## COURSE OF STUDY AND SCHEME OF EXAMINATION OF B.TECH/B.ARCH/M.TECH/M.C.A.
### NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

**Branch:** Biomedical Engineering  
**Semester:** IV  
**Course:** B.Tech.(NIT Scheme)

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<th>Sub. Code</th>
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<td>Microbiology</td>
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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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<th>Microbiology</th>
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**MODULE I Introduction of Microbiology**
Microbial taxonomy; including modern approaches of taxonomy such as DNA homology; ribotyping; ribosomal RNA sequencing characteristics of primary domains and numerical axonomy; Taxonomic nomenclature and Bergey’s manual. Microscopic techniques for study of microorganisms.

**MODULE II Microbial Organism**
Organization of Microbial cells: Morphology and cell structures of Prokaryotes and Eukaryotes (bacteria; fungi; algae; and viruses); comparative account of Prokaryotes and Eukaryotes cells; Different cultures techniques for cultivation; isolation; and preservation methods; effect of environment.

**MODULE III Microbial Growth**
Growth; definition of growth; growth curve; mathematical expression of growth; growth culture; measurement of growth and growth yield synchronous and asynchronous; different factors affecting growth. Pure culture and isolation techniques; growth inhibitory substances; control of microorganisms; fundamentals of control; theory and practices of sterilization; physical and chemical agents and their mode of actions on microorganisms; chemotherapy; sporulation and cell differentiation.

**MODULE IV - Microbial Metabolism**
Principles of microbial nutrition; Nutrition media construction of culture media; choice of media and incubation conditions; growth requirements including different physical conditions; Metabolotic products of industrial importance; metabolic pathways-amphicatabolic and biosynthetic.

**MODULE V - Microbiology of Food**
Water Milk and Soil; Plasmids; YAC’s as vectors; Transformation; conjugation and trasduction processes; mutations; developments of resistance to antibiotics; microbial assays of antibiotics; brief introduction to life cycle molecular biology; microbial disease caused by bacteria and virusestuberculosis; STD diseases; AIDS; malaria; plague etc.

**TEXT BOOKS:**
DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

<table>
<thead>
<tr>
<th>Name of the subject</th>
<th>Numerical Analysis</th>
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**MODULE I - Numerical Solution of Algebraic & Transcendental Equations**

**MODULE II - System of Linear Algebraic Equations**

**MODULE III - Interpolation with Equal and Unequal Intervals**
Finite difference, difference of polynomial in Factorial notation, Other difference operator, Newton’s Forward and Backward interpolation formula, Central interpolation formula, Stirling’s formula, Bessel’s formula, Lagrange’s formula and Newton’s Divided difference interpolation formula.

**MODULE IV - Numerical Differentiation, Integration & Curve fitting**

**MODULE V - Numerical Solution of Ordinary Differential Equation**

**TEXT BOOKS:**

**REFERENCE BOOKS**
DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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<th>Name of the subject</th>
<th>Biomedical Signal Processing</th>
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MODULE I – Fundamentals of Signal & System
Introduction to continuous and discrete time signals and systems; Signals, types of signal, singularity functions, exponential and sinusoidal signal, sinc and signum function, gate signal, manipulation and operation on signals, Energy and power signal, System and types of system, Conversion of analog signal to digital signal, review of Fourier series and Fourier transform.

MODULE II – Introduction and application of Z- Transform & Fourier Transform
Review of Z-transform, Transfer function, Frequency Response, Convolution, correlation, Power spectral Density, Autocorrelation, DTFT, DFT, FFT, Stationary and Non stationary signal, Time frequency analysis of Biomedical signals, Short term Fourier transform, Wavelet.

MODULE III – Filters & Bio signal analysis

MODULE IV – Noise analysis of bio signal

MODULE V – Random Theory

TEXT BOOKS:
DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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**MODULE I – Number system codes & Logic gates**

**MODULE II – Minimization techniques**
Expansion of a Boolean expression to SOP & POS forms, Two, Three & Four variable K-Map, Concept of Don't Care Terms; Quine – Mc Clusky Method.

**MODULE III – Combinational circuits**

**MODULE IV – Sequential circuits, Shift Register & Counters**
Flip-Flops & Timing Circuit, S-R Latch; D Latch; J-K flip-Flop; T Flip-Flip, S-R Flip-Flop, D Flip-Flop, Edge-triggered Flip-Flop; Master - Slave Flip-Flop; Direct Preset and Clear Inputs. PIPO, SIPO, PISO, SISO, Bi-Directional Shift Registers; Universal Shift register. Asynchronous Counter, Synchronous Counter, Up Counter, Down Counter, Ring counter, Jhonson counter, Twisted Ring Counter, Effect of propagation delay.

**MODULE V – Digital Logic Families**
Introduction, Simple Diode Gating and Transistor Inverter; Basic Concepts of RTL and DTL; TTL, IIL, ECL; MOS Logic: CMOS Logic, Comparison between various logic families.

**TEXT BOOKS**
1. Fundamentals of Digital Circuits: A. Anand Kumar, PHI
DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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**MODULE I – Transducers**

Classification, Selection, Resistive strain gauge, Gauge factor, Displacement, Capacitance, Inductance, Potentiometric transducers, velocity, photoelectric, photo magnetic and piezoelectric transducers. Temperature measurement, resistance thermometers, thermistors, Thermocouple and digital transducers.

**MODULE II – Physiological Signals**

Characteristics of ECG, EMG, EEG, PCG and instrumentation for measuring these signals.
Measurement of blood flow by electromagnetic Doppler and plethymographic methods.

