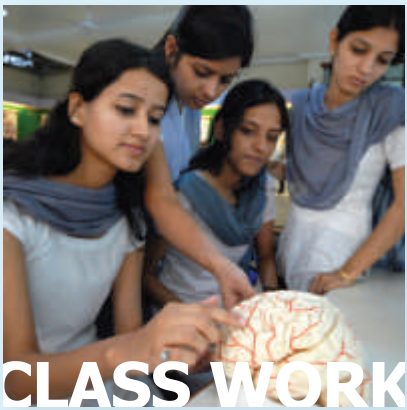
BHARATI VIDYAPEETH UNIVERSITY,
Pune.

(Established under Section 3 of UGC ACT 1956)

COURSE STRUCTURE AND SYLLABUS

B. Tech. (BIOMEDICAL)
(Sem. III & IV)



COURSE STRUCTURE & SYLLABUS

BHARATI VIDYAPEETH UNIVERSITY, PUNE

B. Tech. (BIOMEDICAL) (Sem. III & IV)

HIGHLIGHTS

Bharati Vidyapeeth University College of Engineering (BVUCOE) is the largest Engineering College in Maharashtra with an intake of 700 students in each academic year. Imparting quality technical education from Under Graduate to Doctorate Level, BVUCOE is probably the only Engineering College in India with an accreditation from both NAAC as well as NBA. The faculty at BVUCOE boasts of highly qualified academicians, a quality that is further emphasized by the fact that 15 of them are presently pursuing their Ph.D. degree.

BVUCOE has been ranked 29th amongst the Top 50 Technical Schools of India in survey conducted by DATAQUEST-IDC. We have enjoyed a ranking in this list for the last 4 years. Research is of utmost importance in all our programs. A total of 113 research papers were published in the academic year 2007-2008.

Currently we have 12 ongoing research projects. The infrastructure of BVUCOE is state-of-the-art with 62 classrooms, 59 laboratories and a well-stocked library that currently holds 27,130 titles. The college has an international presence with MoUs signed with the North Carolina A&T State University (Greensboro, USA), University of Venice (Italy), Actel Corporation (USA). Corporate interaction is also inculcated in our programs through our association with Oracle India Ltd., Infosys Ltd. and Tata Consultancy Services.

SALIENT FEATURES

Biomedical Engineering is the application of Engineering Principles & Techiques to the medical field. It combines the design & problem solving skills of engineering with medical & biological sciences to help improve patient health care & the quality of life of individual.

Biomedical Engineering is an interdisciplinary field, influenced by various fields & sources. It integrates physical, chemical, mathematical & computational sciences & Engineering principles to study biology, medicine, human behavior & health. It advances fundamental concepts; creates knowledge from the molecular to the organ system behavior & develops innovative biologies, materials, processes, implants, devices & informatics approaches of disease for patient rehabilitation & for improving health.

Biomedical Engineering is a study that uses engineering expertise to analyze & solve problems in biology & medicine. It is usually based on one of the traditional engineering disciplines, such as Electrical or Mechanical Engineering. There has been a great expansion of Biomedical Engineering in areas such as Medical Electronics, Clinical Engineering, Bio-materials, & Rehabilitation Engineering.

The scope of the field is enormous; from cardiac monitors to clinical computing, artificial hearts to contact lenses, wheel chairs to artificial tendons, modelling dialysis therapy to modelling the cardiovascular systems. In most aspects of health care, disease prevention & treatment or rehabilitation, there are problems that require an engineering approach. These may include developing systems to maintain & enhance life, designing replacement parts for people, or creating systems to allow the handicapped to use computers for work & communication.

Major Groups / Areas

Biomedical Instrumentation, Biomedical Digital Signal Processing, Nuclear Medicine, Advanced Medical Imaging, Biomechanics and Biomaterials

Major Equipments

X-ray Machine (Demo type), ECG Stress Test Software with Tread Mill, Blood Cell Counter, Spectrophotometer (Demo Type), Gas Chromatography System (Demo Type), Pacemaker (External/Internal)(Demo type), Defibrillator (Demo Type), Solid State Electrosurgery (Demo Type).

Software

MATLAB, Labview, EEG Software, EMG Software, ECG Stress Tst Software, PET Software, ECG Central Monitoring Software, ECG Monitoring Software.

Laboratories

Biomedical Lab - I, Biomedical Lab - II

B. Tech. - Biomedical Engineering

Semester III

Total Duration : 28Hrs/Week
Total Marks : 750

Subject Code	Subject	Teaching Scheme(Hrs)		Examination Scheme				Total
		L	P	Theory	Unit Test	TW & Pr.	TW & Or.	
K50211	Signals & Systems	04	-	80	20	-	-	100
K50242	Electronic Devices & Circuits - I	04	04	80	20	50	50	200
K50243	Human Biology	04	02	80	20	-	50	150
K70201	Engg. Mathematics-III	04	-	80	20	-	-	100
K50245	Network Theory	04	02	80	20	50	50	200
	Total	**20**	**08**	**400**	**100**	**100**	**150**	**750**

