

**GANPAT UNIVERSITY**  
**U. V. PATEL COLLEGE OF ENGINEERING**  
**DEPARTMENT OF BIOMEDICAL & INSTRUMENTATION ENGINEERING**  
**B. Tech. SEMESTER – IV**

Sub.Code	Sub. Name	Teaching Scheme			Credit			Examination Scheme					
		Lect. (Hrs.)	Pract. (Hrs.)	Total (Hrs.)	Theory	Pract .	Total	Theory			Pract.	Grand Total	
2BM401	Analog Integrated Electronics	4	2	6	4	1	5	Int.	Sem.End		Total		Pract.
								Asses.	Marks	Hrs.			
								30	70	3	100	50	150

**UNIT-1**

**INTRODUCTION TO INTEGRATED CIRCUIT:**

Integrated circuit, types of integrated circuit , Scale of Integration of ICs and manufacturing Techniques , Manufacturers' designation for IC , IC package types , Pin identification , Device identification , Analog and Digital ICs difference , Advantages of ICs.

**UNIT-2**

**BASIC OPERATIONAL AMPLIFIER:**

Introduction, Basic differential amplifier emitter coupled circuits, Block diagram representation of typical op amp, the ideal op amp, Equivalent circuit of op amp, Op amp IC Properties of op amp, Transfer characteristic of op amp, op amp parameters and specifications Frequency response of internally compensated and Non-compensated op amp, op amp package.

**UNIT-3**

**OP AMP BASIC APPLICATION:**

Various configuration- inverting, non-inverting and differential circuits and their analysis, Op amp differential amplifier circuit using two op amp and three op amps, Op amp adder Subtractor, Differentiator, Voltage follower circuit, Comparator, op amp non-linear amplifier V to I and I to V converters, Op amp voltage regulators, Op amp bridge amplifier, Instrumentation amplifier, Instrumentation amplifier with variable gain, op amp as AC amplifier.

**UNIT-4**

**OP AMP OSCILLATOR:**

Oscillators- principles and types, Phase shift oscillator, Wein bridge sine wave oscillator, square wave generator, triangular wave generator, sawtooth wave generator, op amp multivibrators, Schmitt trigger, op amp timer.

**UNIT-5**

**NON-LINEAR APPLICATION:**

Precision rectifier , zero crossing detector , window detector , sample and hold circuit , V to F and F to V converters , peak detector , log amplifier – antilog amplifier.

**UNIT-6**

**OP AMP PERFORMANCE:**

Introduction , input offset voltage , input bias current , input offset current , total output offset voltage , thermal drift , effect of variation in power supply voltage on offset voltage , common mode configuration and common mode rejection ratio , offset nulling techniques.

**UNIT-7**

**SPECIAL OP AMP APPLICATION:**

Phase locked loop : Study of IC 565 , Uses of PLL

**UNIT-8**

## ACTIVE FILTERS:

Introduction, Active filters, Highpass and lowpass Butterworth and chebyshev , Notch filter and their designs.

## UNIT-9

### LINEAR ICs:

Timer IC 555 – functional diagram , pin operation and application , Three terminal monolithic voltage regulator ICs 78XX and 79XX series and 317, Study of 723- voltage regulator , protection , heat dissipation , switching mode power .

## UNIT-10

### MODULATION AND DEMODULATION:

Theory and mathematics of amplitude modulation , Sum and difference frequency , Side frequencies and sidebands , Frequency spectrum of balanced and standard amplitude modulation , Amplitude modulation circuit , Multiplier as modulator , Demodulating AM voltage , Demodulator circuit.

**Term Work and Practical shall be based on the above syllabus.**

## REFERENCE BOOKS:

1. Op Amp and Linear Integrated Circuits  
By – Ramakant Gayakwad
2. Operational Amplifiers: Design & Applications  
By – Driscoll and Coughlin
3. Op Amp & Linear Integrated Circuit  
By – James M.Fiore
4. Operational Amplifiers & Linear Integrated Circuits  
By – K. Lal Kishore
5. Op-amps and Linear Integrated Circuits  
By – Robert F. Woghlin & Frederick F. Driscoll
6. Analog Electronic Circuits  
By – Lakmi Jain & Swash Hungenehally

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2BM402	Control System Engineering	4	2	6	4	1	5	Int. Asses.	Sem.End		Total		Pract. Asses.
									Mark s	Hrs.			
								30	70	3	100	50	150

**UNIT-1**

**INTRODUCTION:**

History of automatic control, Types of control system: Manual and Automatic control system, Open loop and Close loop control systems, Linear and Non linear Control System, Time variant and Time invariant control system, Block diagram representation of control system, Examples of control systems.

