RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BE-3001 Energy, Environment, Ecology & Society

Unit –I
 Energy-   Sources of Energy : Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydal, nuclear sources.

Unit –II
 Ecosystem –   Segments of Environment: Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation,

Unit –III
Air Pollution & Sound Pollution -
 Air Pollution: Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Green house effect, ozone layer depletion, acid Rain.
 Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

Unit –IV
 Water Pollution– Water Pollution: Pollutants in water, adverse effects. Treatment of Domestic & Industrial water effluent.
 Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

Unit –V
 Society, Ethics & Human values– Impact of waste on society. Solid waste management Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, objectives of ethics and its study . Preliminary studies regarding Environmental Protection Acts , introduction to value education, self exploration, sanyam & swasthya.

References:

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. Rana SVS ; "Essentials of Ecology and Environment"; PHI Pub.
3.Raynold, GW "Ethics in information Technology"; Cengage.
4. Svakumar; Energy Environment & Ethics in society; TMH
5. AK De "Environmental Chemistry"; New Age Int. Publ.
6 BK Sharma, "Environmental Chemistry" ; Goel Publ. House.
7. Bala Krishnamoorthy; "Environmental management"; PHI
8. Gerard Kiely, "Environmental Engineering" ; TMH
9. Miller GT JR; living in the Environment Thomson/cengage

10. Cunninghan WP and MA; principles of Environment Sc;   TMH
11. Pandey, S.N. & Mishra, S.P. Environment & Ecology, 2011, Ane Books , Pvt.
   Ltd, New   Delhi
12. Joseph, B. Environmental Studies, 2009 Tata Mcgraw Hill, Edu India Ltd. New Delhi.
13. Gour R.R, Sangal, R &Bagaria, G.P. , Excel Books, A-45, Naraina Phase-I
    New Delhi.-110028

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BM-4002 Digital Circuits & Systems

Course Objective:
1. To have the basic knowledge of number system & Boolean algebra.
2. To give knowledge of basic concept of computer and memory system.
3. To understand the working of Digital circuits & system
4. To develop skills for implementation of digital circuits system.

Course Outcome:
1. Students will be able to represent numerical values in various number systems and Boolean algebra
2. Learners will able to analyze and design digital combinational circuits and sequential digital circuits
3. Learners have the knowledge of the nomenclature and technology in the area of memory devices: ROM, RAM, PROM, PLD, FPGAs, etc.
4. Understand the importance and need for verification, testing of digital logic and design for testability.
5. Learners will have the skills to implement digital circuits in real time system.

COURSE CONTENTS

Introduction
Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems.

Number Systems and Codes
Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.

Combinatorial Logic Systems - Definition and specification; Truth table; Basic logic operation and logic gates.

Boolean Algebra and Switching Functions - Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods; Synthesis of combinational logic circuits.

Combinational Logic Modules and their applications

Decoders, encoders, multiplexers, demultiplexers and their applications; Parity circuits and comparators; Arithmetic modules- adders, subtractors and ALU; Design examples.

Sequential Logic systems:
Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples

Sequential logic modules and their applications
Multi-bit latches and registers, counters, shift register, application examples

Logic families
Introduction to different logic families; Operational characteristics of BJT in saturation and cut-off regions; Operational characteristics of MOSFET as switch; TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. Linear wave shaping circuits,

Bistable, monostable & astable multivibrators, Schmitt trigger circuits & Schmitt-Nand gates. Introduction to D/A converters, Various types of Analog & Digital to Analog converters, sample & hold circuits and V-F converters.

Memory
Read-only memory, read/write memory - SRAM and DRAM
Programmable Logic Devices:
PLAs, PALs and their applications; Sequential PLDs and their applications; State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs)

Reference books:
1. W.H. Gothman, Digital Electronics, PHI Publication.
2. R.J. Tocci, Digital Systems Principles & Applications, TMH Publications.
3. Z. Kohavi, Switching & Automata Theory, TMH Publications.
4. M. Mano, Digital Logic & Computer Design, PHI Publication.
5. H.V. Malmstadt & C.G. Euke (W.A. Benjamin IOC), "Digital Electronics for Scientists".
6. B.S. Sonde, Introduction to System Design using Integrated Circuits, New Age International.
7. Millman & Taub, Pulse, Digital & Switching Waveforms, McGraw Hill.
8. Digital Fundamentals by B. Basavaraj

