

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

TEACHING SCHEME (w. e. f. 10th Jan,' 11)

SEMESTER- VI

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	360301	Bio Medical Signal Processing	4	0	4	8
2	360302	Rehabilitation Engineering	4	0	4	8
3	360303	Project	0	0	4	4
4	360304	Tele Medical Instrumentation	3	0	2	5
5		Elective	3	0	2	5
		TOTAL	14	0	16	30

Select **ANY ONE** of the following subject

Sr No.	Subject Code	Elective Subjects
1	360305	Dental Medical Equipments
2	360306	Pharmaceutical Instrumentation
3	360307	Virtual Medical Instrumentation
4	360308	Ophthalmic Instrumentation
5	360309	Bio Informatics

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360301

Subject Name: BIOMEDICAL SIGNAL PROCESSING

Sr. No.	Subject Content	Hrs.
1	<p>1.0 Nature and Types of Bio-Medical Signals and Images:</p> <p>1.1 Introduction of the following signals</p> <p>1.2 Draw & study the Electro-cardiogram signal</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of ECG electrodes & associated components <p>Draw the constructional features of them</p> <p>1.3 Draw & study Electro-neurogram (ENG) signal</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of ENG electrodes & associated components <p>Draw the constructional features of them</p> <p>1.4 Draw & enumerate Electro-myogram signal (EMG) signal</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of EMG electrodes & associated components <p>Draw the constructional features of them</p> <ul style="list-style-type: none"> • Explain the measurement techniques of EMG <p>1.5 Draw & enumerate Electro-retinogram signal (ERG) signal</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of ERG electrodes & associated components <p>Draw the constructional features of them</p> <ul style="list-style-type: none"> • Explain the measurement techniques of Electro-retinogram signal (ERG) <p>1.6 Study& enumerate Electro-encephalogram signal (EEG)</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of EEG electrodes & associated components <p>Draw the constructional features of them</p> <ul style="list-style-type: none"> • Explain the measurement techniques of EEG <p>1.7 Study& enumerate The Magneto-encephalogram signal (MEG)</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Listing all types of MEG electrodes & associated components <p>Draw the constructional features of them</p> <ul style="list-style-type: none"> • Explain the measurement techniques of MEG <p>1.8 Study the techniques of measuring a Mammogram</p> <ul style="list-style-type: none"> • Understand its deriving with the instrumentation employed in it • Explain the measurement techniques of MEG 	22

	1.9 MRI images	
2	2.0 Signal Conversion: 2.1 Listing Sampling of these biomedical signals listed in 1.0 a comparing detail of the same 2.2 Need of the Quantization understand its importance 2.3 Source coding 2.4 Channel coding 2.5 Signal conversion requirements for biomedical signals	6
3	3.0 Concepts of Digital Filtering: 3.1 State the Advantages of digital filters 3.2 List the Types of digital filters 3.3 Study the FIR filter 3.4 Study the IIR filter 3.5 Study the Adaptive filters and compare all of the above	10
4	4.0 Time Frequency Signal Analysis Methods: 4.1 The Fourier transform 4.2 Correlation 4.3 Convolution 4.4 Frequency domain analysis of ECG signal 4.5 Introduction of wavelet 4.6 Basic concepts of wavelet transform 4.7 Advantages of wavelet transform 4.8 Applications of wavelet transform in biomedical field	10
5	5.0 Data Reduction Techniques: 5.1 Enumerate necessity for data reduction 5.2 State Types of data reduction techniques 5.3 Briefly describe Redundancy and irrelevancy removal 5.4 Enumerate necessity for Entropy coding briefly describe it 5.5 Study the ECG data reduction algorithms	8
	TOTAL	56

NOTE:-

Following are the minimum experiences required, but the college can do more Experiences if possible.

Laboratory Experiences:

1. To understand various biomedical signals	4
2. To understand open source software library BioSig for analysis of bio-signals	4
3. Analyze bio-signals such as the electroencephalogram (EEG), electrocardiogram (ECG), electromyogram (EMG), etc. using software	4
4. Write programs for digital filter in C language	4
5. MATLAB programs for plotting of signals and images	4
6. Filtering of 1-D signal using MATLAB programs	4
7. De-noising of images with MATLAB programming	4
8. Use of MATLAB simulink, signal-processing toolbox	4
9. Deliver seminar on recent trends in bio-medical signal processing	12
10. Field visit of hospitals/Pharmaceutical companies	12

Total 56

Note:

Students must submit or present at least one report/seminar regarding advancements and new trends in the field of bio-medical signal processing as a part of term work.

