ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025
AFFILIATED INSTITUTIONS
CURRICULUM 2008
B.E. BIOMEDICAL ENGINEERING
3 & 4 SEMESTERS CURRICULUM AND SYLLABI

SEMESTER III
(Applicable to the students admitted from the Academic year 2008–2009 onwards)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
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<td>THEORY</td>
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<td>MA 2211</td>
<td>Transforms and Partial Differential Equations</td>
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<td>BM 2201</td>
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<td>BM 2202</td>
<td>Signals and Systems</td>
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<td>BM 2203</td>
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SEMESTER IV
(Applicable to the students admitted from the Academic year 2008–2009 onwards)

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<td>Probability and Random Processes</td>
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<td>BM 2253</td>
<td>Basics of Electrical Engineering</td>
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<td>BM 2254</td>
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<td>BM 2252</td>
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<td>BM 2255</td>
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OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I  FOURIER SERIES

- Dirichlet’s conditions
- General Fourier series
- Odd and even functions
- Half range sine series
- Half range cosine series
- Complex form of Fourier Series
- Parseval’s identify
- Harmonic Analysis.

UNIT II  FOURIER TRANSFORMS

- Fourier integral theorem (without proof)
- Fourier transform pair
- Sine and Cosine transforms
- Properties
- Transforms of simple functions
- Convolution theorem
- Parseval’s identity.

UNIT III  PARTIAL DIFFERENTIAL EQUATIONS

- Formation of partial differential equations
- Lagrange’s linear equation
- Solutions of standard types of first order partial differential equations
- Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

- Solutions of one dimensional wave equation
- One dimensional equation of heat conduction
- Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded)
- Fourier series solutions in cartesian coordinates.

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS

- Z-transforms
- Elementary properties
- Inverse Z-transform
- Convolution theorem
- Formation of difference equations
- Solution of difference equations using Z-transform.

Lectures : 45  Tutorials : 15  Total : 60
TEXT BOOKS


REFERENCES

AIM
To get the complete understanding of radioactivity and medical applications of various radio isotopes

OBJECTIVES
To Study the effects of sound and light in Human body
To study the effects of radiation in matter and how isotopes are clinically used.

UNIT I
Electromagnetic spectrum and its medical application

UNIT II

UNIT III

UNIT IV
PHYSICS OF CARDIOPULMONARY SYSTEM The Airways, blood and lung interaction – measurement of lung volume – pressure air flow volume relations in lungs – physics of alveoli – the breathing mechanism – Major components of cardiovascular system – O2 and CO2 exchange in the capillary system – Physical activity of heart – transmural pressure – Bernolli’s principles applied to cardiovascular system - Blood flow – laminar and turbulent

UNIT V
RADIATION EFFECTS Acute Radiation Effects - The concept of LD 50 – Radiation syndromes- Central nervous system syndrome - Gastro-intestinal syndrome –Bone Marrow syndrome Delayed Effects of Radiation - Stochastic and Deterministic effects – Late Deterministic effect in different organs and tissues.

TOTAL : 45 PERIODS
TEXT BOOKS


REFERENCES

AIM
To study and analyse characteristics of continuous, discrete signals and systems

OBJECTIVE
- To study the properties and representation of discrete and continuous signals
- To study the properties and representation of discrete and continuous systems
- To study the signals in time domain and frequency domain using Fourier
- To study the sampling process and analysis of signals and systems using Laplace and Z-transforms.
- To study the analysis and synthesis of systems.

1. Classification of Signals and Systems

2. Fourier Series and Fourier Transform
Discrete-time Fourier series (DTFS) and Discrete-time Fourier transform (DTFT) – properties – linearity, time-shifting, time-reversal, time-scaling, multiplication, Parseval’s relation – difference – accumulation. Application to systems - solution to difference equation using DTFT.

3. Laplace Transform
4. **Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)**


5. **Z-tranform and state matrix**

Z-transform (ZT) – region of convergence (ROC) - properties of ZT – linearity, time-shifting, time-reversal, time-scaling, multiplication, convolution, parseval’s relation – differentiation in time and frequency domain – integration – initial value and final value theorem – inversion of ZT – power series method, partial-fraction method, residual method - solution to difference equation using ZT.

