GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: TELEMEDICAL INSTRUMENTATION
(COURSE CODE: 3360303)

Diploma Programmes in which this course is offered	Semester in which offered
Biomedical engineering	Sixth

1. RATIONALE

Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It helps eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. This course will enable to understand the various techniques used for data transferring in health care services.

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 medical instrumentation.**

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:

i. Explain the concept of telemedical system.
ii. Apply the basic communication system and its tools in telemedical Instrumentation.
iii. Use hardware and software tools employed for data exchange.
iv. Develop logic for data security.
v. Apply communication in teleradiology.

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**	**ESE**	**PA**	**ESE**	**PA**	**150**
4	0	2	06	70	30	20	30	

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In Cognitive Domain)	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.
Unit– II Types of Communication and Network	2a. Describe the different types of information that can be used for tele-medicine. 2b. With sketches explain various communication networks possible for for tele-medicine. 2c. Describe the wireless communication suitable for tele-medicine. 2d. Explain with sketches the GSM technology. 2e. Describe how satellite communication can help telemedicine. 2f. Describe micro wave bands that can be used for telemedicine. 2g. Justify the need of antenna for telemedicine 2h. Explain with sketches various antennas with radiation pattern. 2i. Describe the system integration required for telemedicine. 2j. Explain real time operation in tele medicine.	2.1 Types of information: Audio, Video, Images, Text and Data, Fax 2.2 Types of communication 2.3 Network: PSTN, ISDN, Internet 2.4 Wireless communications: Wave propagation, GSM network (Global system for mobile communication), Satellite and micro wave 2.5 Antennas: Parabolic reflector, Di-pole antenna, Array antenna 2.6 System integration 2.7 Real-time telemedicine
Unit– III Data Exchanges	3a. Justify the need for data exchanges. 3b. Explain with sketches circuit switching network. 3c. Explain with sketches packet switching network. 3d. Describe video phone based ISDN. 3e. Describe video phone based PSTN. 3f. Explain with sketches video conferencing.	3.1 Data exchanges: Network configuration, Circuit switching, Packet switching 3.2 H.320 series (Video phone based ISDN) 3.3 T.120, H.324 (Video phone based PSTN) 3.4 Video conferencing
Unit – IV Data Security	4a. Justify the need of cryptography. 4b. Describe the data security and standards. 4c. Describe the encryption process. 4d. Differentiate between TCP/IP and	4.1 Cryptography, Data security and standards: Encryption, Mechanisms of encryption, Phases of encryption

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
	OSI protocol. 4e. Distinguish ethical and legal aspects of telemedicine. 4f. Differentiate between confidentiality and law. 4g. Differentiate between patient rights and consent. 4h. Describe the access to medical records.	4.2 Protocols: TCP/IP, ISO-OSI 4.3 Ethical and legal aspects of Telemedicine: Confidentiality and Law, 4.4 Patient rights and consent, 4.5 Access to medical records
Unit – V Teleradiology	5a. Explain with sketches teleradiology system. 5b. Describe the fundamental parts of teleradiology system. 5c. Explain with sketches telepathology, telecardiology and telesurgery system.	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

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Telemedicine	07	04	04	00	08
II	Types of Communication and Network	18	08	08	06	22
III	Data Exchanges	10	06	04	04	14
IV	Data Security	14	06	06	06	18
V	Tele Radiology	07	00	04	04	08
	Total	**56**	**24**	**26**	**20**	**70**

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

7. SUGGESTED EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note*: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme***

Outcomes (*as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours Required
1	I	Identify various parts and give the specifications of components of the trainer kit of communication model.	02
2	I	Perform the ECG telemedicine system using trainer kit.	02
3	II	Perform the Public switch telephone network trainer kit.	02
4	II	Demonstrate the ISDN using trainer kit.	02
5	II	Demonstrate the GSM using trainer kit.	02
6	II	Plot various antenna radiation patterns using antenna trainer kit.	02
7	III	Test and compare techniques of circuit switching with Packet switching.	02
8	III	Compare various wave propagation methods.	02
9	III	Perform video conferencing using internet.	02
10	IV	Identify different layers of TCP/IP protocols.	02
11	IV	Identify different layers of OSI protocols.	02
12	V	Perform teleradiology system using trainer kit.	02
13	V	Perform telesurgery system using trainer kit.	02
14	V	Perform encryption of documents using encryption tools.	02
Total			**28**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Visit to nearer Doordarshan Kendra.
ii. Visit Multi-specialty Hospital, where Tele medical facilities are available.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. 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.
ii. Arrange visit to supplier of telemedicine equipment/devices or their websites.
iii. Arrange expert lectures
iv. Arrange visit to a Multi-specialty Hospital

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Title of Book	Author	Publication
1.	Computer networks	Andrew S Tanenbaum	PHI Learning, New Delhi, 2010
2.	Data Communication	Forouzan	PHI Learning, New

S. No.	Title of Book	Author	Publication
	and Networking		Delhi, 2012
3.	Electronic Communication	Dennis, Roddy; John, Coolen	Pearson Education, New Delhi, 2011
4.	Electronic Communication Systems	Kennedy, George; Davis, Bernard	McGraw-Hill Education (ISE Editions),2006
5.	Handbook of Tele-medicine	Ferrer-Roca, Olga; Sosa, M.Ludicissa	IOS press,2002

B) Major Equipment/ Instrument with Broad Specifications

i. Communication Trainer Kit
ii. Antenna Trainer Kits
iii. GSM Trainer Kit
iv. PSTN Trainer Kit
v. ISDN Trainer Kit

C) Software/Learning Websites

i. www.amdtelemedicine.com
ii. www.telemedicine.knet.ca
iii. www.biomedical-engineering-online.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. N.D.Makwana,** Lecturer, Dept of Biomedical Engineering, G.P.Gandhinagar
- **Prof. B.C.Changela,** Lecturer, Dept of Biomedical Engineering, A.V.P.T.I. Rajkot.
- **Prof. A.K.Bula,** Lecturer, Dept of Instrumentation Engineering, G.P.Gandhinagar
- **Prof. M.H.Dave,** Lecturer, Dept of Biomedical Engineering, G.P.Gandhinagar
- **Prof. S.S.Malkan,** Lecturer, Dept of Biomedical Engineering, G.G.P.Ahmedabad

Faculty Members from NITTTR

- **Prof. (Mrs.) Susan S. Mathew,** Associate Professor, Dept. of Electrical and Electronics Engineering, NITTTR Bhopal
- **Dr. S.K. Gupta**, Professor and Coordinator, NITTTR Extension Centre, Ahmedabad