08-11-2025 03:03:23 PM

WIRELESS AND MOBILE NETWORK **Course Code : 316325**

Programme Name/s : **Information Technology**
Programme Code : **IF**
Semester : **Sixth**
Course Title : **WIRELESS AND MOBILE NETWORK**
Course Code : **316325**

I. RATIONALE

The rapid growth of wireless and mobile technologies has transformed the telecommunications industry, enabling seamless connectivity, mobility, and convenience. This course provides students with a deep understanding of the technologies and principles behind wireless communication, which is now a crucial part of modern life, enabling ubiquitous connectivity through devices like smartphones and tablets. Studets will able to analyse wireless protocols and their performance using tools and realisic simulation.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry/employer expected outcome throughvarious teaching learning experiences:Maintain mobile and wireless communication system.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify various terminologies used in GSM network systems.
- CO2 - Establish wireless network with the given technology.
- CO3 - Differentiate between various generations of mobile network .
- CO4 - Expalin 5G network system architecture.
- CO5 - Establish wireless sensor networks for the given application.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
316325	WIRELESS AND MOBILE NETWORK	WMN	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	-	-	25	10	150

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe functions of given component in GSM network architecture. TLO 1.2 Classify the given GSM logical channel. TLO 1.3 Implement call processing in GSM. TLO 1.4 Explain the significance of given type of area in cellular network.	**Unit - I Introduction to GSM** 1.1 Global System for Mobile communication (GSM) architecture, GSM frequency spectrum, GSM radio aspects, GSM Supplementary services, GSM channel types 1.2 Call processing in GSM :Registration/location update, mobile terminated call and mobile originate call 1.3 Mobility management: Location update procedure: Inter LA movement, Inter MSC movement, Inter VLR movement 1.4 Concept of roaming 1.5 Types of area: Location area, Routing area, Tracking area 1.6 Network signaling: GSM protocol model	Lecture Using Chalk-Board Presentations Flipped Classroom Demonstration
2	TLO 2.1 Describe function of given components of GPRS architecture. TLO 2.2 Describe features of given IEEE protocol standard for wireless communication network. TLO 2.3 Explain architecture of given protocol standard. TLO 2.4 Compare performance of given wireless technologies based on given criteria.	**Unit - II GPRS and Mobile Data communication** 2.1 General packet radio services (GPRS) architecture, GPRS services 2.2 GPRS network nodes, mobility management and routing in GPRS 2.3 RFID (Radio Frequency Identification): Architecture, classification of RFID tags, applications, advantages and disadvantages 2.4 Wi-Fi : Classification, architecture, applications in business and healthcare domain 2.5 Wi-Max: Need of WMAN and applications in smart cities and public safety domain, Advantages and disadvantages	Lecture Using Chalk-Board Presentations Flipped Classroom Demonstration
3	TLO 3.1 Describe the specification of IMT-2000 global standard. TLO 3.2 Explain features of given next generation standard. TLO 3.3 Describe the function of the given section of UMTS network architecture. TLO 3.4 Compare features of two given next generation mobile communication.	**Unit - III Wireless application protocols and 3G mobile services** 3.1 Mobile internet standard, Wireless application protocol (WAP):Model, WAP Protocol stack 3.2 Wireless markup languages (WML) 3.3 International mobile telecommunications 2000 (IMT-2000) : Features and services 3.4 Wideband Code Division Multiple Access (W-CDMA) and CDMA 2000: Specifications and features 3.5 UMTS (Universal Mobile Telecommunication System) technology: Features, architecture, applications and advantages 3.6 Introduction to 4G technology : Architecture and Features of 4G ,Features of VoLTE, 4.5G	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Describe 5G network architecture. TLO 4.2 List features of IMT 2020 standards. TLO 4.3 Sketch 5G radio spectrum. TLO 4.4 Implemet 5G network slicing.	**Unit - IV Introduction to 5G Technology** 4.1 Introduction to 5G: 5G network architecture, 5G enable technologies 4.2 IMT 2020 standard: Specifications and features 4.3 5G Radio spectrum: low band, medium band, millimeter wave (Ultrahigh) band, 5G service providers 4.4 5G network slicing: Architecture, Advantages of Network Slicing for IoT Ecosystem	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom
5	TLO 5.1 Describe operational principle of Mobile IP. TLO 5.2 Implement line coding techniques. TLO 5.3 Implement shift keying and modulation techniques. TLO 5.4 Explain architecture of wireless sensor networks.	**Unit - V Wireless Network Technologies** 5.1 Mobile IP: Operational Principle, Home agent ,Foreign Agent 5.2 Line coding techniques: Unipolar NRZ, Bipolar RZ and Manchester NRZ 5.3 Binary amplitude shift keying, Binary phase shift keying, Binary frequency shift keying, PCM (Pulse code modulation), DM(Delta Modulation) 5.4 MANETs (Mobile Adhoc Networks): Topologies, features, applications, architecture 5.5 WSN (Wireless Sensor Networks): Different types of architecture, characteristics, applications	Lecture Using Chalk-Board Presentations Flipped Classroom Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different sections and components of mobile phone such as ringer section, dialer section, receiver section and transmitter section, camera, microphone, speaker, Dash light.	1	* Identify different sections of mobile phone	2	CO1
LLO 2.1 Analyze process of call connection and call release of cellular mobile system.	2	* Perform process of call connection and call release of cellular mobile system(Using any simulation tool)	2	CO1
LLO 3.1 Determine hardware information of the mobile using relevant software.	3	* Detect the hardware details of mobile handset. (Using any relevant mobile application)	2	CO1
LLO 4.1 Determine system information of the mobile using relevant software.	4	* Detect operating system and its version(Windows, Blackberry and mac OS) using any relevant mobile application.	2	CO1
LLO 5.1 Build a Personal Area Network of mobile devices.	5	Establish Personal Area Network for two or more devices.	2	CO2
LLO 6.1 Implement Bluetooth protocol services.	6	Transfer an image, audio and video file using Bluetooth protocol with varying distance between two or more devices	2	CO2
LLO 7.1 Create hotspot connection of any two devices.	7	* Make Hotspot connection on Wifi on any 2 devices	2	CO2
LLO 8.1 Configure Wi-Fi settings in mobile devices.	8	* Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile phone to laptop	2	CO2