State variable description for LTI system – determination of transfer function from state model – discrete-time model.

**TEXT BOOK**

**REFERENCE**
UNIT I  SCIENCE OF MEASUREMENT


UNIT II  DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS

Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gage, biomedical applications; strain gauge as displacement & pressure transducers: force summing devices, capacitive transducer, inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, biomedical applications of Temperature sensors. Active type: Thermocouple – characteristics.

UNIT III  PHOTOELECTRIC AND PIEZOELECTRIC SENSORS

Phototube, Photo Multiplier Tube (PMT), photovoltaic, photoconductive cells, photodiodes, phototransistor, comparison of photoelectric transducers, spectro-photometric applications of photoelectric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

UNIT IV  SIGNAL CONDITIONING & SIGNAL ANALYSER


UNIT V  DISPLAY AND RECORDING DEVICES

Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, X–Y recorder, thermal recorder.

TOTAL : 45

TEXT BOOK

REFERENCES
AIM
The aim of this course is to familiarize the student with analysis and design of basic transistor amplifier circuits, signal generator circuits and power supplies.

OBJECTIVES:
On completion of this course, the student will understand
- The methods of biasing transistors,
- Design the simple amplifier circuits, and design of signal generation circuits,
- Advantages and analysis of feedback,
- Design of Power supplies.

UNIT I  DIODE APPLICATIONS AND TRANSISTOR BIASING  9
Rectifiers – HWR, FWR, Bridge rectifier with and without capacitor and pie filter.

UNIT II  SMALL SIGNAL AMPLIFIERS  9
Two port network, h-parameter model – small signal analysis of BJT (CE and CC configurations only) — high frequency model of BJT – (CE configuration only) - small signal analysis of JFET (CS configuration only) - Frequency response of BJT and FET.

UNIT III  FEEDBACK AMPLIFIER AND OSCILLATORS  9
Basic of feedback system (block diagram approach) – Types of feedback amplifier – Basic principles of oscillator. Audio oscillators – RC phase shift and Wein bridge oscillator. RF oscillators – Hartly and Collpit oscillator – Crystal oscillator, Multivibrators.

UNIT IV  POWER AMPLIFIERS  9
Definition – Types of power amplifiers – Class A (series fed – transformer coupled )- Class B amplifier – Class-B push-pull amplifier – Complimentary symmetry type - Class-C amplifier – Heat sinking.

UNIT V  VOLTAGE REGULATIONS  9
Shunt voltage regulator – Series voltage regulator – current limiting – feedback technique – SMPS (Block diagram approach) – DC to DC converter - Three terminal IC regulators (78XX and 79XX).

TEXT BOOKS:

REFERENCES
AIM

➢ To study the biochemical reactions and the various methods to analyze them.

Objective:

➢ To give a clear understanding of important biomolecules and their functions.
➢ To analyze the metabolic pathways in normal and diseased state.
➢ To help in devising analytical & diagnostic tools.

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


TOTAL: 45

TEXT BOOKS

REFERENCE BOOKS
1. Understanding Enzymes By Trevor palmer. Published by Ellis Horwood LTD.
AIM
To provide the students the exposure to the fundamentals in human anatomy and physiology.

UNIT I  STUDY OF CELLULAR SYSTEM  8

UNIT II  HEMATOLOGICAL SYSTEM  9
Blood composition - functions of blood – functions of RBC. WBC types and their functions. Blood groups –importance of blood groups –identification of blood groups. blood flow factors regulating blood flow such as viscosity, radius , density etc (Fahrenlindqvist effect, Poiseuille’s Law )

UNIT III  RENAL AND RESPIRATORY SYSTEM  9

UNIT IV  CARDIAC SYSTEM  9
Structure of heart – Properties of Cardiac muscle – Cardiac muscle and pacemaker potential - Cardiac cycle – ECG - Heart sound - volume and pressure changes and regulation of heart rate.

