

Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING & EXMINATION B.E. IV SEMESTER BIO MEDICAL ENGINEERING

S.No.	Board of Study	Subject Code	Subject	Period per Week			Scheme of Exam Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Electronics & Telecom.	317411 (28)	Analog And Digital Electronics	4	1	-	80	20	20	120	5
2.	Biomedical Engineering	317412 (17)	Biomedical Transducer	4	1	-	80	20	20	120	5
3.	Biomedical Engineering	317413 (17)	Microbiology	3	1	-	80	20	20	120	4
4.	Biomedical Engineering	317414 (17)	Bio Signals And System	3	1	-	80	20	20	120	4
5.	Biomedical Engineering	317415 (17)	Biomechanics	3	1	-	80	20	20	120	4
6.	Applied Mathematics	317416 (14)	Numerical Techniques	2	1	-	80	20	20	120	3
7.	Electronics & Telecom.	317421 (28)	Analog And Digital Electronics Lab	-	-	3	40	-	20	60	2
8.	Biomedical Engineering	317422 (17)	Biomedical Transducer lab	-	-	3	40	-	20	60	2
9.	Biomedical Engineering	317423 (17)	Microbiology Lab	-	-	3	40	-	20	60	2
10.	Biomedical Engineering	317424 (17)	Bio Signals And Systems Lab	-	-	3	40	-	20	60	2
11.	Humanities etc.	300425 (46)	Health Hygiene & Yoga	-	-	2	-	-	40	40	1
12.			Library	-	-	1	-	-	-	-	-
Total				19	6	15	640	120	240	1000	34

L- Lecture

T-Tutorial

P-Practical

ESE- End Semester Exam

CT-Class Test

TA- Teacher Assessment

Note (1) : Duration of all theory will be a **Three Hours**.

Note (2) : Industrial Training of twelve weeks is mandatory for all students. It is to be completed in two equal parts. The first part will be in summer after IV sem.after, which students have to submit a training report, which will be evaluated by the college teachers during B.E. V sem.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**

Subject: Analog And Digital Electronics

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Bio Medical Engineering

Code: 317411 (28)

Total Tutorial Periods: 12

ANALOG ELECTRONICS:

Unit 1

Rectifiers and unregulated power supply: Zener regulator. Linear voltage regulator, principles of switched mode power supply. Voltage doublers, quadruples.

BJT characteristics (CF and CR) biasing and stabilization of Q- point, self bias, stability factors.

BJT as an amplifier: Graphical analysis DC and AC load line. CE, CB, CC configuration and their application using CE model only. Composite transistors (Darlington pair, cascade connection. etc.

Unit 2

JFET and MOSFET characteristics: Biasing and stabilization of Q-point, small signal analysis. CS, CD and CG configuration.

Transistor and high frequency: Hybrid – pi Model, high frequency limitations.

Multistage amplifiers: Frequency response characteristics (Log- magnitude & Polar plots), gain bandwidth product, distortion in amplifier.

Review of R-C and RL circuits' transient analysis, time constant.

Clipping and clamping circuits.

Transistor as switch, high frequency limitation.

Digital Electronics:

Unit 3

Basic logic gates (AND, OR, NAND, NOR) Universal gates (NAND, NOR). Generic gates (TTL, MOS & CMOS).

Transfer characteristics, noise margin. Propagation delay, fan-in, power dissipation consideration.

Number system: Binary Hexadecimal, Octal, BCD. Negative number representation. Non-weighted code (Gray code).

Unit 4

Boolean algebra: Boolean identities. De Morgan's theorems. Combinational logic circuits, truth table K-map and MEV techniques.

Memory element: Latch R-S, J-K, D – flip-flops. Master-Slave arrangement. Edge triggered flip-flops. Shift registers.

Asynchronous and synchronous counters.

Unit 5

MSI'S: Multiplexes. Demultiplexers. Encoders. Decoders. Comparators. Parity generators/checkers. ROMs, RAMs. Half adder, Full Adder. Look ahead carry adder Combinational logic design using MSIs.

Suggested Books & References:

Analog electronics:

- J. Milman & C. Halkias Integrated electronics. Mc Grow Hill. 1971.
- Boylestad and Nashelski electronic Devices and circuit theory. Ed. S. PHI. 1993.

Digital electronics:

- Malvino & Leach. Digital Principle and Application .IV ed. TMH. 1993
- Morris mano. Digital Design. II ed. PHI. 1971.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: IVth

Subject: Bio Medical Transducer

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Bio Medical Engineering

Code: 317412 (17)

Total Tutorial Periods: 12

Unit 1

Generalized Instrumentation system :

General properties of input transducer s. Static characteristic : Accuracy , Precision , Resolution , Reproducibility, Sensitivity , Drift, Hysteresis, Linearity, Loading effect , Input Impedance and Output Impedance.

Dynamic Characteristics : First and second order Characteristic, Time delay , Error free instrument , Transfer function , design criteria, generalized instrument specifications.

Unit 2

Displacement and pressure measurement: Resistive –Potentiometers, strain Gauges, Bridge circuits, Inductive- variable inductance and LDVT, Capacitive type, piezoelectric transducers, Types of diaphragms, Bellows, bourdon tubes.