Teaching Scheme		Examination Scheme				Total
Lectures	Practical	Theory	Unit Test	T. W. & Pr	T. W. & Or.	
20	08	400	100	100	150	750

Semester IV

Total Duration : 30Hrs/Week
Total Marks : 750

Subject Code	Subject	Teaching Scheme(Hrs)		Examination Scheme				Total
		Lect.	Prac.	Theory	Unit Test	TW & Pr.	TW & Or.	
K50246	Biomechanics-I	04	02	80	20	-	50	150
K50247	Electronic Instruments	04	-	80	20	-	-	100
K50248	Biochemistry	04	02	80	20	-	50	150
K50249	Principles of Instrumentation & Measurements	04	02	80	20	-	50	150
K50250	Electronic Devices and Circuits-II	04	04	80	20	50	50	200
	Total	**20**	**10**	**400**	**100**	**50**	**200**	**750**

Teaching Scheme		Examination Scheme				Total
Lectures	Practical	Theory	Unit Test	T. W. & Pr.	T. W. & Or.	
20	10	400	100	50	200	750

RULES FOR CONDUCTING TESTS

Mode of the test

In each semester for each subject three tests shall be conducted. The schedule for the same will be declared at the commencement of academic year in the academic calendar.

Each test shall carry 20 marks.

University examination pattern has given weightage of 20 marks for the tests.

To calculate these marks following procedure is followed:

i) Out of the three tests conducted during the semester, the marks of only two tests in which the candidate has shown his/her best performance shall be considered, to decide the provisional marks in each subject.

ii) Average marks obtained in two tests in which students have performed well, shall be considered as provisional marks obtained by the student in the tests.

iii) If the candidate appears only for two tests conducted during the semester, he/ she will not be given benefit of the best performance in the tests.

iv) If the candidate appears only for one test conducted during the semester, to calculate the marks obtained in the tests it will be considered that the candidate has got 0 (zero) marks in other tests.

v) The provisional marks obtained by the candidate in class tests should reflect as proportional to theory marks. In cases of disparity of more than 15% it will be scaled down accordingly; These marks will be final marks obtained by the student. No scaling up is permitted.

vi) If the candidate is absent for theory examination or fails in theory examination his final marks for tests of that subject will not be declared. After the candidate clears the theory, the provisional marks will be finalized as above.

Paper Pattern for Tests

i) All questions will be compulsory with weightage as following

Question 1	-	7 marks
Question 2	-	7 marks
Question 3	-	6 Marks

ii) There will not be any sub-questions.

For granting the term it is mandatory to appear for all the three tests conducted in each semester.

Roll numbers allotted to the students shall be the examination numbers for the tests.

SEMESTER - III

K50211: SIGNALS AND SYSTEMS

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

Unit-I (07 Hours)

Introduction To Signals:

Signals: Definition of signal, Classification of signals. Continuous and Discrete time, Analog & Digital, Periodic & Non-periodic, Deterministic and non-deterministic, Energy & Power. Basic Signals & Operations on signals, Sine. Cosine, Exponential, and Unit step, Unit impulse. even, odd. Time shifting, time scaling, Differentiation and integration of signals.

Unit-II (09 Hours)

Classification of Discrete Time System:

Definition, Classification, Linear & Nonlinear, Time variant and time invariant, Causal & Non-Causal, Static & dynamic, Stability.

LTI System Analysis: Introduction to LTI systems. Block Diagram & System Terminology. Impulse response. Convolution & Methods of Convolution. Properties of convolution, System interconnections, stability & impulse response of systems to standard signals.

Unit-III (08 Hours)

Continuous Time System Analysis:

Response of LTI systems to exponential signals, periodic signals. Fourier series, Fourier transforms, properties, application of Fourier series & Fourier transforms to the system analysis.

Laplace Transforms: Definition and its properties, methods of inversion (Review only), application to LTI system analysis.

Unit-IV (09 Hours)

Sampling Theorem And Correlation:

Correlation The correlation function: Conceptual basis, Energy signals, power-signals, Autocorrelation: Relation to signal energy and signal

power, Properties of auto-correlation, Crosscorrelation: Properties of cross-correlation, Sampling Theorem and its proof, effects of under sampling, sampling of band pass signals.

Unit-V (08 Hours)

Probability:

Sample space, Event, Probability, Conditional Probability and statistical independence. Random Variables, Discrete Random Variable, Cumulative Distributive Function, Continuous Random Variable, Probability Density Function, Properties of CDF and PDF.

Unit-VI (07 Hours)

Random Variables And Random Processes:

Transformation of random variables, Statistical averages, Mean, Moments and expectations, Standard Deviation and Variance, Chebyshev inequality, Multivariate expectations. Probability models, Binomial, Poisson's. Gaussian, Rayleigh.

Random Process: Ensemble averages and correlation functions, Ergodic and stationary process. Gaussian process.