Reference Books:

1. Biomedical digital signal processing	By. Willis J. Tompkins (PHI).
2. Biomedical signal processing	By. Metin Akay Hardcover
3. Biomedical Signal Analysis	By. Rangraj M Rangayann, IEEE Press
4. Time frequency and wavelets in biomedical signal processing	By. Metin Akay (Wiley)
5. Biomedical signal and image processing	By. Kayvan Najarian (CRC Press)
6. Biomedical signal processing and modelling	By. Eugene Bruce (Wiley)
7. Wavelet Transforms	By. Raghuvir Rao, Ajit Bopardikar (Pearson)
8. Insight into wavelets: (Theory to practice)	K.P. Soman (PHI)

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360302

Subject Name: REHABILITATION ENGINEERING

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction to Rehabilitation: 1.1 State the types & meaning of physical Impairment, Enumerate the engineering concept in sensory & motor rehabilitation.	4
2	2.0 Orthotics and Orthoprosthetics in Rehabilitation: 2.1 Understand Intelligent prosthetic knee, Prosthetic hand, Advance and automated prosthetics and Orthotics. 2.2 Study the Externally powered and controlled orthotics and prosthetics-FES system, Restoration of Hand function. 2.3 Enumerate the Restoration of standing and walking, <ul style="list-style-type: none"> • Understand the Hybrid assistive system (HAS). • Understand the Myoelectric Hand and Arm prosthesis. 2.4 Intelligent Hand Prosthesis (MARCUS).	10
3	3.0 Electronic Travel Applications (Eta): 3.1 Listing the below mentioned ETAs understand with operational block diagram . <ul style="list-style-type: none"> • Path Sounder, • Laser Cane, • Ultrasonic Torch, • Sonic Guide, • LightProbes, • Nottingham Obstacle Sensor, • Electro-cortical Prosthesis, • Electro Roftham. 3.2 Polarized Ultrasonic Travel Aid. 3.3 State the Types of wheel chair, <ul style="list-style-type: none"> • Design of wheelchair, • Ergonomic considerations in design of wheelchair, • Powered wheelchair, • Tricycle, • Walkers, Crutches.	12

4	4.0 Sensory Augmentation and Substitution: 4.1 Classify the visual impairment, <ul style="list-style-type: none"> • Describe the methods to prevent and cure of visual impairment • Understand the Visual augmentation techniques 4.2 Understand the following <ul style="list-style-type: none"> • Tactual vision substitution • auditory substitution • augmentation of the above • Tactual auditory substitution • Assistive devices for the visually impaired. 	8
5	5.0 Measurement Tools and Processes in Rehabilitation: 5.1 Listing Subjective and Objective measurement methods context too rehabilitation. <ul style="list-style-type: none"> • Explain the Measurement and assessment. 5.2 Listing study the Measurement, objectives and approaches, characterizing of the human systems and sub-systems. Characterizing assistive techniques.	6
6	6.0 Computer Application in Rehabilitation Engineering: 6.1 List the need area of Rehabilitation Engineering needing the computer application <ul style="list-style-type: none"> • State the Interfaces in compensation for visual perception. • Improvement of orientation and Mobility. 	8
7	7.0 Rehabilitation Aids for Mentally Impaired: 7.1 List rehabilitation aids for mentally impaired <ul style="list-style-type: none"> • Describe the Sleeping aids • Study the Seating aids • Study the walking aids • Study the Postural aids 	8
	TOTAL	56

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1.	Study of Engineering concept in sensory & motor rehabilitation	4
2.	Demonstration of Intelligent prosthetic knee, Prosthetic hand	4
3.	Demonstration of Externally powered and controlled orthotics and prosthetics-FES	4
4.	Demonstration of Intelligent Hand Prosthesis (MARCUS).	4
5.	To demonstrate the performance of Path Sounder,	4
6.	To demonstrate the performance of Laser Cane,	4
7.	Study of Nottingham Obstacle Sensor	4
8.	Study of Electro-cortical Prosthesis	4
9.	To demonstrate the performance of Assistive devices for the visually impaired	4
10.	Study of Subjective and Objective measurement methods, Measurement and Assessment	4
11.	Study of Computer Application in Rehabilitation Engineering	4
12.	To demonstrate the performance of Sleeping aids	4
13.	To demonstrate the performance of walking & Postural aids	4
14.	To demonstrate the performance of Polarized Ultrasonic Travel Aid	4

