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Credit Based Grading System

Biomedical Engineering, VI-Semester

BM-6001 Data Communication

Unit I

Basic data communication concepts:

Host computers and terminal modems, parallel and serial transmission Asynchronous and Synchronous transmission. Simplex, half duplex and duplex. Front end processor, Port-sharing device, Line splitters and remote intelligent controllers. Multiplexer: TDM, FDM, WDM. Data compression devices, Inverse multiplexer.

Unit II

Data Interfaces and transmission :

Digital interface standards ; RS-232C standard, hand shaking, connecting a DTE in RS-232 C, RS-449, RS-422A and RS-423A standards. High speed desktop serial interfaces. Remote digital transmission : T carrier ISDN, Packet data networks, Digital access. Data Communication Efficiency : Modems, AM, FM, Phase modulation, multi speed modems, high speed modems, Error Correcting modems Data compression in modems. Short-wave modems, Facsimile and Fax modems.

Unit III

Data Integrity and, Security:

Data Integrity, Sources of error control approaches. Implementation of error Control Echo checking parity, checking and cyclical parity, Hamming code, Checksums, Cyclical Redundancy check. Security and security measuring.

Unit IV

Architectures and Protocols:

OSI model, Traditional communications architectures: Systems network architecture and other communication architecture Protocols: Polling and selecting, automatic repeat request common link level protocols. Binary synchronous communications characters in a BSC frame, Synchronous data link control. Protocols Converters and Code Converters TCP/IP protocols.

Unit V

Data transport Network:

Packet switching, LAN and Internet working.

Reference Books:

1. Computer network " Tenenbum"
2. Digital Communication "Forouzen "
3. Digital Communication & Computer Networking "William Stalling"

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Biomedical Engineering, VI-Semester

BM-6002 Digital Signal Processing

UNIT-I

Description of Signals and Systems: Types of signals and their characteristics, types of systems and their behavior. Discrete-time description of signals: Discrete-time sequences, their frequency domain behaviour, comparison with analog signals, convolution of two sequences, sampling a continuous function to generate a sequence, reconstruction of continuous-time signals from discrete-time sequences.

Discrete-time description of systems: Unit-sample response of a system, Time-invariant systems, Superposition principle for linear systems, Stability criterion for discrete-time systems, Causality criterion for discrete-time systems, Linear constant-coefficient difference equations.

UNIT-II

Z-transform: Definition of the z-transform, properties of the z-transform, the system function of a digital filter, digital filter implementation from the system function, the complex z-plane, the region of convergence in the z-plane, determining the filter coefficients from the singularity locations, geometric evaluation of the z-transform in the z-plane, relationship between the Fourier transform and the z-transform, the z-transform of symmetric sequences, the inverse z-transform.

UNIT-III

The Discrete Fourier Transform: Discrete Fourier series, Discrete Time Fourier Transform(DTFT),Discrete Fourier Transform (DFT), properties of DFT, circular convolution, linear convolution using the DFT.

Computation of the Discrete Fourier Transform: Goertzel algorithm, FFT algorithms: Decimation in time (DIT) and Decimation in frequency (DIF), Comparison of DIT and DIF algorithms, Computation advantages of FFT Algorithms, Chirp Z transform (CZT).

UNIT-IV

FIR filter Design

Introduction to Digital filters, Types of digital filters: FIR and IIR filters,

FIR filter specifications, FIR filter design: Window method, Frequency Sampling method, Optimal filter design method, Realization structures for FIR filters, Finite wordlength effects in FIR filters.

UNIT-V

Comparison of IIR and FIR digital filters, IIR filter specifications, IIR filter design methods: Impulse Invariant method, Bilinear Transformation method, Matched

Z-Transform method, Realization structures for IIR filters, Finite wordlength effects in IIR filters.

References Books:

1. A.V.Oppenheim and R. W. Schafer," Digital Signal Processing", Prentice Hall
2 .L.R.Rabiner and B. Gold," Theory and Application of Digital Signal Processing"
3. S.Salivahanan, "Digital Signal Processing"

List of Experiments-

1. Calculate Linear convolution of given two sequences.
2. To calculate cross correlation of given sequences.
3. Compute the DFT of the given sequence and plot magnitude and phase response.
4. Find circular convolution of given sequences using twiddle matrix.
5. Design IIR low pass filter for given specification.
6. Design IIR High pass filter for given specification.
7. Design IIR band pass filter for given specification.
8. Design FIR low pass filter using windowing method for given specification.
9. Design FIR band pass filter using windowing method for given specification.
10. Design FIR high pass filter using windowing method for given specification.
11. Design Notch filter for given specification.

