pressman, "Software engineering- A practitioner's Approach", McGraw-Hill International Editions
2	Ian Sommerville, "Software Engineering", Pearson Education Asia
3	Boris Beizer , "Software Testing Techniques", 2nd edition, , 1990
Reference Books	
1	Srinivasan Desikan , "Software Testing: Principles and Practices", Dorling Kindersley (India).
2	Kshirasagar Naik and Priyadarshi Tripathy , "Software Testing and Quality Assurance: Theory and Practice", Wiley Publication.
3	Michael Haug and Eric W Olsen ,"Software Quality Approaches: Testing, Verification, and Validation: Software Best Practice" Springer.
	Project Based Learning: Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VIII **ITC-VI: BLOCKCHAIN TECHNOLOGY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks	Credits: 04
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
Tutorial: 00	Oral :50 Marks	Credits:01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
	Expertise In Programming
	Basic Knowledge Of Computer Security
	Cryptography
	Networking
	Concurrent Or Parallel Programming

Course Objectives:	
1	To introduce the student to blockchain systems.
2	To make student learn about the securely interact with bitcoin and ethereum.
3	To make the student ro design, build, and deploy smart contracts and distributed applications.
4	To make the student to integrate ideas from blockchain technology into their own projects.

Course Outcomes: After learning this course, students will be able to	
1	Understand the design principles of Bitcoin and Ethereum
2	Describe Nakamoto consensus.
3	Explain the Simplified Payment Verification protocol.
4	List and describe differences between proof-of-work and proof-of-stake consensus.
5	Interact with a blockchain system by sending and reading transactions.
6	Design, build, and deploy a distributed application.

UNIT – I	**Introduction**	**(08 Hrs)**
	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance,Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof	
UNIT–II	**Blockchain**	**(08 Hrs)**
	Introduction, Advantage over conventional distributed database, Blockchain Network, MiningMechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee,Anonymity, Reward,	

	Chain Policy, Life of Blockchain application, Soft & Hard Fork, Privateand Public blockchain	
UNIT-III	**Distributed Consensus**	**(08 Hrs)**
	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, SybilAttack, Energy utilization and alternate.	
UNIT–IV	**Cryptocurrency**	**(08 Hrs)**
	History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	
UNIT – V	**Cryptocurrency Regulation**	**(08 Hrs)**
	Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.	
UNIT–VI	**Cryptocurrency Applications**	**(08 Hrs)**
	Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).
2. Imran Bashir, "Mastering blockchain: Distributed Ledger Technology, Decentralization and Smart Contract Explained", Second Edition, Packt Publishing, 2018.

Reference Books:

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.
2. Josh Thompson,"Blockchain:The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing platform 201

List of Experiments

1. Demonstration of Blockchain https://andersbrownworth.com/blockchain.
2. Installation of Ganache, Flask and Postman
3. Write a Simple Python program to create a Block class that contains index, timestamp, and previous hash. Connect the blocks to create a Blockchain.
4. Demo of Remix-Ethereum IDE https://remix.ethereum.org and Test Networks
5. Write a Simple Smart Contract for Bank with withdraw and deposit functionality.

6. Write a Smart Contract for storing and retrieving information of Degree.
Project-Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. Electronics & Communication Engineering Sem VIII **PROJECT STAGE-II**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 04 Hrs/week	Internal Assessment (IA): -NA	
	TW :100 Marks OR:100 Marks	Credits:06
	Total:200 Marks	**Total Credits:06**

Course Objectives:	
1	To familiarize the students with the product development cycle.
2	To impart the importance of working as a team. .
3	To introduce the student to literature survey and documentation process.
4	To encourage the students to visualize & formulate a viable solution to practical engineering problems.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for projects.
CO2	Understand the process to make reports and presentation.
CO3	Apply engineering knowledge to solve industrial problems.
CO4	Analyze ethical practices and tools used in different technologies for projects.
CO5	Justify the performance on parameters such as communication skills, technical knowledge.
CO6	Generate project report and present it effectively.

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B. Tech. Electronics & Communication Engineering Sem VIII **CLOUD COMPUTING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	Credits: 00
Practical: 02 Hrs/week	Internal Assessment (IA): NA	
	TW : 25 Marks	Credit:01
	Total: 25 Marks	**Total Credits:01**

Course Pre-requisites:	
The students should have knowledge of	
	Computer Networks, Basics of Operating System (O.S.)

Course Objectives:	
1	To make the student learn and use version control systems.
2	To enable student to develop web applications in cloud.
3	To make student learn and work with virtual machine.
4	To design and develop a process involved in creating a cloud based application.
5	To introduce student to the advanced technologies in cloud computing
6	To implement parallel programming using Hadoop.

Course Outcomes: After learning this course students will be able to	
CO1	Configure various virtualization tools such as virtual box, VMware workstation.
CO2	Design and deploy a web application in a PaaS environment.
CO3	Simulate a cloud environment to implement new schedulers.
CO4	Install a generic cloud environment as a private cloud.
CO5	Design open-source cloud.
CO6	Install and use Hadoop.

List of Experiments:

1. Use gcc to compile c-programs. Split the programs to different modules and create an application using make command.
2. Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.
3. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
4. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
5. Install Google App Engine. Create hello world app and other simple web applications using python/java.
6. Use GAE launcher to launch the web applications
7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
8. Find a procedure to transfer the files from one virtual machine to another virtual machine.

9. Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion)

10. Install Hadoop single node cluster and run simple applications like wordcount.

Software requirements

- Open stack
- Hadoop
- Eucalyptus or Open Nebula or equivalent

Text Books:

1. Srinivasan, J.Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation " Pearson**.**
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishing.

Reference Books:

1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Deven Shah, "Cloud Computing Black Book", Dreamtech Press.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education.
3. Arora Pankaj , "To the cloud: cloud powering an Enterprise", Tata Mc Graw Hill Education.
4. Kai Hwang, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things", Morgan Kaufmann.

Project Based Learning:

Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

B. Tech. Electronics & Communication Engineering Sem VIII ADD ON COURSE: RESEARCH PAPER PUBLICATION		
TEACHING SCHEME:	**EXAMINATION SCHEME**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
	Internal Assessment (IA): -NA	
		Total Credits:02

Course Objectives:	
1	To expose students to various types of research papers, paper writing tools, and plagiarism
2	Develop skills to write research papers using various tools.
3	To create awareness among students effectively choose journal metrics for manuscript submission

Course Outcomes: After learning this course, students will be able to	
CO1	Gain knowledge of various types of research papers
CO2	Choose various paper writing tools as per the need
CO3	Develop article writing skills
CO4	Apply skills to minimise plagairism
CO5	Effectively use journal maetrics for specific journal selection

Research Paper Publication:
Main objective of Research paper publication is to teach students how to do research and help them to acquire skills that students can use beyond the academic environment. Students should publish minimum one research paper in UGC care/Peer reviewed journal.