GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-III

Course Title: Principle of Telemedical Communication
(Course Code: 4330304)

Diploma programme in which this course is offered	Semester in which offered
Biomedical Engineering	Third

1. RATIONALE

Telemedicine is the use of telecommunications and information technologies in order to provide medical support during face-to-face interaction between the providers were difficult due to the distance, cost, or simple unavailability of suitable transport. By use of telemedicine, it is possible to access a wide range of care services like primary care consultations, psychotherapy and even some emergency services. These courses will enable to understand the various techniques used for data transferring in health care services and also develop the skills required for networking computers with medical equipment and each other for data communication.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Use various communication techniques in the field of health care**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

a) Explain the concept of Telemedicine system.
b) Apply the basic communication system and its tools in Telemedical Instrumentation.
c) Illustrate type of communication and networking
d) Explain modulation and its techniques.
e) Apply green communication in Telemedicine system.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	5	30	70	25	25	150

(*):Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. *Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	To study the block diagram of telemedicine system using chart	1	2
2	Identify various parts and give the specifications of components of the trainer kit of communication model.	1	2
3	To Connect the computers in Local Area Network	1	2
4	To Study of IP address	2	2*
5	To study analog to digital converter using trainer kit	2	2*
6	To study digital to analog converter using trainer kit	2	2*
7	To study amplitude modulation using training kit	4	2
8	To study frequency modulation using training kit	4	2
9	Identify different layer of OSI Model using chart	3	2
10	Identify different layer of TCP/IP Model using chart	3	2*
11	To study Phase modulation using training kit	5	2*
12	To study Tele radiology system using chart	5	2*
13	To study Tele surgery system using chart	5	2*
14	To study ISDN Network using training kit	2	2
15	To study the Eco-friendly benefits of Telehealth	5	2
16	To study the process of E-waste Recycling using chart	3	2
	Total		**32**

Note

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills(more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Operate the equipment setup	20
3	Follow safe practices measures	10
4	Record observations correctly	20
5	Interpret the result and conclude	30
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

a) Communication Trainer Kit
b) Analog to digital Trainer Kits
c) Digital to analog Trainer Kit
d) PSTN Trainer Kit
e) ISDN Trainer Kit

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfill the development of this competency.

a) Work as a leader/a team member.
b) Follow safety practices while using electrical appliances.
c) Practice environmental friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory / field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I Introduction to Telemedicine	1a. Justify the need for telemedicine system 1b. With sketches explain block diagram of tele-medical system. 1c. Describe the scope of tele-medical system with its benefits and limitations.	1.1 Telemedicine: Origins and development 1.2 Concept of telemedicine 1.3 Block diagram of telemedicine system 1.4 Scope, benefits and limitations of telemedicine system
Unit – II Concept of Data Conditioning and Transmission	2a. Define analog and digital signals. 2b. Identify the different types of information that can be used for tele-medicine. 2c. Explain A/D and D/A convertor 2d. Explain Transmission Modes	2.1 Analog and digital signals 2.2 Types of information: Audio, Video, Images and Text 2.3 A/D and D/A converters 2.4 Transmission Modes: Simplex, Half Duplex, Full Duplex