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Biomedical Engineering, VI-Semester

BM-6003 Microcontroller Theory and Applications

UNIT – I

Introduction to Microcontrollers: From microprocessors to microcontrollers – changes in hardware architecture, instruction set and applications.

MCS-51 (8-bit Microcontroller) Hardware Overview: Functional block diagram with pin description, I/O port structure, Memory Organization, Special Function Registers, External Memory options, Reset operation.

UNIT – II

Instruction Set: Introduction, Addressing Modes, and Instruction Types.

Assembly Language Programming: Program Format, Assembly language programs.

Assembler Directives, Macros, Linker operation.

UNIT – III

Timer Operation: Introduction, Timer Mode and Timer Control Registers, Different modes of operation, Clocking sources, Controlling the timer, Illustrative examples.

UNIT – IV

Serial Port Operation: Introduction, Serial Port Control Registers, Modes of operation, Serial Port Baud Rates, Multiprocessor Communication, Illustrative examples.

Interrupts: Interrupt Organization, Processing interrupts, Program design using interrupts, Interrupt timing.

UNIT – V

Design & Interface Examples: Interfacing a 12-bit A/D converter, DAC, Interfacing a Real Time Clock IC, Interfacing multiple 7-segment LEDs display, LCD panel display, Display multiplexing, Interfacing a hexadecimal keypad, stepper motor, Buzzer, opto-isolators, Relay, Solenoid etc.

Case Study: Design of an 8-channel Temperature Scanner.

Suggested Text Books:

1. 8051 microcontroller – Kenneth J. Ayala, Penram International, 3rd edition
2. 8051 Microcontroller and embedded systems – M. Mazidi, Pearson Higher Education
3. Programming and Customizing the 8051 microcontroller – Myke Predko, TATA McGraw Hill Edition.
4. Embedded System - Raj Kamal, TATA McGraw Hill Edition

List of Experiments:

1. Familiarization with 16 bit, 32 bit, Microprocessor, Instruction sets, and architecture.
2. Assembly language program examples using 8086.
3. Realization of programmable time delay circuit using 8253, 8254.
4. Interfacing of ADC, DAC with 8086/8051 system.
5. Design of Hardware interrupts system.
6. Design and fabrication of fixing circuit for single phase controlled converter.
7. Assembly language program examples for micro controller 8051.
8. Serial communication using 8051.
9. Steeper motor controller design using 8051.
10. Programming of 8051 as event counter.
11. Timer programming of 8051.

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Biomedical Engineering, VI-Semester

BM-6004 Clinical Laboratory Equipment

Unit I

Difference between analytical and other instruments. Gas Analysis: Gas chromatography, Thermal conductivity method, Heat of reaction method. Estimation of oxygen, hydrogen, methane, carbon dioxide, CO, etc. in binary or complex gas mixtures. Zirconia-probe oxygen analyser. Paramagnetic oxygen meters, Electrochemical reaction method.

Unit II

Ultraviolet and visible photometry spectro : Radiation sources, detectors, read - outmodules, filters, monochromators. Instruments for absorption photometry. Fundamental laws of photometry. Infrared Spectrophotometry : Basic components of IR-spectrophotometers, sample handling, Types of spectrophotometers, Fourier transform infrared spectroscopy.

Unit III

Mass spectrometry: Basic mass spectrometer, components of mass spectrometers, types of mass spectrometers resolution and applications. X-Ray methods. Production of X-Rays & X-Ray spectra, Instrumental units, Detectors for the measurement of radiation, direct X-Ray methods, X-Ray absorption methods, X-Ray fluorescence methods, X-Ray diffraction, Applications Spectroscopy, ESR Spectroscopy.

Unit IV

Clinical Laboratory Equipments: Measurement of pH value of blood, ESR measurements, Hemoglobin measurement, oxygen and carbon dioxide concentration in blood, GSR measurement, polarographic measurements, blood cell counter, blood gas analyzer. Principle of Transmission & Scanning Electron Microscopy, Principle of simple, compound and phase contrast microscopes.

Unit V

Fundamentals of X-ray generation: Basics of radiography & fluoroscopy system – H/TV chains. Basics of nuclear medicine – radio chemical uses. Nuclear Instruments – detectors and counters.

Reference Books: -

1. R.S. Khandpur, " Hand Book of Biomedical Instrumentation. TMH
2. R.S. Khandpur, " Analytical & Industrial Instrumentation. TMH
3. Carr J.J., Brown J.M., " Introduction to Biomedical Equipment Technology" Asea Parson
4. Chromwell, Weibell & Pfeiffer," Biomedical Instrumentation and Measurements" PHI
5. Togawa, Tamura & Oberg – Biomedical Transducers & Instruments – CRC Press Boca Raton, New York
6. Willard Van, Nostrand, ."lnstrumental Methods of Analysis"
7. Sharma. "Instrumental Methods", S Chand & Co.