**UNIT-2**

**MATHEMATICAL MODELING AND TRANSFER FUNCTION OF PHYSICAL SYSTEM:**

Transfer functions and Mathematical models of Mechanical and Electrical systems. Analogy system, Transfer functions of mechanical translational and rotational systems, Electrical RLC systems, Fluid and Thermal systems, Block diagram of a closed loop systems, Block diagram reduction technique, Signal flow graphs technique: signal flow graph terms, properties, signal flow graph algebra, mason's gain formula.

**UNIT-3**

**GENERAL FEEDBACK CHARACTERISTICS:**

Reduction of parameter variation and sensitivity, Effect of feedback on band width, Effect of feedback on system dynamics, Effect of feedback in presence of disturbances, Regenerative feedback and its use in control system, Advantages and Disadvantages of feedback.

**UNIT-4**

**CONTROL SYSTEM COMPONENTS:**

Elements of a control system, **Error detectors:** Potentiometers, Synchros. **Servo Amplifiers:** Amplidyne, Magnetic Amplifier. **Actuators:** DC and AC servo motors, Stepper Motors. **Feedback components:** DC and AC Tachogenerators, Optical incremental and absolute encoders, Control system Models of position and speed controls. Instrument servomechanism.

**UNIT-5**

**TIME DOMAIN ANALYSIS:**

Transient Response, standard test signals, Time response of first and second order system, Time response specifications, Transient response specifications of second order systems, Steady state response, Evaluation of steady state error and Error constants, Steady state error of second order system, Effect of control actions on transient response, Effect of Integral control on transient response, Effect of Zero on transient response.

**UNIT-6**

**STABILITY ANALYSIS:**

Characteristic equations of closed loop control systems and stability concept, Locus of complex conjugate roots, Poles and Zeros of transfer function. Routh and Hurwitz stability criterion, Relative stability

**UNIT-7**

**ROOT LOCUS TECHNIQUES:**

Basis of root locus, construction rules for sketching root locus.

## **UNIT-8**

### **FREQUENCY DOMAIN ANALYSIS:**

Frequency response of a control system, Frequency response of second order system, Performance specifications in frequency domain, Correlation between time response and frequency response, Normalized bandwidth, **Polar Plots, Bode diagrams:** concept of logarithmic plots, bode plots of standard terms, stability from bode plot, gain and phase margins.

## **UNIT-9**

### **NYQUIST STABILITY CRITERION:**

Principle of argument, Nyquist criterion, Nyquist contour modification for poles on  $j\omega$  axis, Relative stability from Nyquist criterion, Gain and Phase margins

## **UNIT-10**

### **STATE VARIABLE ANALYSIS AND DESIGN:**

Introduction, Concept of State, State Variables and State Model, State model of Linear Continuous-Time System, Diagonalization, Solution of state equations, Concept of Controllability and Observability.

## **UNIT-11**

### **MATLAB SOLUTIONS OF CONTROL SYSTEMS:**

MATLAB basics and operations, MATLAB solutions for time response plots, root locus plots, bode plots and nyquist plots.

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### **REFERENCE BOOKS:**

1. Control systems Engineering  
By: I.J.Nagrath and M.Gopal
2. Morden Control Engineering.  
By: k.Ogata.
3. Control system Engineering, 2e  
By: Prof. H.T. Kashipara
4. Elements of Control Systems  
By: Sudhir Gupta
5. Automatic Control Systems  
By: Benjamin C. Kuo and Farid Golnaraghi

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2BM403	Digital Logic Circuits	3	2	5	3	1	4	Int. Asses.	Sem.End		Total		Pract. Asses.
									Marks	Hrs.			
								30	70	3	100	150	

**UNIT: 1**

NUMBER SYSTEMS, CODES, BINARY ARITHMETIC:

Binary, Octal, Hexadecimal number systems, Conversion from any base to another base number system Binary, BCD, Excess-3, Gray, Alphanumeric, EBCDIC, Hollerith, ASCII codes, code conversion.