Total		56

Reference Books:

1. Rehabilitation Engineering, Robinson C. J.
2. Rehabilitation Technology, Ballabio E.
3. Text Book of Bio-Medical Engineering, R. M. Kennedy.
4. Hand Book of Bio-Medical Engineering, Richard Skalak & Shu Chien.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360303

Subject Name: PROJECT

Suggested Project Work for Bio-Medical Engineering:

Some of the suggested projects in the field of medical electronics are listed below for the benefit of students:

1. Designing ECG amplifier. Viewing the amplified ECG on Oscilloscope.
2. Measuring pulse pressure from finger and viewing it on oscilloscope.
3. Respiration monitoring circuit based on temperature difference between expired air and inspired air. Viewing the respiration waveform on oscilloscope.
4. Designing amplifier circuit for measuring Galvanic Skin Resistance.
5. Microprocessor based circuit for temperature measurement.
6. Microprocessor based stepper motor control.
7. Interface A/D converter with microprocessor for data acquisition.
8. Interface D/A converter with microprocessor.
9. Microprocessor based function generator.
10. LEDs based oscilloscope.
11. Temperature controlled soldering station.
12. Burglar's alarm.
13. Microprocessor based water level control system.
14. Design variable voltage power supply with 500 mA capacity.
15. Design audio power amplifier based on transistors/ICs.
16. Design amplifier for recording eye movements.
17. Repair of X-Ray Machines, ECG, EEG, EMG machines, Calorimeter and Centrifuge etc.
18. Microprocessor based traffic light system.
19. Study of equipment used in ICU. Description of one instrument in detail.
20. Study of OT equipment. Description of one instrument in detail.
21. Transmission and detection of signal through optical fiber (e.g. ECG Signed)
22. Intruder counter using photo detectors and digital ICs.
23. Light dimmer using diac and triac.
24. ECG Simulator
25. Pulse generator for electrical stimulation for excitation of muscles using external electrodes.
26. Measurement of earth resistance and leakage current for testing safety of medical equipment.
27. Machine for measurement of weight of unconscious patients.
28. Pulse rate-measuring instrument using photo-resistor, bulb and digital ICs.

29. Quantitative/Analysis of ECG. Waveform quantitative.
30. Quantitative/Quantitative Analysis of EEG waveform
31. Study of pressure transducers and its application, in the Biomedical requirement like ventilators/Dialysis etc.
32. Electronic wheel chair for patients.
33. Hydraulic bed for Dialysis patient.
34. Dialysis chair for patient.
35. Dental chair for patient (electronic controlled)
36. Image transform project
37. Design and fabricate of recorders with use of flash card memory to store ECG waveform.
38. Physiotherapy items for patients (such as foot drop splint, foam splint, knee brace, Night splint foot drop, etc.)
39. Blood pumps of the range 0-300 ml/hr. (Electronic based)
40. Syringes infusion pump (Electronic Based)
41. Micro controller Based project for Auto-processor used by X-Ray Department.
42. Project Based on Electro-Magnetic field for the requirement MRI/Gamma Camera/Radiotherapy Equipment
43. Measuring pH value and conductivity of water. I.e. project on treated water used in Bone Marrow transport.
44. Ozone generator
45. Air purifier
46. Air Curtain flier.

Note:

The list is only the guideline for selecting a project, however a student is at liberty to select any other related project of his choice independently under guidance of his teacher. Suggestive criteria for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Total marks

100

The overall grading of the practical training shall be made as per following table. In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluated before being disqualified and declared "not eligible to receive diploma". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

Range of maximum marks

- i) More than 80
- ii) 79 <= 65
- iii) 64 <= 50
- iv) 49 <= 40
- v) Less than 40

Overall grade

- Excellent
- Very good
- Good
- Fair
- Poor

Important Notes:

1. These criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the student's performance as per the above criteria.
4. It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries were approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition. It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific industries were approached for instituting such awards.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360304

Subject Name: TELE MEDICAL INSTRUMENTATION.