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Biomedical Engineering, VI-Semester

Elective-II BM-6005 (1) Virtual Instrumentation for Medical System

COURSE CONTENTS

Unit-I

Review of Virtual Instrumentation: Historical perspectives, Need of VI, advantages, Define VI, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, and comparison with conventional programming.

Unit-II

VI Programming Techniques: VI front panel, Block diagram, LabVIEW Environment startup, Shortcut, and Pull down menu, Palletes, *Control structures*: for loop, while loop, Shift Registers, feedback nodes, *Selection Structures*: Case and sequence structures, Formulae nodes, Arrays, Clusters, Waveform Chart and graph, XY Graph, Strings, Tables, File I/O functions.

Unit-III

Data Acquisition Basics: Data acquisition in LABVIEW, hardware installation and configuration Architecture NI ELVIS-II, Data acquisition (DAQ): Components, Accessories, Hardware, and Software, Measuring the passive components using NI ELVIS-II, Building, testing and analysis of circuits using NI ELVIS-II.

Unit-IV

Common Instrument Interfaces: GPIB/IEEE 488 concepts, and embedded system buses PCI and USB. Current loop, RS.232C/RS.485, GPIB, interface System buses, Industrial applications, Visa and VI image acquisition and processing. Motion control.

Unit-V

Use of Analysis Tools: Fourier transforms, Power spectrum, Correlation, Windowing, filtering, Oscilloscope, Waveform generator, Multi-channel data acquisition using LABVIEW, ECG acquisition for long term monitoring of heart rate using VI

Reference Books:

1. Gary Jonson, LabVIEW Graphical Programming, 2nd ed., McGraw Hill, New York, 1997
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall Inc., NJ; 1997
3. S. Gupta, J.P: Gupta, PC interfacing for Data Acquisition & Process Control, Second Edition, Instrument Society of America, 1994
4. Technical Manuals for DAS Modules of Advantech and National Instruments.

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Credit Based Grading System

Biomedical Engineering, VI-Semester

Elective-II BM-6005 (2) Total Quality Management and Safety Measurements

UNIT I - Fundamentals Of Quality Management

Definition of Quality, Dimensions of Quality, Quality Planning - Quality costs. - Analysis Techniques of quality Cost - Basic concepts of Total Quality Management, Historical Review. - Principles of TQM, Leadership – Concepts, Role of Senior Management - Quality Council, Quality Statements – Strategic Planning - Deming Philosophy - Barriers to TQM Implementation

UNIT II - Quality Management Principles

Customer satisfaction – Customer Perception of Quality - Customer Complaints, Service Quality, Customer Retention - Employee Involvement – Motivation, Empowerment - Teams and Team Work - Recognition and Reward, Performance Appraisal, Benefits - Continuous Process Improvement – Juran Trilogy – PDSA Cycle, 5S, Kaizen - Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development - Performance Measures – Basic Concepts, Strategy, Performance Measure

Benchmarking – Reasons to Benchmark - Benchmarking Process – Quality Function Deployment (QFD) – House of Quality - QFD Process - Benefits - Taguchi Quality Loss Function - Total Productive Maintenance (TPM) – Concept, Improvement Needs - FMEA – Stages of FMEA

UNIT III - Statistical Process Control

Seven Tools of Quality: I, II, and III - Concept of Six Sigma: I and II - New Seven Management tools: I and II - Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample - Normal Curve, Control Charts for variables and attributes, Process capability

UNIT IV- Regulatory Organizations In Medicine

Need for ISO 9000 and Other Quality Systems - ISO 9000:2000 Quality System – Elements, Implementation of Quality System - Quality Auditing - Need for Accreditation of hospitals - FDA Regulations- Joint Commission – Regulatory Bodies of India-Medical Council of India - Pharmacy Council Of India, Indian Nursing Council - Dental Council of India, Homeopathy Central Council

UNIT V - Safety Measurements

Designing to reduce radiation hazards- Radio frequency radiation safety management, Guidelines for radiation protection- Molecular medicine and radiation safety program-procedures for safe operation of radiation equipment ,Hazard and risk in radiation protection- radiological incidents and emergencies- Regulation to radiation protection. Hazards associated with UV radiation- UV control measures - Safety management of UV

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Biomedical Engineering, VI-Semester

Elective-II BM-6005 (3) Cardiopulmonary System and Measurement

COURSE CONTENTS

Unit I

Cardiac Recorders: Electrocardiograph (ECG),ECG leads (bipolar,unipolar & chest leads), Standard 12 lead configuration ECG machine, Microprocessor based ECG machine, Effects of Artifacts on ECG recording, Vectorcardiograph (VCG), Phonocardiograph(PCG).