UNIT V  SENSORY SYSTEM  10

TEXT BOOK

REFERENCE BOOKS
1. Review of Medical Physiology,22nd edition,William F.Ganong Mc Graw Hill New Delhi,
1. General tests for carbohydrates, proteins and lipids.

2. Preparation of serum and plasma from blood.

3. Estimation of blood glucose.


5. Assay of SGOT/SGPT.


8. Separation of amino acids using thin layer chromatography.

9. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and Hemoglobin estimation

10. Differential count of different WBCs and Blood group identification

11. Ishihara chart for color blindness and Snellen’s chart for myopia and hyperopia – by letters reading and ophthalmoscope to view retina.

12. Weber’s and Rinnee’s test for auditory conduction.  

**TOTAL : 60 PERIODS**

**LAB EQUIPMENTS**

1) Test tube, microscope (Binocular), colorimeter
2) Centrifuge, Test tubes, anticoagulant
3) Blood Glucose kit
4) Cholesterol kit
5) SGOT/SGPT kit
6) Creatinine kit
7) Electrophoresis apparatus
8) Glass tanks, thin layer chromatography
9) ESR glan tube wintrobe PCV tube(Haematocrit tube) , sahli’s Haemoglobinometer, Microscope, Haemocytometer(Mirror coated)
10) Differential count Leishman stain(readymade), Blood group antigen , microscope slides.
11) Ishihara chart, Snellen’s chart, Opthalmoscope
12) Weber’s and Rinnee’s test.
1. Rectifiers – HWR and FWR (with & without capacitor filter)
2. Zener diode as regulator
3. Study of biasing circuits
   a. i). Fixed bias, ii). Self bias, iii). collector to base bias
4. FET amplifier
5. Differential amp – CMRR and determination of Gain
6. Design of RC coupled amplifier
7. Design of Voltage series feedback amplifier
8. Design of Class A and Class B amplifier
9. Design of RC phase shift oscillator
10. Design of Hartley Oscillator
11. Design of Colpitt oscillator
12. Study of pulse shaping circuits
   i). Astable Multivibrator
   ii). Monostable Multivibrator

TOTAL : 45 PERIODS

(Common to Electronic and Communication Engineering & Bio Medical Engg.)

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 30 STUDENTS
(3 per Batch)

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<td>Variable DC Power Supply</td>
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<td>Fixed Power Supply</td>
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<td>Multimeter</td>
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<td>Function Generator</td>
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<td>Resistors 1/4 Watt Assorted</td>
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AIM
This course aims at providing the necessary basic concepts in random processes. Knowledge of fundamentals and applications of random phenomena will greatly help in the understanding of topics such as signals & systems, pattern recognition, voice and image processing and filtering theory.

OBJECTIVES
At the end of the course, the students would

- Have a fundamental knowledge of the basic probability concepts.
- Have a well-founded knowledge of standard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- Be able to analyze the response of random inputs to linear time invariant systems.

UNIT I RANDOM VARIABLES 9 + 3

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9 + 3
Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem (for iid random variables)

UNIT III CLASSIFICATION OF RANDOM PROCESSES 9 + 3

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9 + 3
Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9 + 3
Linear time invariant system - System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output – white noise.

LECTURES : 45 TUTORIAL : 15 TOTAL : 60
TEXT BOOKS

1. Oliver C. Ibe, “Fundamentals of Applied probability and Random processes”, Elsevier, First Indian Reprint (2007) (For units 1 and 2)

REFERENCES

1. BIO POTENTIAL ELECTRODES


2. ELECTRODE CONFIGURATIONS

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG, ERG and EOG – unipolar and bipolar mode.

3. BIO AMPLIFIER


4. MEASUREMENT OF NON-ELECTRICAL PARAMETER


5. BIO-CHEMICAL MEASUREMENT

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TEXT BOOKS:

REFERENCE
AIM
To make the students understand the basics of electricity generation and utilization.

OBJECTIVES
- To study the magnetic circuits
- To study the principle and application of transformers
- To study the principle of operation of DC motors
- To study the principle and operation of AC machines
- To study the principle of fractional-kW motors and their applications.