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction to Telemedicine: <ul style="list-style-type: none"> History of Telemedicine origins and Development of Telemedicine Scope, Benefits and limitations of Telemedicine. Definition of telemedicine Block diagram of telemedicine system 	4
2	2.0 Types of Communication and Network: <ul style="list-style-type: none"> Types of information: Audio, Video, still Images, text and data, Fax. Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Different modulation techniques, Types of antennas depending on requirements, Over view of Integration and Operational issues: system integration Over view of store-and-forward operation, real-time Telemedicine. 	12
3	3.0 Data Exchanges: <ul style="list-style-type: none"> Data Exchanges: Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing. 	6
4	4.0 Data Security: <ul style="list-style-type: none"> Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Photocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. 	6

	<ul style="list-style-type: none"> Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment, jurisdictional Issues, Intellectual property rights. 	
5	5.0 Tele Radiology: <ul style="list-style-type: none"> Tele radiology: Basic parts of Teleradiology system: Image Acquisition system, Display system, Communication network, Interpretation. Tele Pathology: Multimedia databases, color images of sufficient resolution: Dynamic range, spatial resolution, compression methods, Interactive control of colour, Controlled sampling, security and confidentiality tools. Tele cardiology Teleoncology Telesurgery 	14
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. To study Scope and application of telemedicine.	2
2. To study block diagram of telemedicine system.	2
3. To study tcp/ip protocols.	2
4. To study amplitude modulation technique.	2
5. To study frequency modulation technique.	2
6. To study pulse code modulation technique.	2
7. To study basic parts of teleradiology system.	2
8. To study basic block diagram of telesurgery.	2
9. To study circuit and packet switching network.	2
10.To study ISDN,POTS,ATN.	6
11.To impart knowledge of ethical and legal aspects of telemedicine.	2
12.To study mechanism of encryption.	2
Total:	28

Reference Books:

1. Olga Ferrer-Roca, M.Sosa Ludicissa, Handbook of Telemedicine, IOS press 2002.
2. A.C.Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360305

Subject Name: DENTAL MEDICAL EQUIPMENTS (Elective)

Sr. No.	Subject Content	Hrs.
1	<p>1.0 Introduction of the Basic Examination and Anesthetic Instruments:</p> <p>section i. Introduction 1-1. general 1-3. parts of dental hand instruments 1-4. black's classification of instruments 1-5. maintenance of cutting instruments</p> <p>section ii. The Basic Oral Examination 1-6. State the importance of the oral examination diagnosis service 1-7. State the scope of oral diagnosis 1-8. facilitating patient treatment 1-9. instruments in the above patient treatment 1-10. basic dental examination setup</p> <p>section iii. Standard Procedures 1-12. oral examinations 1-13. medical histories 1-14. radiographs (x-rays) 1-16. study casts</p> <p>section iv. Anesthetic instruments 1-19. general 1-20. instruments for local anesthesia 1-21. anesthetic instrument setup 1-22. procedures</p>	12
2	<p>2.0 Introduction of Restorative Instruments:</p> <p>section i. Introduction 2-1. general 2-2. definitions 2-3. classes of cavity preparations 2-4. facilitating patient treatment</p> <p>section ii. Instruments 2-5. examination and diagnostic instruments 2-6. local anesthetic instruments 2-7. rubber dam</p>	10

	2-8. saliva ejectors 2-9. motor driven rotary instruments used for cavity preparation 2-10. hand instruments used for cavity preparation 2-11. matrix retainers and bands 2-12. instruments used in filling prepared cavities 2-13. carving and finishing instruments	
3	2.0 Surgical Instruments: section i. Introduction 3-1. general 3-2. asepsis and cleanliness 3-3. the dental specialist as an assistant in oral surgery section ii. Instruments 3-4. general 3-5. extraction forceps 3-6. root elevators 3-7. periosteal elevators 3-8. curettes 3-9. rongeur forceps 3-10. bone files 3-11. bone chisels 3-12. surgical mallets 3-13. surgical burs 3-14. scissors 3-15. surgical knives 3-16. suture needles 3-17. gingival retractors 3-18. irrigating syringe 3-19. dental aspirator 3-20. dressing forceps 3-21. sponge forceps 3-22. instrument forceps 3-23. hemostats 3-24. needle holders 3-25. towel clamp 3-26. surgical instrument stand	10
4	3.0 Periodontic and Endodontic Instruments: section i. Periodontic Instruments 4-1. introduction. 4-2. instruments 4-3. instrument setups and surgical procedures 4-4. common periodontal duties	10