**MODULE III – Biochemical Transducers & Amplifiers for Biomedical Application**

Working Principles and characteristics of electrode, electrode–electrolyte model, half-cell potential, electrode models, microelectrodes.
Patient lead device, diode circuits, diode bridge current limiters, JEET limiter, isolated leads.

**MODULE IV - Clinical Laboratory Equipment**

Medical diagnosis with chemical tests, Spectrophotometry and this type of instrument, colorimeter, spectrophotometer, Automated Biochemical Analysis System, Flame photometer, Selective ion electrodes based electrolytes analyzer.

**MODULE V – Neonatal Instrument, Respiratory Measurements & Electrical Hazards**

Incubator, Principal and techniques of impedance pneumography and pneumomotachography, Apnea monitor, study of mechanical ventilators, Nebulizers & Humidifiers, Anesthesia machine, capnograph. Safety code standards Micro and macro shock and its physiological effects. Leakage currents and protection by use of isolation transformers, equipotential grounding and earth free monitoring.

**TEXT BOOKS**

2. John G. Webster: Medical Instrumentation Application & Design Haughton Mifflin, Co. Boston. USA, I 978
Module I – Transistor at Low Frequency
Graphical analysis CE configuration, Two Port device and their hybrid model, Transistor hybrid model, h parameter, Conversion formula for the parameters of three transistor configuration, Analysis of transistor amplifier circuit using h parameter, Emitter follower, Comparison of transistor amplifier configuration, Linear Analysis of transistor circuits, Miller’s theorem and its Dual, Simplified CE hybrid model, Simplified calculation for CC configuration, Common emitter amplifier with emitter resistance, High input resistance transistor circuits.

Module II - Transistor at High Frequencies

Module III – Multistage Amplifier

Module IV – Feedback Amplifier and Oscillator
Feedback Concept, General Characteristics of Negative feedback amplifier, Voltage Series feedback and voltage series feedback pair, Current Series feedback, Voltage shunt feedback, Sinusoidal Oscillator, Phase Shift Oscillator, Resonant circuit Oscillator, General term of Oscillator Circuit, Wein Bridge Oscillator, Crystal Oscillator, Frequency Stability.

Module V – Power Circuit and System
Classification of amplifiers, Class A large signal amplifier, Second Harmonic Distortion, Higher Order harmonic distortion, Transformer coupled audio power amplifier, Puss-pull amplifier, Class B amplifier, Class AB Operation.

Text Books
DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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Experiment No. 1: Pure culture of Bacteria.
Experiment No. 2: Pure culture of fungi.
Experiment No. 3: Isolation & identification of bacteria.
Experiment No. 4: Isolation & identification of fungi.
Experiment No. 5: Permanent slide identification of bacteria & fungi.
Experiment No. 6: Growth curve study of bacteria.
Experiment No. 7: Growth curve of fungi.
Experiment No. 8: Thermal Death point (TDP).
Experiment No. 9: Thermal death time (TDT).
## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

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Experiment No. 1: To verify the Truth Table of all Basic, Universal and Special gates.

Experiment No. 2: To make all Basic gates and EX-OR and EX-NOR using NAND and NOR gate.

Experiment No. 3: To design Half Adder using EX-OR, AND and NOT gate verify the Truth Table.

Experiment No. 4: To study Full Adder and Subtractor and verify the Truth Table.

Experiment No. 5: To design RS, JK, D and T Flip-Flop and verify the Truth Table.

Experiment No. 6: To study and verify the Truth Table of Universal Shift Register.

Experiment No. 7: To design Binary to Gray and Gray to Binary Code Converters and verify the Truth Table.

Experiment No. 8: To study and design Multiplexer and Demultiplexer.

Experiment No. 9: To study and design Asynchronous Mod-n Counter.

Experiment No. 10: To design RTL, DTL, TTL circuits.

Experiment No. 11: To study the static input and output characteristics of CB, CC and CE transistor.

Experiment No. 12: To study the drain and Transfer Characteristics of JFET.

Experiment No. 13: To study Wien Bridge Oscillator.

Experiment No. 14: To determine the frequency of RC phase shift oscillator.

Experiment No. 15: To study the Darlington Pair amplifier using transistor.
Experiment No. 1: To study and measure Blood pressure using analog and digital sphygmomanometer.

Experiment No. 2: To study EMG waveform generated by built-in EMG Simulator as well as subject (Human Body).

Experiment No. 3: To study LEAD I, LEAD II & LEAD III of standard Bipolar lead configuration.

Experiment No. 4: To study AVR, AVF & AVL lead of standard augmented Uni-polar leads configuration.

Experiment No. 5: To study chest lead of standard Uni-polar leads configuration.

Experiment No. 6: To measure heart rate of subject and study the heart abnormalities (Tachycardia, Bradycardia).

Experiment No. 7: To measure and observe the normal and abnormal respiratory signal waveform.

Experiment No. 8: To study EEG trainer in unipolar and average recording mode.

Experiment No. 9: To observe PCG signal and hear the PCG signal sound.

Experiment No. 10: To study and measure the intensity of light by spectrophotometer.

Experiment No. 11: To study Coulter counter instrument for counting cells.

Experiment No. 12: To study Differential Blood Cell Counter used in hematology for classification and counting white blood cells.

Experiment No. 13: To study incubator used in cell culture.

Experiment No. 14: To study Ventilator, Anesthesia machine, Capnograph and Nebulizer.

Experiment No. 15: To measuring airflow and the corresponding changes in lung volume by pneumotachometer.

Experiment No. 16: To study working of Plethysmograph.

Experiment No. 17: To determine characteristics of thermistor.