Text Books /References

Roberts M J, "Signals & Systems" TMH
Oppenheim, Wilsely & Nawab, "Signals & Systems" (NIGH) V C
Alan V. Oppenheim, Alan S. Willsley, “Signals & Systems”, PHI
John G. Proakis, “Digital Signal Processing”, PHI
Rodger E. Ziemer, William H. Tranter, “Signals & Systems, Continuous & Discrete”, MGH

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50242: ELECTRONIC DEVICES & CIRCUITS – I

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 04 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks
		T. W. & Or.	: 50 Marks

Unit-I (08 Hours)

Study of Electronic Materials & Components and Semiconductor Diode Characteristics:

Classification of materials based on band gaps, types of resistors like fixed, variable, precision, Carbon film, metal film, wire wound, their standard values, specifications & applications, classifications of capacitors based on dielectrics, standard values, specifications & application of capacitors, types of capacitors like electrolytic, ceramic, paper, mica, tantalum, plastic film etc., study of different core materials depending on range of frequencies for inductors & transformers, semiconductor materials Si, Ge, AIII & BV group components with their properties. Diffusion phenomenon, voltage equivalent of temperature, total current (drift diffusion), current components in forward biased/reverse biased p-n junction diode, cut in voltage, reverse saturation current.

Unit-II (08 Hours)

Application of Semiconductor Diodes:

Diode as rectifier, half wave, full wave & bridge rectifier with and without capacitor filter, different types of filters L-section & choke input, parameters like ripple factor efficiency, transformer utilization factor (TUF), peak inverse voltage (PIV), Imax, Isurge, Derivation of ripple factor for L, C & L section filter, bleeder resistor, diode as a wave-Shaping element in clipping and clamping circuits, voltage multipliers.

Unit-III (08 Hours)

Bipolar Junction Transistor (BJT):

BJT as a two port device, configuration of BJT [Common Emitter (CE) / Common Base (CB)/Common Collector (CC)], input-output and transfer characteristics in all three configurations with relevant V-I expressions and

definitions of DC current gains, concept of load line and quiescent point (Q point) with active, cut off, saturation region of operation of BJT, early effect and punch through effect, various biasing circuits for CE configuration, definition of stability factors for CE transistor and their derivations for above circuits, condition to avoid thermal runaway, absolute maximum ratings of BJT as referred to data sheets.

Unit-IV (08 Hours)

BJT as Small Signal Amplifier:

Small signal low frequency (LF) - h parameter model in CE, CB, CC configuration concept of AC equivalent circuit of single stage amplifier, need of coupling and bypass capacitor; analysis CE, CB, CC amplifier for current gain (Ai), voltage gain (Av), input impedance (Ri), output impedance (Ro) in terms of h-parameter, simplified h-parameter model, effect of biasing and source resistance on performance of single stage amplifier, concept of frequency response.

Unit-V (08 Hours)

Field Effect Transistor (FET):

Construction of p-channel and n-channel junction field effect transistor (JFET), depletion metal oxide semiconductor FET (D-MOSFET), enhancement metal oxide semiconductor FET (E-MOSFET) output and transfer characteristics of each with definitions of parameters like transconductance (gm), drain resistance (rd), and biasing techniques for all types, small signal LF model of FET, analysis of [Common Source (CS), Common drain (CD), Common gate (CG)] amplifier for voltage gain and input- output impedance, comparison of BJT / JFET and metal oxide semiconductor FET (MOSFET), frequency response for FET amplifier, absolute maximum ratings / specifications of FET as referred to data sheet.

Unit-VI (08 Hours)

Considerations of Printed circuit boards (PCB):

Design fabrication and assembly: mechanical dimensions of devices and components used in electronics circuit and their dependence on package of device, rules of preparing layout and drawing artwork, fabrication process of single sided PCB board, double sided printed through holes (DSPTH), various copper clad laminates, composition of solder metal.

List of Practical

Study of electronic components
Study of CRO
Study of Clippers and Clampers
Biasing Circuits
Frequency response of single stage CE amplifier
Comparison of CE, CC, CB amplifier
FET as an amplifier
Half wave and Full wave rectifier
Opto-isolator
FET characteristics
H-parameter measurement
PCB design of small circuits

Text Books / References

Millman & Halkias, "Integrated Electronics", Mc Graw Hill
Millman & Halkias, "Electronic Devices & Circuits", Mc Graw Hill
Boylestad & Nashelsky, "Electronic Devices & Circuits", PHI
Allen Mottorshed, "Electronic Devices & Circuits", PHI
David A. Bell,"Electronic Devices & Circuits", PHI
Sedra Smith, "Microelectronics Circuits", Oxford International Edition

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50243: HUMAN BIOLOGY

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

General Anatomy:

Cell, Tissues, Six parts of the Body, Types of Bones with Examples, Bones of Upper & Lower Extremities, Special groups of Muscles, Skin

Unit –II (08 Hours)

Systemic Anatomy:

Organ & Structures of following Systems: Cardiovascular System, Respiratory System, Gastrointestinal System, Excretory System, Reproductive System.