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 9.1 Installation of eSim on mobile handset. LLO 9.2 Authenticate eSIM(virtual SIM)on mobile handset.	9	* Install and authenticate eSIM(virtual SIM)on mobile handset	2	CO3
LLO 10.1 Identify different parts of smartphones.	10	* Identify Dual sim interface section, Touchscreen display section, battery charging circuit, power management unit of 4G or 5G smartphone and test working	2	CO3
LLO 11.1 Determine location of nearby tower. LLO 11.2 Determine internet connection strength.	11	Using appropriate mobile app locate and find Internet signal strength of mobile tower	2	CO3
LLO 12.1 Identify network topology and check availability of network.	12	Check network availability and network topology using any open share website	2	CO4
LLO 13.1 Configure manual and auto selection network.	13	* Implement manual and auto selection of network using mobile handset	2	CO4
LLO 14.1 Establish wireless connectivity using access points.	14	* Create seamless wireless connectivity using multiple access points	2	CO4
LLO 15.1 Develop a mobile application for wireless technology.	15	* Develop a mobile application for wireless technology using any wizards such as available on www.appypie.com or any other website	2	CO4
LLO 16.1 Implement radio frequency connectivity.	16	Apply RFID technology for real life applications using RFID kit	2	CO2
LLO 17.1 Simulate line coding technique Unipolar NRZ.	17	* Implement line coding technique Unipolar NRZ using MATLAB and Simulink	2	CO5
LLO 18.1 Simulate line coding technique Bipolar RZ.	18	* Implement line coding technique Bipolar RZ using MATLAB and Simulink	2	CO5
LLO 19.1 Simulate line coding technique Manchester NRZ.	19	* Implement line coding technique Manchester NRZ using MATLAB and Simulink	2	CO5
LLO 20.1 Implement amplitude shift keying using any relevant software.	20	* Simulate binary amplitude shift keying using MATLAB and Simulink	2	CO5
LLO 21.1 Implement amplitude shift keying using any relevant software.	21	Simulate binary phase shift keying using MATLAB and Simulink	2	CO5
LLO 22.1 Implement frequency shift keying using any relevant software.	22	Simulate frequency shift keying using MATLAB and Simulink	2	CO5
LLO 23.1 Simulate pulse code modulation using using any relevant software.	23	* Implement pulse code modulation using MATLAB and Simulink	2	CO5
LLO 24.1 Simulate delta modulation using any relevant software.	24	Implement delta modulation using MATLAB and Simulink	2	CO5
LLO 25.1 Simulate WSN using any relevant software.	25	* Implement WSN node to determine position on node and blink LED using cubcarbon simulator and senscript	2	CO5
LLO 26.1 Analyze performance of Wi-Fi Network.	26	* Analyse a Wi-Fi network using related software (Like NetSpot or Wi-Fi analyzers)	2	CO5
LLO 27.1 Create a Basic MANET.	27	Use network simulators such as NS3 or OMNeT++ to create a basic MANET	2	CO5
LLO 28.1 Configure mobile IP addressing on a local network.	28	Setup mobile IP addressing on a local network using Cisco Packet Tracer or any other software	2	CO5