1. MAGNETIC CIRCUIT
Magnetic effects of electric current, Magnetic circuits, Magnetic materials and B-H relationship, Electromagnetic induction and force, Hysteresis and eddy current losses.

2. DC MOTORS
Parts of DC motors, types of motors, principle of operation of DC motors, Back EMF, circuit model, power balance, calculation of torque and speed, armature and field control, DC motor starting, calculation of efficiency.

3. TRANSFORMERS
Methods of generation of AC voltages, role of transformers in the distribution of electricity, Construction and principle of operation of single phase transformers, Ideal transformer, voltage and current relationships, impedance transformation, definition of voltage regulation, Losses in the transformer, calculation of efficiency of transformer, construction and voltage ratio aspects of single phase autotransformer, construction and voltage ratio aspects three phase transformer.

4. AC MACHINES
Synchronous machines, construction, principle of operation, phasor diagram, voltage equation, Open circuit and short circuit characteristics, voltage regulation, induction motor, construction, circuit model, torque slip characteristics, starting, speed control-slip control, frequency control

5. FRACTIONAL -KW MOTORS
Single phase induction motor, principle of operation, torque-speed characteristics, two-phase motors, split phase motor, universal motor, two value capacitance motor, stepper motors - variable reluctance stepper motor-single stack and multistack-permanent magnet stepper motor- drive concepts-unipolar drive circuit, bipolar drive circuit-calculation

TOTAL : 45

TEXT BOOKS:

REFERENCE
AIM
To understand the functions of various analog and digital IC and their applications

OBJECTIVES
To acquire the knowledge about the characteristics and operation of various analog ICs
To study the application of analog ICs in the designing circuit.
To study the applications of these Digital ICs.
To understand the basic of the Digital systems.
To study the design of the various functional circuits using these ICs.

1. OPERATIONAL AMPLIFIERS

2. ACTIVE FILTERS AND SIGNAL GENERATOR
Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift and Wein-bridge. Waveform generators - Square, triangular and saw tooth.

3. TIMER, PLL, A/D AND D/A CONVERTERS
555 Timer (internal diagram) and its applications – monostable multivibrator, astable multivibrator. Phase locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC

4. NUMBER SYSTEMS AND LOGIC GATES

5. REGISTERS AND COUNTERS

TOTAL = 45 HOURS
TEXT BOOKS

REFERENCE:
2. Sergio Franco, DESIGN with Operational Amplifiers and analog Integrated circuits, McGraw-Hills
UNIT I:  
Cell Degeneration, repair and neoplasia-Cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification, cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours.

UNIT II:  
Fluid and hemodynamic derangements, - edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock.  
Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III:  
Microscopy: Light microscopy, dark field microscopy, phase contrast microscopy, fluorescence and electron microscopy.

UNIT IV:  
Genetic disorders, Infection and Immunity-Mutations, Autosomal and X linked disorders, Mendelian disorders, types of immune response, hypersensitivity disorders, Immune deficiency syndrome, Viral disease, Chlamydial ,Bacterial, Mycoplasma, Rickettsial, Fungal, protozoal and helminthic disease.

UNIT V:  
Identification of disease producing organisms, simple stain, Gram stain, AFB stain, Fluorescent techniques, antigen-antibody techniques.

TEXT BOOKS:  

REFERENCE:  

MICROBIOLOGY  

TEXT BOOK  

REFERENCES:  
1. ANALOG MODULATION


2. PULSE MODULATION

Low pass sampling theorem – Quantisation - PAM – Line coding - PCM, DPCM, DM, ADPCM and ADM, Channel Vocoder,– Time Division Multiplexing, frequency Division Multiplexing

3. DIGITAL MODULATION AND TRANSMISSION

Phase shift keying – BPSK, DPSK, QPSK - Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding - Cosine filters – Eye pattern, equalizers

4. INFORMATION THEORY AND CODING

Measure of information – Entropy – Source coding theorem - Shannon-Fano coding, Huffman Coding, LZ Coding– Channel capacity – Shannon-Hartley law – Shannon’s limit- Error control Codes – Cyclic codes, Syndrome calculation – Convolutional Coding, Sequential and Viterbi decoding