Unit-III (08 Hours)

Central Nervous System & Special Senses:

In Short Anatomy of Cerebrum, Cerebellum, Brain Stem & Spinal Cord, Eye, Ear, Nose & Tongue

Unit-IV (08 Hours)

Physiology of Cardio-Respiratory System:

Blood: Plasma & Blood Components, Coagulation, Hemoglobin, Blood Groups, Blood Transfusion; Vessels: Pulse, Blood Pressure; Heart: Parts, Conducting System, Cardiac Cycle, ECG, Physiology of Respiration: External Respiration, Gaseous Exchange, Artificial Respiration, Spirometer, Peak flow meter

Unit-V (08 Hours)

Physiology of Gastrointestinal, Reproductive & Endocrine System:

Secretions of all digestive organs & Their Functions, Physiology of Nephron, Urine Formation Excretion of Urine & Function of Kidney, Functions of Male & Female Reproductive Organs, All Endocrine Glands, their Secretions & Functions & Control of Secretions.

Unit-VI (08 Hours)

Physiology of Nervous System & Sense Organs:

Functions of Cerebrum, Cerebellum, Brain Stem & Spinal Cord, Functions of Eye, Ear, Nose, Tongue & Skin.

List of Practical

Study of anatomy of Tissue, Cell
Study of anatomy of Endocrine system and Skeleton system
Study of physiology of Blood and Cardiovascular system
Study of physiology of Nervous System
Study of Spirometer and peak Flow Meter
Study of physiology of Female Reproductive System and Male Reproductive System

Text Books/References

Tortora and Grabowski," Principals of Anatomy and physiology", Harper Collin Publication
B. D. Chaurasia, "General Anatomy", Third Edition, CBS Publications
Sujit K. Chaudhari, " Medical physiology", Second Edition, New central book agency (P) Ltd., India
Arthur C. Guyton, "Medical Physiology", Prism Book
William Ganong, "Review of Medical Physiology", Prentice Hall International

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K70201: ENGINEERING MATHEMATICS-II

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

Unit -I (09 Hours)

Differential Equations:

Solution of Linear differential equation of nth order with constant coefficients, Method of variation of parameters, Cauchy's and Legendre's linear equations, Simultaneous linear differential equations, Total differential equations, Symmetrical simultaneous differential equations. Applications to Electrical circuits

Unit –II (08 Hours)

Complex Variables:

Function of complex variables, Analytic function, Cauchy–Riemann equations, Conformal mapping, Bilinear transformation, Residue theorem, Cauchy's Integral theorem and Cauchy's Integral formula.

Unit-III (09 Hours)

Transforms:

Fourier transforms: Fourier integral theorem, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, Inverse Fourier transforms, Discrete Fourier transform and its applications. Z- Transform: Definition, Properties, Inverse Z-Transform, Applications to difference equation, Relationship between Z-Transform and Fourier Transform.

Unit-IV (09 Hours)

Laplace Transform:

Definition, Properties and Theorems, Inverse Laplace transform, Methods of finding Inverse Laplace transforms, Laplace transform of Unit-step function, Dirac-delta functions, Periodic functions, Ramp functions, Error function, First order Bessel's function, Si(t), Ci(t), Ei(t). Applications to solution of linear differential equations.

Unit-V (09 Hours)

Vector Differentiation:

Vector Differentiation, Gradient, Divergence and Curl, Directional derivative, Vector identities, Irrotational and Solenoidal vector fields.

Unit-VI (08 Hours)

Vector Integration:

Line integral, Surface integral and Volume integral, Work done, Gauss-Divergence theorem, Stoke's theorem and Green's lemma, Applications to Electromagnetic fields.

Text Books/References

Peter V. O'Neil, "Advanced Engineering Mathematics", 5e, Thomson Learning
Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.
Wylie C. R. and Barrett L. C., "Advanced Engineering Mathematics", MGH
M. D. Greenberg, "Advanced Engineering Mathematics", 2e, Pearson Education
B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi
P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volume I & II), Pune Vidyarthi Griha Prakashan
Murray R. Spiegel, "Laplace Transforms", Schaum's Outline Series – International Edition

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50245: NETWORK THEORY

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

Network Techniques and Network Theorem:

Network definition, mesh and node analysis, principle of duality, source transformation, simplification of network, T & Π conversion, twin T & wien bridge network, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Maximum power transfer theorem.

Unit –II (08 Hours)

Transient analysis and Resonance:

Undriven and driven RC, RL, RLC circuits, initial conditions. Figure of merit (Q- factor), conditions for resonance, various properties of series and parallel resonance.

Unit-III (08 Hours)

Two Port network:

Various types of four terminal networks, definition of characteristic impedance, propagation constant, image impedance, iterative impedance, calculation of above parameters

Unit-IV (08 Hours)

Passive Filters:

Filter fundamentals, low pass filter (LPF), high pass filter (HPF), band pass filter (BPF), band stop filter (BSF) , prototype(constant K) and m derived filters, composite filters

Unit-V (08 Hours)

Network Functions:

Terminals and terminal pairs, network functions, poles and zeroes and

their significance, Z, Y, H, ABCD parameters, interrelationship between parameters, interconnection of two port networks, study of ideal transformer.