List of Experiments

1. Study of different Digital IC's in term of their Technical Specification (pin diagram, applications ,etc)Testing of IC's by using IC tester.
2. Study of different logic gates and verify their truth table.
3. To Design the basic logic gates using universal gates and verify their truth table.
4. To Design 4-bit two input adder using 7483 IC and verify truth table.
5. To convert the binary code to Gray code using 7486 IC.
6. To study and verify the De Morgans Theorem.
7. To Design the Half Adder using Universal Gates.
8. To Design the Full Adder using Universal Gates.
9. Study of Digital to Analog Converter.
10. To design a 4-bit 2-input Binary Subtraction using IC's 7483 and 7486.
11. Implementation of the given Boolean function using logic gates in both sop and pos forms.
12. Implementation of 4x1 multiplexer using logic gates.
13. Implementation and verification of decoder/demultiplexer and encoder using logic gates.
14. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
15. Design and verify the 4-bit synchronous counter.
16. Design and verify the 4-bit asynchronous counter.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BM-4003 Analog Electronics

Course Objectives:
1. To understand the internal block diagram of operational amplifier and its characteristics both ideal and practical.
2. To illustrate some typical applications of operational amplifiers in linear and non linear modes of operation.
3. To construct various active filter circuits using operational amplifier for various frequency response characteristics.
4. To introduce students the basic theory of power semiconductor devices and passive components, their practical application in power electronics.
5. To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.

Course Outcomes:

After completing this course, the student will be able to:
1. Understand the internal operation of Op-Amp and its specifications.
2. Analyze and design linear applications like adder, substractor, instrumentation amplifier etc. using Op-Amp.
3. Analyze and design non linear applications like timer, comparator etc, using Op-Amp.
4. Classify various active filter configurations based on frequency response and construct using 741 Op-Amp.
5. An ability to understand basic operation of various power semiconductor devices and passive components.
6. An ability to understand the role power electronics play in the improvement of energy usage efficiency.

COURSE CONTENTS

Operational Amplifier Fundamentals

Amplifier Fundamentals, Differential amplifier, Operational Amplifier, Op-Amp Characteristics. Op-Amp in open loop, inverting, non-inverting and differential mode, Practical Op-Amp limitations: D.C. errors, Slew rate, Frequency response, Noise effect, Frequency compensation.

Operational Amplifiers Applications-I
Linear Op-Amp Circuits: Basic Op-Amp Circuits, V-I Converter with floating and grounded load, Current amplifier, Difference amplifier, Instrumentation amplifier,
Non-linear Op-Amp Circuits: Schmitt trigger and applications, Precision rectifiers, Analog switches, Peak detectors, S/H circuits. Comparator, logarithmic amplifiers, Analogue computation, Summer, Average, integrators, differentiators, scaling, multipliers.

Operational Amplifiers Applications-II
Filter specifications, introduction to Butterworth, Chebyshev, inverse Chebyshev approximations and their comparison, first and second order low pass high pass, band pass and band stop filters, switched capacitor filters, 555 timer and its applications. V/F and F/V converters, Multivibrators: Astable, Monostable. Signal Generators: Wien bridge oscillator, Triangular wave generator, Sawtooth wave generator.

Power, Semiconductor Devices
Classification of Power semiconductor devices, characteristics, construction, application and theory of operation of power diode, power transistor, thyristors. Device specifications and ratings, working of Diac, Triac, IGBT, GTO and other power semiconductor devices. Turn-on / Turn-off methods and their circuits.

Rectifiers, Inverters and Choppers
Review of uncontrolled rectification and its limitations, controlled rectifiers, half wave, Full wave configurations, multiphase rectification system, use of flywheel diode in controlled rectifier configurations. Classification of inverters, Transistor inverters, Thyristor inverters, Voltage and Current Communicated inverters, PWM inverters, Principle of Chopper, Chopper classification and types of regulators.

Some Suggested Textbooks/ Reference books:
1. OP-Amps their design and applications-Tobbey et all
2. OP-Amps and Linear Integrated circuit-R.A. Gayakwad (PHI)
3. Integrated Electronics -Millman & Halkias
4. Power Electronics Circuits, devices & applications - M.H. Rashid
5. Power Electronics -P.C.Sen
6. Power Electronics & its applications- Alok Jain, Penram Publication
7. An Introduction Thyristors & their applications - M. Rammurthy

List of experiments:-
1. To obtain the frequency response characteristics of non inverting amplifier using 741 opamp.
2. Design of inverting and non inverting amplifier using 741 opamp for a desired voltage gain and specified input voltage.
3. Design of inverting and non inverting schmitt trigger circuit using 741 opamp.
4. Design of adder and subtractor circuit using 741 opamp.
5. Design of integrating & differentiating circuit using 741 opamp.
6. Design of square wave and triangular wave generator using 741 opamp.
7. To generate a sine wave using 741 opamp by weins bridge circuit.
8. Design of mono stable and astable multivibrator using 741 opamp.