5. SPREAD SPECTRUM AND MULTIPLE ACCESS


Tutorial = 15
TOTAL 45+15 = 60

TEXT BOOK:

REFERENCES:
2. H P Hsu, Schaum Outline Series - “Analog and Digital Communications” TMH 2006
AIM
The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE
At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land
resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Active filter – first order LPF and HPF
4. Schmitt trigger using IC741
5. Instrumentation amplifier using IC741
6. Wein bridge oscillator
7. Multivibrator using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Encoder and BCD to 7 segment decoder
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flipflops
12. Design of mod-N counter

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 30 STUDENTS (3 per Batch)

<table>
<thead>
<tr>
<th>S.N o</th>
<th>Name of the equipments / Components</th>
<th>Quantity Required</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dual ,(0-30V) variable Power Supply</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CRO</td>
<td>9</td>
<td>30MHz</td>
</tr>
<tr>
<td>3</td>
<td>Digital Multimeter</td>
<td>10</td>
<td>Digital</td>
</tr>
<tr>
<td>4</td>
<td>Function Generator</td>
<td>8</td>
<td>1 MHz</td>
</tr>
<tr>
<td>5</td>
<td>IC Tester (Analog/Digital)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bread board</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Consumables (Minimum of 25 Nos. each)

| 1     | IC 741                                              | 25                |               |
| 2     | IC NE555                                            | 25                |               |
| 3     | LED                                                 | 25                |               |
| 4     | Potentiometer                                       | 25                |               |
| 5     | Seven Segment Display                               | 25                |               |
| 6     | Capacitor                                           | 25                |               |
| 7     | Resistors 1/4 Watt Assorted                         | 25                |               |
| 8     | Single Strand Wire                                  | 25                |               |
| 9     | Encoder and Decoder ICs (IC7445, IC 74147)          | 25                |               |
| 10    | Multiplexer and Demultiplexer ICs. (IC74150, IC74154) | 25                |               |
| 11    | Shift register ICs, Counter ICs                     | 25                |               |
| 12    | IC7400                                              | 25                |               |
| 13    | IC7404                                              | 25                |               |
| 14    | IC7402                                              | 25                |               |
| 15    | IC7408                                              | 25                |               |
| 16    | IC7411                                              | 25                |               |
| 17    | IC7432                                              | 25                |               |
1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Hematoxylin and eosin staining.
3. Study of parts of compound microscope
4. Histopathological slides of benign and malignant tumours.
5. Manual tissue processing and section cutting (demonstration)
7. Gram stain.
8. AFB stain.
9. Slides of malarial parasites, microfilaria and leishmania donovani.
10. Haematology slides of anemia and leukemia
11. Bleeding time and clotting time.
12. Study of bone marrow charts

TOTAL : 60 PERIODS

(Lab Requirement for a both of Semester)

1) Test tubes, Test tube racks, Bunsen burner(gas), (Benedict’s solution, Acetic acid, Sulphosalicylic acid), centrifuge, microscope.
2) Slides, cover slips, H & E stains
3) Microscope
4) Beakers, graded alcohols, acetone, moulds (or maling bodies), paradigm wax, water bath, microtone for section cutting, slides, cover slips, hotair oven, refrigerator to store chemical and ice.
5) Whatman filter paper for bleeding time Test tubes.
6) Simple Stain test
SIMPLE STAIN, Glass Slide
Reagents – Methylene blue, Crystal Violet, Cabal Iuschin
7) Gram Stain test
SIMPLE GRAM STAIN
Reagents – Crystal Violet, Gram’s Iodine, 95% ethyl alcohol Safranin
Urine bacterial count/ml exceeding 100,000(10s) denotes urinary tract infection.
Normal : 0-100 ml
Glass Slide
8) AFB Strain test
ACID FAST STAIN (ZIEHL – NEELSON METHOD)
Reagent – Carbal Iushin, Acid Alcohol, Methylene blue, Glass slide
9) Bone marrow charts