Unit-VI (08 Hours)

Network Synthesis:

Positive real function, properties of LC, RL, RC, driving point functions, realization of Positive real function (PRF) in four canonical forms for one Port network.

List of Practicals

To study the various characteristics of two port network
To study the Twin-T network
Study of Z and Y parameters
To study the characteristics of series and parallel resonance
To verify superposition theorem, Norton's Theorem
To study frequency response of Band Pass Filter
To study frequency response of High Pass Filter
To study frequency response of Low Pass Filter

Text Books / References

A. Chakraborty, "Circuit Theory", Dhanpat Rai & Co.
Franklin Kuo, "Network Analysis and Synthesis", Wiley Eastern
D. Roy Chaudhary, "Network Analysis and Synthesis", Wiley Eastern
John D. Ryder, "Network Lines and Fields", PHI

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

SEMESTER - IV

K50246: BIO-MECHANICS-I

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

BioMechanics:

General principles of Biomechanics, Analysis of biological subsystems from Biomechanical view and rise modeling instrumentation

Tissue Biomechanics:

Direct, shear, bending and torque actions and the Corresponding stresses, strains in biological tissues, Stress relaxation and creep Stability & instability, biomechanical characterization of bone and the soft Connective (Skin, tendon, ligaments) covering structure, function and physiological Factors.

Unit –II (08 Hours)

Movement Biomechanics:

Gait analysis, body and limb mass & motioncharacteristic actions, forces transmitted by joints, Joint forces result in the normal and disabled human body, normal and fast gait on the level, Strain and ramp ascent& descent, Joint replacement.

Unit-III (08 Hours)

Prosthetics and Orthotics:

Principles in designing Orthesis and Prostheses: Principles of three point pressure, total contact, partial weight relieving. Positions of anatomical axis and corresponding movements of the body parts, International conventions with respect to above. Purpose for providing prostheses and Orthosis: Various aspects regarding diagnosis, Prognosis, stature and socio- economic conditions.

Unit-IV (08 Hours)

Classification in Prosthetics and Orthetics :

Lower Extremity Orthesis and prostheses, Upper Extremity Orthesis and

Prostheses, Spinal Orthosis. Recent developments in Prostheses & Orthosis.

Unit-V (08 Hours)

Material Technology in Prostheses and Orthosis:

Indigenous metals and their alloys. Different types of leather and leather tanning. Types of Rubber. Thermoplastic and Thermosetting resins. Wood and binding materials

Unit-VI (08 Hours)

Artificial Machines and Implants:

Introduction, basic transport Paper, Artificial lungs / Respirator, Artificial Kidney, Intra- Aortic Balloon pumps.

List of Practicals

Study of Hip Knee Ankle Foot Orthosis
Study of Hip Knee Ankle Foot Prosthesis
Study of Below Elbow Orthosis
Lamination of Prosthesis
Study of Milwaukee Brase
Study of Hand Prosthesis and Orthosis

Text Books / References

R. M. Kennedy, "A Textbook of Biomedical Engineering", Blackie Publication
Prof. Ghista, "BioMechanics ", Private Publication, UAE
White and Puyator, "BioMechanics ", Private Publication, UAE
S. Sunder, "Textbook of Rehabilitation", Jaypee Publication
Wise Donald, Trantolo Debra, "Encyclopedic Handbook of Biomaterials & Bioengg.", Dekker

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50247: ELECTRONIC INSTRUMENTS

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

Unit -I (08 Hours)

Error Analysis and Standards:

Types of errors, Statistical analysis of errors, probability of errors, Limiting errors, standards of measurements – classification – Primary, Secondary and working standards, standards for – mass, length, time, frequency, voltage, current, resistance, inductance, capacitance.

Unit –II (08 Hours)

Input/Output Devices:

Digital I/O devices – punched card, paper tape, bar codes, line printer, ink jet printer, digital tape recording, Method of Digital recording, floppy disk, Displays – LED, LCD, LED seven segment display driver, Alpha numeric display, Bar graph display. Brief comparison with analog displays & recorders.

Unit-III (08 Hours)

Digital Instruments:

Automation in voltmeter (ranging, zeroing, polarity indication), DMM (digital multimeter) circuit (block diagram), Accuracy & guarding of DVM, significance of ½ & ¾ digits, Sine wave Generator, Square wave generator, Pulse generator, Function generator, Wave analyzer, Harmonic distortion analyzer, Heterodyne wave analyzer, spectrum analyzer, Frequency response analyzer, Lock-in amplifier.

Unit-IV (08 Hours)

Digital Counters and Timers:

Circuitry of logic elements (DTL, TTL FAMILIES), Interfaces and LOGIC converters, Basic internal counter circuitry, modes of operation ac, rms, digital time and frequency. Ratiometric sampling plug in units and special functions, Accuracy.