9. To draw the V-I characteristics of S.C.R.
10. To draw the V-I characteristics of DIAC.
11. To draw the V-I characteristics of TRIAC.
12. To study a single phase half wave controlled rectifier and measure the ripple (AC voltage), ripple factor and firing angle.
13. To study single phase center tapped controlled rectifier and measure the firing angle, ripple (AC voltage), ripple factor.
14. To study single phase fully controlled bridge rectifier and measure the firing angle, ripple (AC voltage), ripple factor.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BM-4004 Microprocessors and Interfacing

Course Objective:

1. To introduce fundamental concepts of digital circuits and system to understand why we need microprocessor and memory interfacing devices.
2. The objective of this course is to become familiar with basics of computer, architecture and instruction set of an Intel microprocessor.
3. Developing an Assembly language programming and design the various types of digital and analog interface devices.
4. The accompanying lab is designed to provide practical hands-on experience with microprocessor software applications and interfacing techniques.

Course Outcomes:

1. Understand the concepts of microprocessor and familiar with assembly language programming.
2. Learner will able to utilize instruction set in programming.
3. Ability to interface various devices to the microprocessor.
4. An ability to design and implement a microprocessor based system used in real time system.

COURSE CONTENTS

Introduction to Microprocessor – Architecture & Pin Diagram of typical 8 bit microprocessor-Intel 8085, Study of Functional units, Function & generation of various control signals, Timing Diagrams, Memory Interfacing, Peripheral mapped I/O, Memory Mapped I/O techniques, Interrupts in 8085.

Instruction set of 8085, Types of Instructions, Addressing modes, Programming Techniques of 8085: Counters and Time Delays, Stack and Subroutines, Code Conversion, 16 bit data operations,

Interfacing of 8085 to General purpose programmable peripheral devices- Programmable Peripheral Interface (PPI) 8255, Programmable Interval Timer 8253/8254, Programmable interrupt controller 8259A, DMA controller8257.

Interfacing of 8085 with keyboards, LEDS, ADC, DAC, motors, and stepper motors and Introduction to Programmable keyboard/display interface.
Serial I/O & Data communication, USART (8251), RS 232C, Modems. and various bus standards.

Reference Books:

1. Microprocessors and Interfacing: R.S.Gaonkar
2. Advanced Microprocessors and Peripherals, A.K.Ray and K.M.Bhurchundi, TMH

List of Experiments:
1. Write a program store 8 bit data in memory.
2. (a)Write a program add two 8 bit numbers.
   (b)Write a program subtract two 8 bit numbers.
3. (a)Write a program add two 16 bit numbers.
   (b)Write a program subtract two 16 bit numbers.
4. Finding's 1's complement of number.
5. Findings 2's complement of number.
6. Write a program Factorial of given numbers.
7. Write a program for Fibonaci series.
8. Write a program for Finite series.
9. (a) Write a program Binary to BCD code conversions.
   (b) Write a program BCD to Binary code conversions.
10. (a) Write a program multiplication of two 8 bit numbers.
    (b) Write a program division of two 8 bit numbers.
11. Write an Assembly language program (ALP) to arrange given 10 numbers in   ascending order.
12. Write an Assembly language program (ALP) to count number of 1's (Ones-logic high bits) in a number stored at 2000H.the result must be stored at 2001H.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BM-4005 Clinical Laboratory Equipments

Course Objective:

1. To provide fundamental concepts and methods of various analytical techniques like spectroscopy, chromatography & environmental pollution.
2. To give knowledge of analytical techniques to accurately determine the elements present in the given sample.
3. To enhance the skills for computation of various data.

Course Outcomes:

1. Ability to select Instrument for a particular analysis with come idea of its merits, demerits and limitations
2. Learn will understand specific technique employed for monitoring different pollutants in air and water.
3. Understand the applications and usage of various analytical techniques in real time industrial application.

COURSE CONTENTS

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.

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.

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.

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

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.
8. Geddes & Baker , "Principles of Applied Biomedical Instrumentation" Wiley

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, IV-Semester

BM-4006 Simulation Lab (MATLAB)

1. MATLAB Windows.

2. Elementary Math built in Functions.

3. Arrays, Mathematical Operations with arrays.

4. Matrices, Matrix algebra with MATLAB.

5. Curve Plotting with MATLAB.

6. Control Structures –Conditional statements, loops, Branch control structure.

7. Input/Output Functions.

8. Script Files.

9. Functions and Function files.

10. Cell Arrays, Structure Arrays.

11. Simulink Basics.

12. GUI Basics.

Some Suggested Textbooks/ Reference books:

1. MATLAB Programming for Engineers S.J.Chapman, Thomson Learning
2. MATLAB and its applications in Engineering, R.KBansal, A.K. Goel,M.K.Sharma
3. Programming in MATLAB , M.E. Herniter, Thomson Learning
4. MATLAB - An Introduction with Applications, Amos Gilat ,Wiley India.
5. Essential MATLAB for Engineers and Scientists, B.H.Hahn, D.T.Valentine, Elsevier