Program Name	: Diploma in Information Technology
Program Code	: IF
Semester	: Sixth
Course Title	: Wireless and Mobile Network
Course Code	: 22622

1. RATIONALE

Wireless and mobile networks play an increasingly important role in the world of communications. This course provides an introduction to various current and next generation wireless networking technologies, and undertakes a detailed exploration of fundamental architectural and design principles used at all layers of communication protocol stack. Students will also be able to analyze wireless protocols and their performance using tools and realistic simulations to maintain the wireless and mobile networks.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Maintain wireless and Mobile Networks.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a) Select cellular Mobile system standard.
b) Maintain wireless network Technologies.
c) Maintain wireless mobile application.
d) Interpret the components of WLL Applications.
e) Maintain Adhoc and wireless sensor network.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate attainment of COs and the remaining 20 marks for tests and assignments given by the teacher.

Legends: *L-Lecture;* **T** *– Tutorial/Teacher Guided Theory Practice;* **P** *-Practical;* **C** *– Credit,* **PA** *- Progressive Assessment*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.
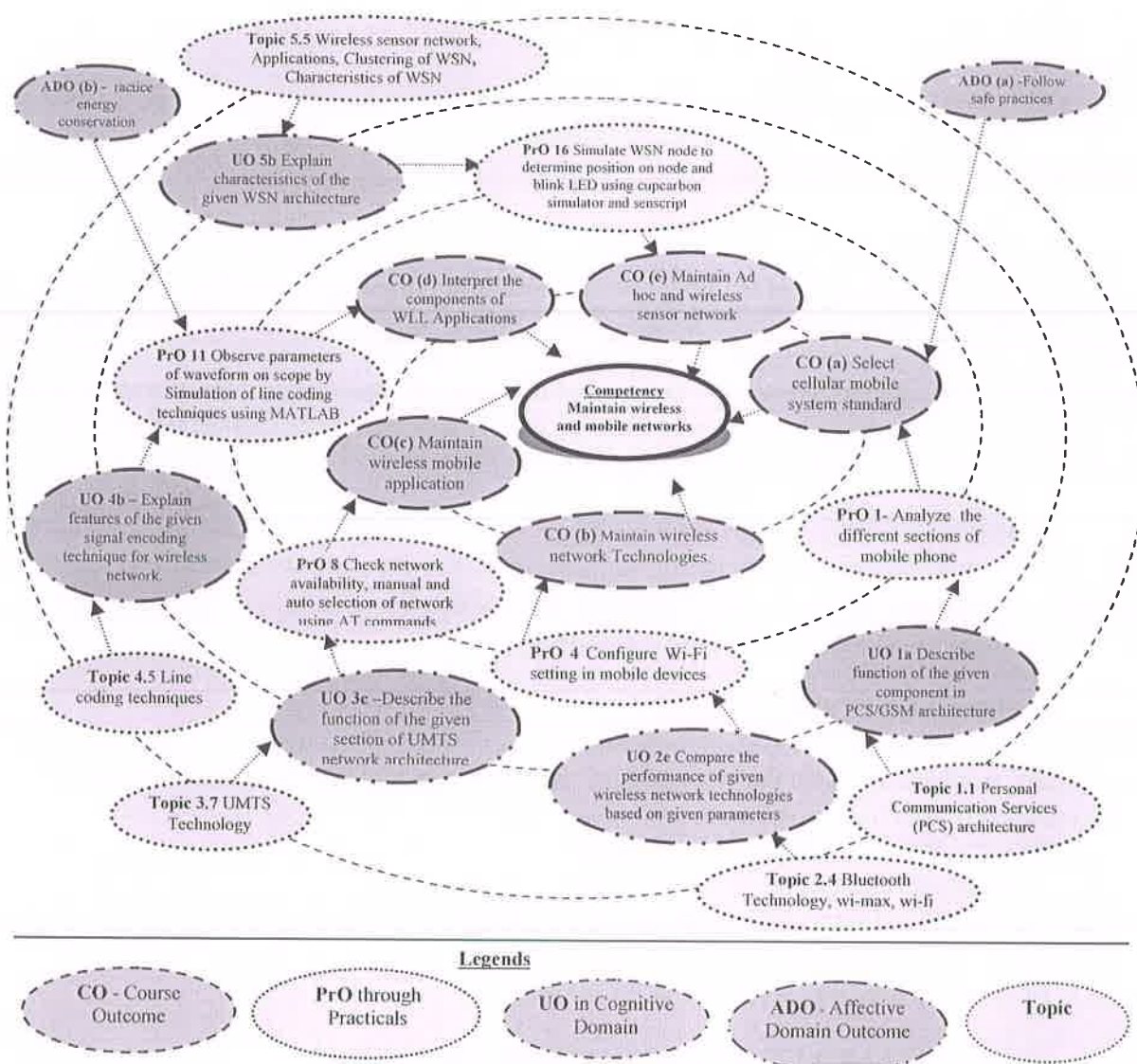
Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the above stated competency.:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Test the different sections of mobile phone. (Such as ringer section, dialer section, receiver section and transmitter section)	I	02*
2	Perform the process of call connection and call release of cellular Mobile system.	I	02*
3	Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.	II	02*
4	Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile phone to mobile phone, mobile phone to laptop.	II	02*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5	Apply RFID technology for real life applications using RFID kit.	II	02
6	Establish seamless wireless connectivity using multiple access point.	II	02
7	Use AT commands to understand working of 3G network using 3G mobile phone Trainer kit.	III	02*
8	Check network availability, manual and auto selection of network using AT commands.	III	02*
9	Simulate Bluetooth voice transmission to observe effect of AWGN and interference of 802.11b on transmission using MATLAB and simulink.	III	02
10	Develop a mobile application for wireless technology using any wizards such as available on www.appypie.com or any other.	IV	02*
11	Simulate the line coding techniques using MATLAB and simulink.	IV	02
12	Simulate the Binary amplitude shift keying using MATLAB and simulink	IV	02*
13	Simulate the Binary phase shift keying using MATLAB and simulink.	IV	02*
14	Simulate the Delta modulation using MATLAB and simulink.	IV	02*
15	Simulate the Direct sequence spread spectrum using MATLAB and simulink.	IV	02*
16	Simulate WSN node to determine position on node and blink LED using cupcarbon simulator and senscript.	V	02*
	Total		**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. The practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Follow Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