Unit-V (08 Hours)

Cathode Ray Oscilloscope:

Block Diagram, Delay line, Horizontal Deflection system, Vertical Deflection system, Types of CRO'S –single beam, double beam, digital storage and sampling, brief comparison between CROs, block diagram, its features like roll, refresh, sampling rate and specification. Application in Instrumentation and measurement, virtual oscilloscope.

Unit-VI (08 Hours)

Sources of Noise and Preventive Maintenance:

Brief Descriptions towards Sources of noise and their reduction techniques, preventive maintenance and troubleshooting of electronic equipments.

Text Books/References

A. J. Bouwens, "Digital Instrumentation", MGH- 1986

T. S. Rathore, "Digital measurement Techniques", Narosa 1996

Oliver and Cage, "Electronic Measurement and Instrumentation", MGH- 1975

A. D. Helfrick and W. D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI- 1995

C. S. Rangan, G. R. Sarma, V.S. Mani, "Instrumentation Devices and Systems", 2nd Edition, TMH- 1983

H. S. Kalsi, "Electronic Instrumentation", TMH- 1991

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50248: BIOCHEMISTRY

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

PH & Buffers:

Water: Properties of water, its biological significance, Dissociation of water & ionic products. PH: Definition, Dissociation of strong electrolytes, Ionization of weak acids & bases, Henderson – Hasselbalch equation. Buffers: Definition & concept, Buffers in biological system, Paper of acid–base balance.

Molecular interactions:

Vander waal's forces, Non-covalent & covalent bonds, Hydrogen bond, Hydrophobic bond, Electrostatic bond, Peptide bond, Disulphide bond and Glycosidic bond.

Unit –II (08 Hours)

Carbohydrates:

Classification, Stereo chemical properties of carbohydrates, Biological & chemical Significance, Physical & chemical properties of Carbohydrates

Unit-III (08 Hours)

Lipids:

Introduction & classification, Fatty acids, prostaglandins, Acyl glycerol waves Phospholipids, Sphingolipids, Glycolipids & their biological significance, Lipoproteins, Biological significance of Lipids, Distribution of lipids in pro & eukaryotic cells.

Unit-IV (08 Hours)

Proteins:

Amino acids: Structure, Essential & Non – essential amino acids, Non – protein amino acids. Properties of amino acids physical properties, Reactions of amino acid, carboxyl group amino acids, R group simple peptides, Classification of proteins: Primary, secondary, tertiary,

quaternary, Fibrous proteins: Keratin silk collagen, Globular proteins: Cytochrome, Antibodies, Blood proteins, Hormones (oxytoxin, vasspressin, and glucagons, ACTH, Insulin) Enzymes.

Unit-V (08 Hours)

Enzymes:

Classification (outline), Properties: Enzyme – substrate complex, specificity, effect of concentration & dilution of enzyme, effect of pH & temperature, Inhibition & activation.

Nucleic acids:

Purines & Pyrimidines, Nucleosides & Nucleotides, RNA – structure, types & functions. DNA– Structure, properties, Watson – Crick model, physio chemical properties of DNA & Biological significance.

Unit-VI (08 Hours)

Vitamins:

Water-soluble vitamins, Fat-soluble vitamins

Minerals:

Elementary knowledge of the Role of following minerals: Na, K, Ca, Mg, Zn, Mn, Fe, Cu.

Biochemical energetics:

Energy rich compounds ADP, ATP, GTP & Co. Exergonic and Endergonic Reactions, Coupled Reactions, Laws of thermodynamics, Role of high-energy phosphate molecule.

List of Practicals

Identification of carbohydrate
Protein estimation by uret method
Sorensens formal titration
Determination of acid value of given oil sample
Estimation of vitamin-C by using 26 Dichlorophynol indophynol
Estimation of Dextrose Dihypoiodate method

Text Books/References

S. Nagini, "Textbook of Biochemistry", Scitech Publications (India Pvt. Ltd.)

Montgomery, "Biochemistry", 6th Edition, Mosby
R. W. Lambert, "Medicinal Chemistry", Roal society of chemistry Burlington House, London W1VOBN
Peter Atkins, "Atkin's physical chemistry", Oxford University Press

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50249: PRINCIPLES OF INSTRUMENTATION & MEASUREMENTS

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

Basic concepts of measurement:

Characteristics of measuring devices-accuracy, precision, linearity, repeatability, hysteresis, threshold, calibration, errors.

Unit –II (08 Hours)

Transducers & Sensors:

Introduction, requirements, definition, classification, specifications, types of sensors and transducers for measurement of temperature, pressure, flow, strain, displacement, vibration.

Unit-III (08 Hours)

Optical transducers:

Fundamentals of electromagnetic (EM) radiation, light sources (Lasers & LEDs) Characteristics of light, photometry photodetectors, optical fiber sensors and the Applications.

Unit-IV (08 Hours)

Bipotential Electrodes:

Electrode electrolyte interface, half-cell potential polarization, polarizable and non-polarizable electrodes, calomel electrode, electrode circuit model, electrode skin interface and motion artifact, body surface electrodes, internal electrodes, needle and wire electrodes (different types), Micro electrodes metal, supported metal, micropipette, microelectronic, Properties of micro electrodes, method of use of electrodes for measurement of ECG, EEG, EMG

Unit-V (08 Hours)

Flow measurement:

Plethysmography, electromagnetic indicator, indicator dilution, thermal

convection and Ultrasonic.