**UNIT: 2**

BOOLEAN ALGEBRA AND LOGIC GATES:

Boolean algebra, Boolean functions, Canonical and standard forms, Logic gates, truth tables, simplification of Boolean functions, Karnaugh map- two, three, four, five and six variable maps, product of sum and sum of products, simplification, don't care conditions, Tabulation method.

**UNIT: 3**

COMBINATION LOGIC:

Concepts of combination and sequential circuits, Realization of circuits using gates- systems, implementing combinational logic; Arithmetic circuits, Half and full adder, subtractor, multiplier, code conversion, parity generator, parity checker, comparators, multiplexers, demultiplexers, encoders. Applications of MSI and LSI for binary parallel adder, decimal adder, magnitude comparator, decoders, multiplexers, ROMS and PLAS

**UNIT: 4**

SEQUENTIAL LOGIC:

Concept of synchronous and asynchronous operations, Flip-flops, triggering of flip-flops, excitation tables, analysis clocked sequential circuits, Design of counters, design of sequential circuits.

**UNIT: 5**

REGISTERS AND COUNTERS:

Registers – Serial in serial out, serial in parallel out, parallel in serial out and parallel in parallel out register, Shift registers, Bi-directional shift register, Serial transfer using shift register Ripple counters – Binary and BCD ripple counter Synchronous counters – Synchronous Binary down and up/down counter and decade counter. Timing sequences, Propagation delay in ripple counter

**UNIT: 6**

D TO A AND A TO D CONVERSION:

D to A conversion – Basics: Resolution and Conversion accuracy, R/2R ladder network DAC. A to D conversion – Basic operation, Digital ramp ADC, Successive approximation ADC, Dual slope integrating type ADC, voltage to frequency converter, Introduction to applications of DAC and ADC.

**UNIT: 7**

DIGITAL ICs:

TTL series, Low power Schottky devices, TTL parameters; CMOS series- Advantages and types, parameters, characteristics, TTL to CMOS and CMOS to TTL interfacing.

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**REFERENCE BOOKS:**

1. Digital Systems : Principles & Applications  
By: Ronald. J. Tocci and Neal. S. Widmer
2. Digital Fundamentals  
By: Thomas. L. Floyd
3. Digital logic and Computer Design  
By: M. Morris and Mano
4. Principles of Digital Electronics  
By: Malvino and Leach
5. Fundamentals of Digital Circuits  
By: A. Anand Kumar

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2BM404	Human Anatomy & Physiology – II	4	2	6	4	1	5	Int. Asses.	Sem.End		Total		Pract. Asses.
								30	Marks	Hrs.		100	
								70	3	50			

**UNIT-1**  
**SKELETAL SYSTEM:**  
**Bone:** Types, Functions Structure and Development of bone; **Axial Skeleton:** Skull, Cranial Cavity, Vertebral Column, Thoracic Cage, Bones of Limbs and Disorders of bones. **Joints:** Types of joints, Main synovial joints of the limbs, Disorder of joints.

**UNIT-2**  
**MUSCULAR SYSTEM:**  
Classification of muscles, Anatomy and Physiology of skeletal muscle, Muscle of body, Physiology of muscle contraction, Structure and physiology of smooth muscle, cardiac muscle, difference of cardiac muscle, smooth and cardiac muscle, Anatomy and Physiology of neuromuscular junction, EMG, Disorder of Muscle.

**UNIT-3**  
**NERVOUS SYSTEM:**  
Neurons, Synapse and neurotransmitters, Central and Peripheral nervous system, various parts of nervous system; **Brain:** Parts and functions; Extra pyramidal system, Spinal cord, CSF, Ventricles of the brain, Autonomic nervous system, Reflex action, Sensation, Receptors, EEG, Sleep, Speech, Disorders of nervous system.

**UNIT-4**  
**EXCRETORY SYSTEM:**  
**Various parts of excretory system, their structure and functions:** Kidneys, Ureters, Urinary Bladders, Urethra; Physiology of urine formation, physiology of micturition, Concentration and Dilution of urine, Composition of urine, Kidney function tests, renal disorders, artificial kidney and Dialysis.