    a) Work collaboratively in team

    b) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications and Software	PrO. No.
1	Mobile phone trainer kit with Battery	1
2	Mobile phone trainer kit with Battery, SIM card of any GSM Service provider supporting 900/1800 frequency band, power supply	2
3	Blue tooth enabled two mobile phones	3
4	Mobile devices, Wi Fi access points	4
5	RFID kit	5
6	3,4 wi-fi enabled devices,Dlink wi fi access point	6
7	Mobile phone trainer kit with Battery	7
8	3G mobile phone Trainer kit,3G activated SIM card of any service provider supporting Tri-band UMTS 2100/1900/850 MHz, power supply,Hands free kit,CRO/Spectrum Analyzer,connecting wires,antenna with coaxial cable,Micro SD card.	8
9	PC with relevant software MATLAB	9, 11,12, 13, 14, 15
10	PC with internet connection	10
11	PC with relevant software Cupcarbon	16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Major Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of PCS and GSM	1a. Describe function of the given component in PCS/GSM architecture. 1b. Classify the given GSM logical channel. 1c. Describe the given step of call processing in GSM. 1d. Explain the significance of given type of area in cellular network.	1.1 Personal Communication Services (PCS) architecture 1.2 Global system for Mobile Communication (GSM) Architecture, GSM frequency spectrum , GSM radio aspects, GSM services, Supplementary services, GSM channel types, call processing in GSM 1.3 Mobility Management: Location updates procedure, Temporary

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Unit	Major Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Mobile Subscriber Identity, concept of roaming, Location area, routing area, tracking area. 1.4 Network signaling.
Unit– II **GPRS** **and** **Mobile** **Data** **Communi** **cation**	2a. Describe function of the given component of the GPRS architecture. 2b. Describe characteristics of the given IEEE protocol standard for wireless communication networks. 2c. Explain architecture of the given IEEE 802.11 protocol standard. 2d. Compare the performance of given wireless network technologies based on given criteria. 2e. State the procedure of scheduled maintenance of the given system	2.1 General Packet Radio Services (GPRS) architecture, GPRS Services, Quality of service 2.2 GPRS Network nodes, Mobility management and routing in GPRS, Logical channels in GPRS 2.3 WLANs (Wireless LANs) IEEE 802.11 standard, RFID 2.4 Bluetooth technology, Wi-Max, Wi-Fi 2.5 Mobile IP: operational principle, Home agent, foreign agent.
Unit– III **Wireless** **Applicati** **on** **Protocol** **and 3G** **Mobile** **Services**	3a. Describe the given specification for compatibility requirements of IMT-2000 global standards. 3b. Explain features of the given next generation standard. 3c. Describe the function of the given section of UMTS network architecture. 3d. Compare features of the two given next generation mobile communication networks based on given criteria. 3e. State the procedure of scheduled maintenance of the given system	3.1 Mobile Internet standard, Wireless Application Protocol (WAP) Gateway and Protocols. 3.2 Wireless Markup Languages (WML) 3.3 International Mobile Telecommunications 2000 (IMT 2000) specification. 3.4 Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in third generation (3G) network. 3.5 UMTS Technology: Features, UMTS data rates, UMTS Spectrum, UMTS Architecture, applications and advantages. 3.6 Features of 4G and 4G LTE,VoLTE,4.5G,5G,4G Architecture, applications of 4G
Unit-IV **WLL,** **signal** **encoding** **technique** **s and** **Spread** **spectrum** **modulati**	4a. Describe the given application of Wireless local loop. 4b. Explain features of the given signal encoding technique for wireless network. 4c. Compare PCM, DPCM, DM modulation techniques on the given criteria. 4d. Describe characteristics of the	4.1 WLL architecture, Wireless local Loop (WLL) technologies 4.2 WLL types: FWT and WT with mobility, WLL Application 4.3 Concept of LEC networks 4.4 Line coding techniques 4.5 Amplitude shift keying, Binary phase shift keying; PCM, DPCM, DM; features; Types of spread spectrum;