	section ii. Endodontic Instruments 4-5. general 4-6. responsibility of the dental assistant 4-7. instruments (dental chair) 4-8. instrument setups and procedures 4-9. root canal treatment (conservative therapy) 4-10. apicoectomy surgical endodontic therapy 4-11. care and cleaning of instruments 4-12. safety precautions	
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. To study importance of oral examination in dentistry. 2
2. To study dental carving process. 2
3. To study root canal treatment procedure. 2
4. To Study various types of dental cements. 2
5. To study the materials used for Dental implant. 4
6. To study Filled and unfilled Resins as Restorative materials. 2
7. To study Construction of various type of dentures and (Removable and fixed) and allied prosthesis including update of materials. 4
8. To study Clinical use of radiography. 4
9. To study operation and working principle of dental chair. 2
10. To study symptoms of periodontal Disease and its management 4

Total: 28

Reference Books:

1. Philip's – Science of Dental Materials:- Anusavice 10th Edition
2. Clinical Aspect of Dental Materials – Gladwin, Bagby
3. Materials in Dentistry (Principles & Applications) Jack L.Ferracane
4. Applied Dental Materials John F.Mecabe
5. Dental Materials (Properties & Manipulation) Craig, Powers, Wataha
6. Endodontics – Ingle.J.I

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360306

Subject Name: PHARMACEUTICAL INSTRUMENTATION (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Uv-Visible Spectroscopy: Brief review of electromagnetic spectrum and absorption of radiations. The chromophore concept, absorption law and limitations. Theory of electronic spectroscopy, absorption by organic molecules, choice of solvent and solvent effects, modern instrumentation – design and working principle. Applications of UV-Visible spectroscopy (qualitative and quantitative analysis), Woodward –Fischer rules for calculating absorption maximum, Photometric titrations and its applications.	3
2	2.0 Spectrofluorimetry : Theory, instrumentation, advantages, relationship of chemical structure to fluorescence spectra, solvent effect, effect of acids and bases on fluorescence spectra, concentration effects, factors affecting fluorescence intensity, comparison of fluorescence and UV-Visible absorption methods and applications in Pharmacy.	3
3	3.0 Infrared Spectrophotometry : Introduction, basic principles, vibrational frequency and factors influencing vibrational frequency, instrumentation and sampling techniques, interpretation of spectra, applications in Pharmacy, FT-IR-theory and applications, Attenuated total reflectance (ATR).	3
4	4.0 Nuclear Magnetic Resonance Spectroscopy : Fundamental Principles and Theory, Instrumentation, solvents, chemical shift, and factors affecting chemical shift, spin-spin coupling, coupling constant, and factors influencing the value of coupling constant, spin-spin decoupling, proton exchange reactions, FT-NMR, 2D -NMR, NMDR, NOE, NOESY, COSY and applications in Pharmacy, interpretation of spectra, C13 NMR-Introduction, Natural abundance, C13 NMR Spectra and its structural applications.	8

5	5.0 Electron Spin Resonance Spectroscopy : Theory And Principle, Limitations Of Esr, Choice Of Solvent, G-Values, Hyperfine Splitting, Instrumentation, Difference Between Esr & Nmr And Applications.	3
6	6.0 Mass Spectroscopy: Basic principles and instrumentation, ion formation and types, fragmentation processes and fragmentation pattern, Chemical ionization mass spectroscopy (CIMS), Field Ionization Mass Spectrometry (FIMS), Fast Atom Bombardment MS (FAB MS), Matrix Assisted laser desorption / ionization MS (MALDI-MS), GC-MS, interpretation of spectra and applications in Pharmacy.	6
7	7.0 X-Ray Diffraction Methods : Introduction, generation of X-rays, X-ray diffraction, Bragg's law, X-ray powder diffraction, interpretation of diffraction patterns and applications.	6
8	8.0 Chromatographic Techniques: 8.1 Classification of chromatographic methods based on mechanism of separation: paper chromatography, thin layer chromatography, ion exchange chromatography, column chromatography and affinity chromatography – techniques and applications. 8.2 Gas Chromatography : Theory and principle, column operation, instrumentation, derivatisation methods and applications in Pharmacy. 8.3 High Performance Liquid Chromatography : Principle, instrumentation, solvents used, elution techniques, RP-HPLC, LC-MS and applications in Pharmacy. 8.4 HPTLC and Super Critical Fluid Chromatography (SFC) : Theory and Principle, instrumentation, elution techniques and pharmaceutical applications.	8
9	9.0 Electrophoresis : Theory and principles, classifications, instrumentation, moving boundary electrophoresis, Zone Electrophoresis (ZE), Isoelectric focusing (IEF) and applications.	2
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences :

- | | |
|---|----|
| 1. Use of colorimeter for analysis of Pharmacopoeial compounds
And their formulations. | 4 |
| 2. Use of Spectro photometer for analysis for Pharmacopoeial compounds
and their formulations. | 4 |
| 3. Effect of pH and solvent on UV Spectrum of certain drugs. | 4. |
| 4. Use of fluorimeter for analysis of Pharmacopoeial compounds. | 4 |
| 5. Experiments on Electrophoresis. | 4 |
| 6. Experiments of Chromatography. | 8 |
| a. Thin Layer Chromatography. | |
| b. Paper Chromatography.
Ascending Technique | |

Total ----- **28**

Reference Books:

- | | |
|-------------------------------|--------------------|
| 1. Biomedical instrumentation | by R.S. Khanpur |
| 2. Analytical instrumentation | by R.S. Khanpur |
| 3. Analytical instrumentation | by Gillian McMahon |

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360307

Subject Name: VIRTUAL MEDICAL INSTRUMENTATION (Elective)

Sr. No.	Subject Content	Hrs.
1	<ul style="list-style-type: none"> Virtual Instrumentation: Historical perspective, advantages, block diagram and architecture of a virtual instrument, Data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller. 	8
2	<ul style="list-style-type: none"> VI programming techniques: VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web. 	5
3	<ul style="list-style-type: none"> Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/ Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements. 	8
4	<ul style="list-style-type: none"> VI Chassis requirements. Common Instrument Interfaces: Current loop, RS 232C/ RS485,GPIB. 	3
5	<ul style="list-style-type: none"> Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. 	3
6	<ul style="list-style-type: none"> Networking basics for office & Industrial applications, VISA and IVI. 	3
7	<ul style="list-style-type: none"> VI toolsets, Distributed I/O modules. Application of Virtual Instrumentation: Instrument Control, Development of process database management system 	6
8	<ul style="list-style-type: none"> Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. 	6
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences :

1. To study block diagram and architecture of virtual instrumentation.	2
2. To study the basic features of LABVIEW.	2
3. To write a program for VIS and sub-VIS, loops and charts in LABVIEW.	2
4. To write a program for arrays, clusters and graphs in LABVIEW.	2
5. To write a program for case and sequence structures, formula nodes, local and global variables in LABVIEW.	2
6. To write a program for , string and file I/O, Instrument Drivers in LABVIEW.	4
7. To study block diagram of data acquisition system using LABVIEW.	2
8. Develop set up to acquire ECG signal and display using LABVIEW.	4
9. To study Common Instrument Interfaces: Current loop, RS 232C/ RS485,GPIB.	4
10. To study Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI.	4

Total:	28

Text Books:

1. Gary Johnson, LabVIEW Graphical Programming, 2nd edition, McGraw Hill, Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

Reference Books:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.

Course Aim:

This course aims to introduce the latest instrumentation system design and development tools available today.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360308

Subject Name: OPHTHALMIC INSTRUMENTATION (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Anatomy & Physiology of Eye: 1.1 Gross, anatomy of coats of eye ball cornea, sclera, Urea, Retina, Lens and vitrous. 1.2 Physiology of eye ball, physiology of vision, color vision, ocular movements	8
2	2.0 Ophthalmic & Geometrical, Physiological Optics: 2.1 Nature of light, Laws of Refraction, Optical aberrations of ophthalmic glasses. 2.2 Optics of the human Eye & refractive error. 2.3 Photometry, fiber optics, colour theory 2.4 Refractive anomalies & their cause.	8
3	3.0 Ophthalmic Diagnostic Procedures: 3.1 Refractive Instruments, Retinoscope, Optometers, Lensometer, slit lamp, 3.2 tonometer, fundus camera, keritometer, orthopticism instruments, colour vision. 3.3 Direct & Indirect ophthalmoscopy.	8
4	4.0 Ocular eye Disease & Primary Eye Care: 4.1 Common Eye Diseases, types of conjunctivitis including trachoma, corneal ulcer & opacities, Iritis, cataract, lids and lacrimal sac eye emergencies, Eye injuries, first aid and treatment, Glaucoma, Squint, Systemic disorders, screening and prevention of blindness & visual impairment. 4.2 Role of Ophthalmic Assistant, Ophthalmic in primary eye care. 4.3 Blindness in adult, children and primary care.	10
5	5.0 Ophthalmic Instruments: 5.1 Trial set, slit lamp, Focimeter, Lensometer, Retinoscopy, Optometers Ophthalmoscope. 5.2 Tonometer, Keritometer, Refractometer. 5.3 Innovation in Ophthalmic equipment.	8
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences :

1. To study laws of refraction.	2
2. To study Clinical use of retinoscope	2
3. To study Clinical use of keratometer.	2
4. To study Clinical use of focimeter.	2
5. To study Clinical use of ophthalmoscope.	2
6. To study examination of fundus .	2
7. To study colour vision testing.	2
8. To Study symptoms of common eye diseases.	2
9. To Study different types of ophthalmoscopy.	2
10. Visit to the eye hospital.(minimum 2 visits).	10

Total:	28

Reference Books:

- | | |
|--|----------------------------|
| 1. Human anatomy and physiology | by ross and Wilson |
| 2. Introduction to Visual Optics, | Alan H. Tumadiffe(1987) |
| 3. Clinical Optics- 2nd ed (1991)- | A.R. Elington & H.J. Frank |
| 4. Optics & Refraction | L.P. Agarwal. |
| 5. Clinical Optics- | Borrish. |
| 6. Principles & Practice of Refraction, | Duke Elder |
| 7. Ophthalmic Optics & Refraction (System of Ophthalmology-Vol. 5), | Duke Elder |
| 8. Visual Optics & Refraction- A clinical approach, | David D. Michaels |

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIO MEDICAL ENGINEERING

SEMESTER- VI

Subject Code : 360309

Subject Name: BIO INFORMATICS (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction : 1.1 Overview of bio-informatics 1.2 Biological classification & nomenclature 1.3 Understand the bio-medical terminology related to bio informatics	4
2	2.0 Basics of Protein & Proteomics: 2.1 Basic protein structure, protein functions, amino acids, protein folding 2.2 Web based protein structure tools 2.3 Structure visualization, classification, alignments 2.4 Computing physico-chemical properties. 2.5 Protein resource Databases.	8
3	3.0 Predictioning Protein Structure & Function From Sequence: 3.1 Determining the structures of proteins 3.2 Predicting the structures of proteins 3.3 From 3D to 1D 3.4 Feature detection in protein sequence 3.5 Secondary structure prediction 3.6 Predicting 3D structure	10
4	4.0 Genomics & Tools for Genomics 4.1 Structure of DNA 4.2 DNA sequencing & Polymeric chain reaction 4.3 From sequencing genes to sequencing genomics 4.4 Accessing genome information the web 4.5 Functional genomics	10
5	5.0 Automating Data Analysis with Perl: 5.1 Perl basics 5.2 Pattern matching & regular expressions 5.3 Parsing BLAST output using perl 5.4 Applying perl to bioinformatics	10
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. writing a CGI program using Perl (the client through the HTML forms action field, submits an HTTP request header method of type_____, -the web server decodes the HTTP request header and calls the CGI program identified in the HTTP request header.,- The CGI program decodes the incoming data.,- the CGI program uses the incoming data to interface with mailing / other application.,- the CGI program completes the client/server transaction by returning an HTTP response header.	2
2. To do exercise on programs using conditional statements of Perl	2
3. To do exercise on programs using looping technique.	2
4. To do exercise on programs distinguishing between scalar context & list context	2
5. To do exercise on programs using scalar data in array	2
6. To use & implement Built in functions for working with arrays	2
7. To do exercise on Programs using file test operators	2
8. Compare the two types of protein structure	2
9. To implement Secondary structure prediction (using JPred, Predict-protein etc.)	2
10. Identify proteins by using proteomics tools like AAcidIdent /Multident / FindMod / GlycoMode etc.	2
11. Compare genomes using Magpie / Pipmaker	4
12. To study PHYLIP programs & analyze protein & DNA sequence data & create your profile & motifs.	4

	Total 28

Note Book:

The list suggested above is only guide line. More Practicals are available covering the syllabus.

Reference Books:

1. Introduction to Bio informatics by Arthur M. Lesk
2. Developing bio-informatics computer skills O'REILY
3. Perl programming O'REILY
4. BLAST O'REILY
5. biochemistry by Dr. N .C. Dey & Dr. T. K. Dey