**UNIT-5**  
**DIGESTIVE SYSTEM:**  
Digestive system-Introduction, **Various parts of digestive system, their structure and function:** mouth, tongue, teeth, salivary glands, pharynx, esophagus, stomach, small intestine, large intestine, mastication, swallowing, digestion, absorption, defaecation, pancreas, liver, biliary tract, gallbladder, Disorders of digestive system.

**UNIT-6**  
**ENDOCRINE SYSTEM:**  
Endocrine glands, Hormones; **Location, physiology and hormones secreted by various endocrine glands:** pituitary, thyroid, parathyroid, adrenal, pancreatic islets, thymus, pineal body, pancreas, Disorders of all glands; Mechanism of hormone regulation.

**UNIT-7**  
**REPRODUCTIVE SYSTEM:**  
**Anatomy and Physiology of Male Reproductive system:** testis, epididymis, spermatic cord, seminal vesicles, prostate gland, penis, spermatogenesis, physiology of coitus, disorders of male sex organs; **Anatomy and Physiology of Female Reproductive system:** uterus, fallopian tube, cervix, vagina, ovaries, menstrual cycle, mammary glands, contraceptive, oogenesis, implantation of the embryo, pregnancy, disorders of female sex organs.

**UNIT-8**  
**SPECIAL SENSES:**

Structure, function and physiology of sight (eye), hearing (ear), taste and smell (nose), Disorders of eyes and ears, physiology of balance.

### **UNIT-9**

#### **HEALTH EDUCATION:**

Types of diseases, spread and prevention of infection, communicable diseases, family planning

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#### **REFERENCE BOOKS:**

1. Anatomy and Physiology in Health and Illness  
By: Ross and Wilson
2. Human Anatomy and Physiology  
By: Dr. Padma Sanghani
3. Text book of Medical Physiology  
By: Guyton and Hall
4. Human Physiology and Anatomy  
By: Fox Staurt Ira
5. Human Anatomy (Volume 1,2,3)  
By: B.D.Chaurasia

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2BM405	Biomaterials & Implants	4	--	4	4	--	4	Int. Asses.	Sem.End		Total		Pract. Asses.
									Marks	Hrs.			
								30	70	3	100	--	100

**BIOMATERIALS:**

**UNIT-1**

**BIOMATERIAL TYPES:**

Types: Synthetics, Metals and non-metallic alloys, Ceramics, Inorganic and glasses. Bioresorbable and biologically derived materials; Standards and assessments of biomaterials, Surface properties of biomaterials and their testing.

**UNIT-2**

**POLYMERS:**

Polymerization, Polyethylene, Prosthodontic polymers, Clinical study of soft polymers, Bioerodible polymers, Blood compatible polymers, Bioactive polymers, Hydrogels; Hard methacrylates. Drug incorporation polymer gels, Biocompatibility of polymers- blood compatibility improvement, Compatibility evaluation. Processing techniques for the polymers, assembling medical disposable

**UNIT-3**

**METALS AND METALLIC ALLOYS:**

Stainless steel, Titanium and titanium alloys, Cobalt based alloys, Nitinol. dental metals- Dental amalgam, Gold, Nickel, Other metals, Corrosion of the metals

**UNIT-4**

**CERAMICS AND COMPOSITE BIO-MATERIALS:**

Ceramics- Introduction to biomedical usages- bonding natural tissues, Bio-active glass, High density alumina; Calcium phosphate ceramics- Porous materials, Biological interactions, Dental ceramics- High strength materials- Thermal expansions, Fracture toughness, Drug delivery from ceramics. Wet chemical synthesis. Particulate and Fibrous composites, Soft composites, Dental composites, Saline, coupling agents, Microfield materials, White-light systems bonding to teeth, Clinical trials, Synthesis of fillers, Matrix resins, Mechanical and Physical evaluation

**UNIT-5**

**BIO-COMPATIBILITY:**

Methods for testing and evaluating biocompatibility: In vitro testing, In Vivo Testing; Hemocompatibility, Osteocompatibility, Odontocompatibility, Tissue reaction to external materials, Blood/biomaterial interaction. Corrosion and wear of biomaterials, Treatment of materials for biocompatibility, Biodegradable materials and their applications, Rheological properties of biological solids- bone, tendons, blood vessels, biological liquids, mucus etc.

**IMPLANTS:**

## **UNIT-1**

### **INTRODUCTION:**

Biological Effects of the implants on the human body: Inflammatory response, coagulation and hemolysis, adaptation, systematic distribution and excretion, allergic foreign body response, chemical and foreign body carcinogenesis.