Unit	Major Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
on	given Spread spectrum modulation technique. 4e. State the procedure of scheduled maintenance of the given system	DSSS, FHSS
Unit –V Mobile Ad-hoc Networks and Wireless Sensor Networks	5a. Explain the feature of given component in MANET architecture. 5b. Explain characteristics of the given WSN architecture. 5c. Describe the given design challenges in WSN 5d. Classify the given clustering algorithm. 5e. State the procedure of scheduled maintenance of the given system	5.1 MANET, MANET topologies, Features of MANET, Applications, types of MANET Architecture, Design challenges in MANET, 5.2 Mesh Networking; Wireless sensor network, Applications, Clustering of WSN, Characteristics of WSN; Sensor node: Block diagram, Different types of WSN Architecture, Energy efficiency in WSN 5.3 WSN, MANET and IOT; ISO equivalent protocol layer architecture for WSN, Classification of clustering algorithms, Components of WSN Architecture

Note: *To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

9. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of PCS and GSM	10	04	04	04	12
II	GPRS and Mobile Data Communication	12	-	04	08	12
III	Wireless Application Protocol and 3G Mobile Services	16	04	12	04	20
IV	WLL, signal encoding techniques and Spread spectrum modulation	14	02	04	04	10
V	Mobile Ad-hoc Networks and Wireless Sensor Networks	12	04	04	08	16
	Total	**64**	**14**	**28**	**28**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Visit nearest MTNL/BSNL exchange and prepare detail report of entire setup of their cellular system.

b) Visit nearest CDMA based cellular switching center and prepare details of entire setup of their cellular system.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.

b) *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c) About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).

d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

e) Guide student(s) in undertaking micro-projects.

f) Correlate subtopics with Electronics communication and Digital communication.

g) Use proper equivalent analogy to explain different concepts.

h) Use Flash/Animations to explain functions of mobile handset.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should *not exceed three.*

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Prepare a report on TRAI regulations related to wireless and mobile Network.

b) Prepare a report on sectorisation, BTS Functions, Structure of BTS, Electronic Board Identification, Mechanical structure, Base station controller, BSS interface, BSS Planning of Base Station Subsystem.

c) Prepare a report on CDMA Base Transreceiver Station which includes BTS Functions, BTS Position in the system, BTS system Architecture, Mechanical features, Electrical

feature, Power Consumption, subsystem of BTS, Antenna and Feeder, Typical application, BTS Network Topology.

d) Prepare a report on Mobile Value added Services which includes Mobile Messaging Services, SMS, SMSC Deployment Architecture, EMS, WAPService, MMS Network Architecture, VMS, Voiceportal, Cell Broadcast Service, Push to Talk.

e) Prepare a report on Mobility management and associated algorithms in wireless and mobile Networks.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Wireless and mobile network Architectures	Lin Yi-Bang, Clamtac Imrich	John Wiley &sons, New Delhi,2001 ISBN 978-81-265-1560-8
2	Wireless communication-Principles and practice	Theodore S. Rappaport	Pearson publication New Delhi,2005 ISBN:978-81-317-3186-4
3	Wireless Communication	Singal T.L.	McGraw Hill Education Private Limited, New Delhi,2010, ISBN:978-0-07-068178-1
4	Mobile Computing Technology, Applications and service creation	Talukdar Asoke K, Javagal Roopa R	McGraw Hill Education Private Limited, New Delhi,2010, ISBN:978-0070144576

14.   SOFTWARE/LEARNING WEBSITES
a) Mobile network standards:-http://gallucci.net/blog/gsm-cdma-and-lte-a-guide-to-mobile-network.../3/4

b) Bluetooth technology: -www.radio-Electronics.com/info/wireless/Bluetooth/Bluetooth_overview.php

c) The Evolution of mobile technologies:-https://www.qualcomm.com/.../the-evolution-of-mobile-technologies-1g-to-2g-to-3g-.

d) Wireless tutorials: https://www.octoscope.com/English/.../octoscope_WirelessTutorial_20090209.pdf