Unit II

Patient Monitoring System: System Concept, Cardiac monitor, Bed side Patient Monitoring System, Central monitors, Measurement of heart rate, Measurement of pulse rate, Blood pressure measurement , Measurement of temperature, Measurement of respiration rate, Catheterization Laboratory Instrumentation.

Unit III

Arrhythmia & Ambulatory Monitoring Instruments: Cardiac Arrhythmia, Arrhythmia Monitor, QRS detection techniques, Exercise detection technique, Exercise stress testing, Ambulatory Monitoring Instruments, Holter monitors

Foetal Monitoring Instruments: Cardiotocograph, Methods of Monitoring Foetal heart rate(AFECG), FHR measurement , Foetal phonocardiograph, Monitoring labour activity, Recording System.

Biomedical Telemetry & Telemedicine: Wireless Telemetry, Single Channel Telemetry, Multi-channel Wireless Telemetry System, Multi-patient Telemetry, Implantable Telemetry Systems, Transmission of analog physiological Signal over telephone, Telemedicine.

Unit IV

Cardiac Measurement and Devices Blood Flow Meter: Electromagnetic Blood flow meter, Types of Electromagnetic Flow meters, Ultrasonic Blood Flow meters, NMR Blood Flow meter, Laser Doppler Blood Flow meter.

Cardiac Output Measurement: Indicator Dilution Method, Dye Dilution Method, Thermal Dilution Techniques, Measurement of Continuous Cardiac Output Derived from the Aortic Pressure Waveform, Impedance Technique, Ultrasound Method.

Unit V

Pulmonary Function Analysers: Regulation of breathing, Pulmonary Function Measurement, Spirometer – Inspiratory and Expiratory, Pneumotachometer, Measurement of Volume , Pulmonary Function Analyzers, Respiratory Gas Analyzer –Nitrogen gas analyzer, oxygen Analyzer, Humidifier, Nebulizers.

Reference Books:

1. Geoddes L.A, and Baker L.E, "*Principles of Applied Biomedical Instrumentation"*, John Wiley, 3rd Edition, 1975, Reprint 1989.
2. Khandpur R.S,"*Hand-book of Biomedical Instrumentation"*, Tata McGraw Hill, 2nd Edition, 2003.
3. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A,"*Biomedical Instrumentation and Measurements"*, Prentice-Hall India, 2nd Edition, 1997.
4. John G. Webster, "Medical *Instrumentation application and design*", John Wiley, 3rd Edition, 1997.

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Biomedical Engineering, VI-Semester

Elective-II BM-6005 (4) IPR (Intellectual Property Rights)

Course Objective

Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*

Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS*. The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative,* Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

Course Outcome:

1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection
3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House

2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014

3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.

4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.

5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.

6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.

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Biomedical Engineering, VI-Semester

BM-6007 Creativity and Entrepreneurship Development

Course Objective:

- Understand and use tools for generating entrepreneurial ideas and problem solving.
- Understand and use tools for the selection of ideas.
- Understand and gain the skills that are needed to implement ideas in today's society
- Understand Entrepreneurship's part in process that includes idea generation and implementation.
- Understand the concept of Entrepreneurship and its place in today's society

Course Outcomes:

- Recognize an opportunity for a user group and frame an appropriate design challenge that addresses the need for the user.
- Practice observation, interview and empathy skills to evolve a thorough understanding of the needs of the user.
- Share and integrate team leanings.
- Generate, develop and describe creative ideas that address the design challenge.

Syllabus:

1. The concept of Entrepreneurship, its history and its place in society.
2. The concept of Entrepreneurship and its relation to concept of innovation.
3. Creative processes for idea generation and problem solving.
4. Business plan.
5. Role of creativity, innovation and business research.
6. Entrepreneurship opportunities in contemporary business environment.

Reference Books :

1. Dollinger M.J. "Entrepreneurship strategies and resources," 3rd edition Pearson Education New Delhi.
2. Panda, Shiba charan "Entrepreneurship development", Anmol publication New Delhi.
3. Richard Blundel & Nigel locket, "Exploring Entrepreneurship : practices & perspectives Oxford.
4. Charles E. Banford & Garry D. Bruton, "Entrepreneurship – A small business Approach, Mcgrawhill Education.
5. P. Narayana Reddy, "Entrepreneurship" : Text and cases, Cengage learning
6. Rajeev Roy, "Entrepreneurship" Oxford.