## **UNIT-2**

### **CARDIAC IMPLANTS:**

Vascular grafts, Aorta and heart valves, Synthetic blood vessels, inferior vena cava filters.

## **UNIT-3**

### **OPHTHALMIC IMPLANTS:**

Contact lenses; Soft and hard lenses, Disposable lenses, Intra ocular lenses (IOLS), Viscoelastic solutions, Vitreous implants, Eye shields, Drainage tubes in Glucoma, Acrylic adhesives.

## **UNIT-4**

### **ORTHOPEDIC IMPLANTS:**

Temporary fixation devices, Fracture healing, Repair of the ligaments, ACL reconstruction using biological and synthetic materials, Joint replacements; Total HIP replacement, Total knee replacements, Bone regeneration with resorbable material.

## **UNIT-5**

### **DENTAL IMPLANTS:**

Dental Implant modalities: Dentures, Subperiosteal, Endosteal; Blade type, Root form, Packaging and preparation of dental implants, Bases liners, and varnishes for cavities, Impression materials.

## **UNIT-6**

### **TISSUE GRAFTS AND SURGICAL AIDS:**

Tissue grafts and rejection process, Prevention of rejection, Skin grafts, Breast implants, Maxillofacial implants Suture materials, wound dressings, Adhesives and sealants, Burn dressings, Catheters.

## **UNIT-7**

### **STERILISATION OF IMPLANTS AND DEVICES:**

ETO, gamma radiation, autoclaving. Effects of sterilization.

## **REFERENCE BOOKS:**

1. Bio-materials  
By: Sujata V. Bhat
2. Biomaterials Medical Devices and Tissue Engineering  
By: Fredrick H. Silver Chapman and Hall, London
3. Biomaterials Science and Engineering  
By: J.V. Park Plenum Press, New York
4. Biomaterials Science- An introduction to materials in medicine  
Edited by: Buddy D. Ratner, Allan S. Hoffman, Frederick j. Schoen, Jack E. Lemons
5. Biomaterials – An introduction  
By: Joon B. Park, Roderic S. Lakes

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2BM406	Simulation Laboratory-II	0	2	2	0	1	1	Int. Asses.	Sem.End		Total		Pract. Asses.
									Marks	Hrs.			
									--	--	--	--	50

**UNIT-1**

INTRODUCTION TO VIRTUAL INSTRUMENT:

Front Panel, Block Diagram, Icon & Connector. VI & SUB VI

**UNIT-2**

FUNDAMENTALS OF LABVIEW ENVIRONMENT:

Getting Started Window, Controls Palette, Functions Palette, Navigating the Controls and Functions Palettes, Addons, Favorites, Tools Palette, Menus and Toolbars, Keyboard shortcuts, Customizing the control & function pallets.

**UNIT-3**

BUILDING THE FRONT PANEL:

Configuring the front panel, Front panel Controls & indicators, Labeling, Creating Custom Controls, Indicators, Dragging & Dropping in Lab VIEW.

**UNIT-4**

BUILDING THE BLOCK DIAGRAM:

Functional overview, Express VI, Using wire to Link Block diagram objects, Polymorphic functions, Numerical data, Block Diagram Data Flow.

**UNIT-5**

RUNNING & DEBUGGING VI:

Running VI, Correcting Broken VI, Debugging Techniques, Handling Errors.

**UNIT-6**

LOOP & STRUCTURES:

FOR loop & WHILE loop Structures, Case & Sequence Structure, In Place element Structure, conditional disable & diagram disable structures.

**UNIT-7**

Local Variables, Graphs & Charts, Graphics & Sound Vis, File IO, Various Tools of Lab view

**REFERENCE BOOKS:**

1. LabVIEW Graphical Programming  
By: Gary W. Johnson, Recharad Jennings
2. Virtual Instrumentation Using LabVIEW  
By: Sanjay Gupta, Joseph John

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	Open Subject	3	--	3	3	--	3	Int. Asses.	Sem.End		Total		Pract. Asses.
								30	Marks	Hrs.		--	

The Open Subject will be opt by students from the following list

1. Personality Development
2. Entrepreneurship Development
3. Yoga & Meditation
4. Professional ethics
5. Foreign Language
6. Industrial Management
7. Techno Marketing