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Case Study

- LTE Network Optimization in Rural India Objective: Explore how LTE (Long Term Evolution) networks are being optimized to provide reliable and affordable mobile data services in rural areas of India
- Wi-Fi 6 in high density venues (Stadiums and Airports) Objective: Examine the implementation of Wi-Fi 6 (802.11ax) technology in high-density venues such as sports stadiums or airports.
- LTE Network Optimization in Rural India Objective: Explore how LTE (Long Term Evolution) networks are being optimized to provide reliable and affordable mobile data services in rural areas of India
- Googles Project Loon-providing internet access via balloons Objective: Investigate Google's Project Loon, which aims to provide internet access to remote and underserved areas through high-altitude balloons

Micro project

- Comparative Study of 4G vs. 5G Network Performance
- Indoor Positioning System for Smartphones Using Wireless Networks
- Improving Mobile Network Connectivity in Remote Areas
- Development of a Mobile App for Real-time Traffic Monitoring Using Wireless Networks
- Prepare report on : Exploring the Transition from 5G to 5.5G - Technological Advancements and Future Prospects
- Prepare report on: 5.5G and Beyond- A Vision for the Future of Telecommunication Networks

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Wireshark Software	12
2	RFID Kit	16
3	MATLAB/Simulink (student version) Tool	2,17,24
4	Octave or Scilab(Free alternative to MATLAB)	2,17,24
5	Cupcarbon Software	25
6	NetSpot Software	26
7	NS3 Network simulator or OMNeT++ (with OMNet 6.1 IDE for windows) Network simulator	27

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
8	Cisco Packet Tracer	28
9	Device Info HW-Mobile application	3
10	D-Link Wi-Fi Access Points	7,8,14
11	Mobile devices (Handsets)-Bluetooth and Wi-Fi enabled	All
12	Computer System-Bluetooth and Wi-Fi enabled	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to GSM	CO1	8	4	6	2	12
2	II	GPRS and Mobile Data communication	CO2	8	4	6	6	16
3	III	Wireless application protocols and 3G mobile services	CO3	8	4	4	4	12
4	IV	Introduction to 5G Technology	CO4	9	4	6	4	14
5	V	Wireless Network Technologies	CO5	12	6	6	4	16
Grand Total				**45**	**22**	**28**	**20**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End Semester Examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	1	2	1	2			
CO2	3	-	3	2	3	1	2			
CO3	3	-	-	2	2	1	3			
CO4	3	-	2	3	3	3	3			
CO5	3	2	2	3	2	3	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

WIRELESS AND MOBILE NETWORK **Course Code : 316325**

Sr.No	Author	Title	Publisher with ISBN Number
1	Theodore S. Rappaport	Wireless Communications Principles & Practice	Pearson Education India : 2nd edition (1January 2010), ISBN : 978-8131731864
2	Lin YI-Bang, Clamtac Emrich	Wireless and Mobile Network Architecture	John Wiley & Sons, New Delhi, 2001 ISBN 978-81-265-1560-8
3	William C.Y. Lee	Mobile Cellular Telecommunications	McGraw Hill Education (India) Private Limited. ISBN : 978-0070635999
4	T.L.Singal	Wireless Communications	McGraw Hill Education (1 July 2017)(India) Private Limited,ISBN : 978-0070681781

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.ericsson.com/en/reports-and-papers/white-papers/advanced-antenna-systems-for-5g-networks	5G-networks
2	https://mobilepacketcore.com/lte-4g-network-architecture/	LTE 4G architecture
3	https://www.linkedin.com/pulse/applications-5g-technology-ramya-chandran-swprc	Applications of 5G
4	https://www.spirent.com/products/automated-wireless-testing-wi-fi-5g	Wi-Fi Testing
5	https://mobilepacketcore.com/lte-4g-network-architecture/	4G architecture

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students