Unit– III Types of Communication and Network	**Communication** 3a. With sketches explain various communication networks possible for tele-medicine. **Network** 3b. Distinguish between internet and intranet 3c. Differentiate between LAN, WAN and MAN. 3d. Describe the OSI and TCP/IP Reference network models. 3e. Describe E-Waste 3f. Explain E-waste Recycling 3g. Enlist the health concept due to disposing of improper E-waste	3.1 Types of communication: Wired and Wireless 3.2 Network: PSTN, ISDN 3.3 Concept of internet and intranet 3.4 Type of network LAN, MAN, WAN 3.5 Concept of OSI and TCP/IP Reference models (Layer) 3.6 E-Waste 3.7 Health Concerns of Improper E-Waste Disposal 3.8 E-waste Recycling and Process of Recycling Electronic Waste
Unit– IV Modulation& its techniques	4a. Describe modulation 4b. Justify the need for various modulation techniques. 4c. Distinguish between analog and digital modulation techniques. 4d. Explain various type of analog modulation and techniques with proper diagram and waveform 4e. Explain various type of digital modulation techniques with proper diagram and waveform 4f. Explain various type of Analog transmission of digital data with proper diagram and waveform	4.1 Modulation & Necessity of modulation 4.2 Modulation techniques:, Amplitude modulation, Frequency modulation, Phase modulation 4.3 Digital modulation (PAM,PWM,PCM) 4.4 Analog transmission of digital data (ASK, FSK, PSK)
Unit– V Application of Telemedicine to reduce carbon footprint	5a. Explain with sketches Teleradiology system. 5b. Describe the fundamental parts of Teleradiology system. 5c. Explain with sketches Telepathology, Teleradiology and Telesurgery system. 5d. Explain Carbon footprint in healthcare 5e. Enlist Eco-friendly benefits of Telehealth	5.1 Tele radiology system: Image acquisition system, Display system 5.2 Tele pathology: multimedia databases, color images of sufficient resolution 5.3 Tele-cardiology 5.4 Tele-surgery 5.5 telemedicine reduce the carbon footprint of healthcare 5.6 Telemedicine can make healthcare greener

***Note**:The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
1	Introduction to Telemedicine	6	6	4	0	10
2	Concept of Data Conditioning and Transmission	7	4	4	2	10
3	Types of Communication and Network	9	4	6	4	14
4	Modulation & its techniques	10	6	10	2	18
5	Application of Telemedicine to reduce carbon footprint	10	6	8	4	18
Total		**42**	26	32	12	70

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may varies lightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

a) Visit to nearer Doordarshan Kendra.
b) Visit Multi-specialty Hospital, where Tele medical facilities are available.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

a) Ask students (in a group of three-four) to prepare projects/reports on status of telemedicine (by exploring internet) for different types of surgeries/procedures/treatments and then present in Seminar/Symposium.
b) Arrange visit to supplier of telemedicine equipment/devices or their websites.
c) Arrange expert lectures
d) Arrange visit to a Multi-specialty Hospital

12. SUGGESTED MICRO-PROJECTS

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Communication model: Build a basic model to demonstrate process and connection between medical devices
b) To establish the simple LAN connection
c) To make chart: A/D and D/A converters
d) To setup local area network in department
e) To make chart: Analog and Digital modulation techniques
f) Make a report on handling recycling and disposal of E waste with comparative charts and strategies used and suggested.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Telemedicine : Technology and applications (Mhealth, Telehealth and Ehealth)	R.S. Khandpur	PHI Learning Pvt. Ltd., 2017
2	Computer networks	Andrew S Tanenbaum	PHI Learning, New Delhi, 2010
3	Data Communication and Networking	Forouzan	PHI Learning, New
4	Handbook of Biomedical Instrumentation	Khandpur	3rd Edition, new
5	Electronic Communication Systems	Kennedy, George; Davis, Bernard	McGraw-Hill Education (ISE Editions),2006
6	Handbook of Tele-medicine	Ferrer-Roca, Olga; Sosa, M.Ludicissa	IOS press,2002

14. SOFTWARE/LEARNING WEBSITES

a) www.amdtelemedicine.com
b) www.telemedicine.knet.ca
c) www.biomedical-engineering-online.com

15. PO-COMPETENCY-CO MAPPING

Semester III	Principle of Telemedical (Course Code: 3330302)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency							
CO a) Explain the concept of Telemedicine system	3	-	-	2	-	-	2
CO b) Apply the basic communication system and its tools in Telemedical Instrumentation	3	1	1	2	-	-	1
CO c) Illustrate type of communication and networking	3	1	1	2	2	-	2
CO d) Explain modulation and its techniques	3	1	1	2	-	-	1
CO e) Apply green communication in Telemedicine system	3	-	1	-	2	-	2

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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