Chemical Transducers:

Blood gas and acid base physiology, reference electrode, pH, pO2, pCO2, electrodes, transcuteneous arterial oxygen tension, CO2 tension monitoring, enzyme electrode.

Unit-VI (08 Hours)

Passive circuits:

Divider circuits, bridge circuits, RC filters. Grounding and shielding techniques, low and high resistance measurement techniques.

List of Practicals

To study the characteristics of Resistance Temperature Detector
To study the characteristics of Proportional Integral Difference Controller
To study the characteristics of Thermocouple
To study the characteristics of ON-OFF controller
To study the characteristics of Linear Variable Differential Transformer
Study of Strain Gauge

Text Books/References

John-G.Webster, "Medical Instrumentation Application and Design", Wiley & Sons
Leslie Cromwell, Fred.J.Weibel "Biomedical Instrumentation and Measurements", PHI
Joseph J.Carr, John M. Brown, "Introduction to Biomedical Equipment Technology" Pearson Education
Richard Aston, "Principles of Biomedical Instrumentation and Measurement", Marwell Macmillar
J. B. Gupta, "Electronic and Electrical measurements and Instrumentation", Kataria and Sons
Bishnu P. Pal, Editor, "Fundamentals of Fiber Optics in Telecommunication & Sensor Systems", Wiley Eastern
Harry. N. Norton, "Biomedical sensors – fundamentals and applications", Prennum Press

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K50250: ELECTRONIC DEVICES AND CIRCUITS – II

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 04 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

Multistage Low Frequency Amplifiers (BJT/FET):

Necessity of cascading low frequency (LF) small signal amplifier in various configurations techniques for improving input impedance for CC stage (darlington connection, boot strapping), CE – CE cascade, CE - CB cascade arrangement, effect of cascading on frequency response of single stage and cascaded amplifier, square wave testing or step response audio frequency (AF) amplifier.

Unit –II (08 Hours)

LF amplifiers with Negative Feedback:

Block schematic of amplifier with negative feedback, gain with feedback, consequences of Introducing negative feedback in small signal and multistage amplifier, classification of amplifier in view of feedback concept, types of sampling and mixing, ways of introducing negative feedback in amplifiers i.e. [voltage amplifier, current amplifier, resistance amplifier, transcondutance amplifier], voltage series, voltage shunt , current series, current shunt and effects of negative feedback on input and output impedance in all four types, methodology of feedback amplifier analysis.

Unit-III (08 Hours)

Operational Amplifiers (Op-Amp's):

Internal block schematic of monolithic op-amp IC, analysis of transistorized difference amplifier stage, method of improving common mode rejection ratio (CMRR), definition and measurements of Op-amp parameters like input offset voltage and current, bias current CMRR, power supply rejection ratio (PSRR), open loop gain etc, concept of dcamplification inability of op-amp to work as linear small signal

amplifier in open loop, Op-amp with closed loop negative feedback, close loop gain, frequency response of op-amp, linear applications like inverting and non-inverting amplifier, summing and difference amplifier.

Unit-IV (08 Hours)

Large signal (power) AF amplifiers and Oscillators:

Classification of amplifiers in class A, B, C etc., concept of large signal amplification, total harmonic distortion, push-pull configuration, efficiency of power conversion, CE transformer coupled amplifer, complementary symmetry CC power amplifier in single dual supply version efficiency and distortion, graphical techniques to calculate harmonicdistortion, cross over distortion, safe operating area (SOA) and its limits, secondary breakdown, heat sink , its standard shapes and sizes, thermal calculations and resistances, Employing positive feedback in amplifier, problems of instability, Barkhausein criteria for Sinusoidal oscillators, derivations and analysis of transistorized RC phase-shift / wein–bridge Oscillators, frequency expressions and gain requirements, LC oscillators: hartley, collpitts, Crystal (Miller and pierce), unijuntion transistor (UJT) relaxation oscillators.

Unit-V (08 Hours)

Voltage Regulators:

Zener diode as shunt regulator, emitter follower regulator, transistorized series feedback type regulator, comparison of above discrete regulators on the basis of voltage stability factor (Sv),Temperature stability factor (St), output resistance (Ro), constant voltage (CV) /constant current (CC) modes, over voltage /over current protection circuit, internal block diagram, pin diagram and specifications of IC regulator 723, applications of IC 723, SOA of IC regulators.

Unit-VI (08 Hours)

Hybrid pi (II) small signal model of BJT and Introduction power Devices such as Thyristors and MOSFETS:

Relations with h-parameters, definitions of fα, fβ, ft, calculations of AI, AV with finite load and source resistances for CE stage, gain bandwidth product, tuned load, loaded and Unloaded Q, insertion loss, single tuned

amplifiers, staggered tuning, cascade configuration for high Frequency (HF) amplification.

Note: No rigorous mathematical treatment is expected.

List of Practicals

Analysis of Multistage LF Amplifier using BJT, verify with theoretical values of Ais, Avs, Ri, Ro (overall) with Square wave testing and comment on the results
Input impedance improvement techniques for emitter follower
Analysis of LF with negative Feedback for voltage and current series topology
Analysis of LF with negative Feedback for voltage and current shunt topology
Power Amlpifier:

a) Class A, B, C

b) Class AB Push Pull Complementary Symmetry

Transistorized differential amplifier: Measurement of CMRR
Measurement of frequency of oscillation for Crystal oscillator, RC Phase Shift oscillator, LC oscillator
Op-Amp-I: Measurement of DC parameters such as input offset voltage and current, input bias current
OP-Amp-II: Measurement of AC parameters such as CMRR, Slew rate, Zi, Zo, frequency response for FH and FT
Linear applications of Op-Amp such as summing, difference, voltage Follower, signal phase shifter
Study of Instrumentation amplifiers using Op-Amp
Regulation characteristics of Voltage Series and Shunt Regulator and calculation of Sv and Ro
IC -723 Regulator as negative regulator
IC- 723 as basic high/ low voltage regulator with simple/ fold back current limiting.
Design build and test for given specification

Text Books/References

Millman and Halkias, "Integrated Electronics", McGraw Hill
Millman and Halkias, "Electronic Devices and Circuits", PHI
Boylstad and Nashelsky, "Electronic Devices and Circuits", PHI
Sedra Smith, "Micro Electronic Circuit", Oxford International Press
David A. Bell, "Electronic Devices and Circuits", PHI
Allen Mottershed, "Electronic Devices and Circuits", PHI
Thomas L. Flyod, "Electronic Devices", 6th Edition, Pearson Publication

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

RULES REGARDING ATKT, CONTINUOUS ASSESSMENT AND AWARD OF CLASS

A. T. K. T.

A candidate who is granted term for B.Tech. Semester-I will be allowed to keep term for his/her B.Tech. Semester-II examination even if he/she appears and fails or does not appear at B.Tech. Semester-I examination.

A candidate who is granted term for B. Tech. Semester - III will be allowed to keep term for his/her B.Tech. Semester-IV examination even if he/she appears and fails or does not appear at B.Tech. Semester-III examination.

A candidate who is granted term for B.Tech. Semester-V will be allowed to keep term for his/her B.Tech. Semester-VI examination if he/she appear and fails or does not appear at B.Tech. Semester-V examination.

A candidate who is granted term for B.Tech. Semester-VII will be allowed to keep term for his/her B.Tech. Semester-VIII examination if he/she appears and fails or does not appear at B.Tech. Semester-VII examination.

A student shall be allowed to keep term for the B.Tech. Semester-III course if he/she has a backlog of not more than 3 Heads of passing out of total number of Heads of passing in theory examination at B.Tch. Semester-I & II taken together.

A student shall be allowed to keep term for the B.Tech. Semester-V of respective course if he/she has no backlog of B.Tech Semester-I & II and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 heads of passing in termwork and practical examination or termwork and oral examination.

A student shall be allowed to keep term for the B.Tech. Semester-VII course if he/she has no backlog of B.Tech. Semester-III & IV and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 Heads of passing in termwork and practical examination or termwork and oral examination.

CONTINUOUS ASSESSMENT

In respect of Term work at B.Tech. Semester-I & II, B.Tech. Semester-III & IV and B.Tech. Semester-V & VI, target date shall be fixed for the completion of each job, project experiment or assignment as prescribed in the syllabus and the same shall be collected on the target date and assessed immediately at an affiliated college by at least one pair of the concerned teachers for the subject and the marks shall be submitted at the end of each term to the Principal of the college.

Termwork and performance of Practical/Oral examination shall be assessed on the basis of the depth of understanding of the principles involved, correctness of results and not on ornamental or colorful presentation.

For B.Tech. Semester-VII & VIII, termwork assessment will be done by external and internal examiners jointly during the examination schedule declared by the university. The record of continuous assessment shall be made available to the examiners during Term work and practical and Term work and oral examinations. Examiner shall use this record for overall assessment of the performance of the student. Every practical/termwork assignment shall be assessed on the scale of 20 marks and weightage of 20 marks shall be distributed as follows:

Sr. No.	Activity	Marks
1	Timely Submission	04
2	Presentation	06
3	Understanding	10

Marks obtained out of 20 for all assignments together will be converted on scale of marks assigned to term work of respective subject in the structure of the course.

CLASS

The class should be awarded to the student on the basis of aggregate marks obtained together in both the semesters of the respective year by him. The award of class shall be as follows.

A	Aggregate 66% or more marks	First Class with Distinction
B	Aggregate 60% or marks but less than 66%	First Class
C	Aggregate 55% or more marks but less than 60%	Higher Second Class
D	Aggregate 50% or more marks but less than 55%	Second Class
E	Aggregate 40% or more marks but less than 50%	Pass Class