Temperature and Flow measurement: Thermistors, Thermocouple, Resistive Temperature detector, Radiation Thermometry, Fiber Optic sensor, Optical measurement. Plethysmography, Electromagnetic, Indicator, Indicator dilution, Thermal Convection and Ultrasonic.

Unit 3

Chemical transducer: Blood gas and acid-Base Physiology, reference electrode, pH, pO₂ , pCO₂, electrodes. ISFETS, Transcutaneous arterial oxygen tension, carbon dioxide tension monitoring enzyme electrode.

Unit 4

Bipotential electrodes : Electrode electrolyte interface, half cell potential polarization , polarizable and nonpolarizable electrodes, Calomel electrode , electrode circuit model, electrode skin interface and motion artifact. Body surface electrodes.

Unit 5

Internal electrodes: Needle and wire electrodes (different types)

Micro electrodes : Metal, supported metal , micropipette (metal filled glass and glass micropipette electrodes), microelectronic, properties of microelectrodes, method of use. Electrodes used for measurement of ECG , EEG and EMG.

Suggested books & References:

- Medical instrumentation, application and design by John G. Webster. (Marcel Dekkar Pub)
- Biomedical Sensors - fundamentals and application –By Harry N. Norton (Plenum Press)
- Biomedical Instrumentation and measurements – By Leslie Cromwell, Fred J. Weibell.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**

Subject: Microbiology

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Bio Medical Engineering

Code: 317413 (17)

Total Tutorial Periods: 12

Unit -1

Principles of Microbiology: Microbial taxonomy; including modern approaches of taxonomy such as DNA homology; ribotyping; ribosomal RNA sequencing characteristics of primary domains and numerical taxonomy; Taxonomic nomenclature and Bergey's manual. Microscopic techniques for study of microorganisms.

Unit -2

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.

Unit -3

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.

Unit -4

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

Unit -5

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 viruses-tuberculosis; STD diseases; AIDS; malaria; plague etc.

TEXT/REFERENCE BOOKS:

1. Methods for general and Molecular Bacteriology by Gerhardt et al. (1994) ASM Press.
2. Microbiology by Pelzar, Chan and Kreig (1986) McGraw Hill.
3. Microbiology by Prescott, Harley and Klein (1996) William C. Brown Press.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**

Subject: Bio Signals and Systems

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Biomedical Engineering

Code: 317414 (17)

Total Tutorial Periods: 12

Unit – I

- Signal conversion
- Sampling basics
- Simple signal conversion systems
- Conversion requirement for biomedical signals
- Signal Conversion circuits
- Other time-and frequency- domain techniques
- The Fourier transforms
- The z transforms
- Correlation
- Convolution
- Power spectrum estimation

Unit – V

- ECG QRS detection
- Power spectrum of ECG
- Band pass filtering techniques
- Differentiation techniques
- Template matching techniques
- A QRS detection algorithm
- ECG analysis system
- ECG interpretation
- ST- Segment analyzer
- Portable arrhythmia monitor

Unit – II

- Basics of digital filtering
- Digital filtering
- Elements of Digital filtering
- Types of Digital filtering
- Transfer function of difference
- The plane pole –zero plots
- Finite impulse response filters
- Characteristics of FIR filters
- Smoothing filters
- Notch filters
- Window design
- Frequency sampling
- Mini-max design

Unit – III

- INFINITE IMPULSE RESPONSE FILTERS
- Generic equation of IIR filter
- Simple one pole example
- Integrators
- Design method for two-pole filter

Unit – IV

- Signal averaging
- Basics of signal averaging
- Signal averaging as a digital filter
- A typical for signal averaging
- Limitation of signal averaging

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**

Subject: Biomechanics

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Biomedical Engineering

Code: 317415 (17)

Total Tutorial Periods: 12

Unit 1

BIOFLUID MECHANICS: Newton's law, stress, strain, elasticity, Hooke's law, viscosity, Newtonian fluid, non-Newtonian fluid, viscoelastic fluids, Vascular tree. Relationship between diameters, Velocity and pressure of blood flow, Resistance against flow

Unit 2

CARDIAC MECHANICS: Cardiovascular system, Mechanical properties of blood vessels: arteries, arterioles, capillaries, and veins. Prosthetic heart valves and replacements.

Unit 3

RESPIRATORY MECHANICS: Alveoli mechanics, interaction of blood and lung, P-V curve of lung. Breathing mechanism, Airway resistance, Physics of lung diseases.

Unit 4

SOFT TISSUE MECHANICS: Pseudoelasticity, non-linear stress-strain relationship, viscoelasticity. Structure function and mechanical properties of skin, ligaments and tendons.

Unit 5

ORTHOPEDIC MECHANICS: Mechanical properties of cartilage. Diffusion properties of articular cartilage. Mechanical properties of bone. Kinetics and Kinematics of joints. Lubrication of joints.

REFERENCES

- Biomechanics: Y C Fung

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**

Subject: Numerical Techniques

Total Theory Periods: 28

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Biomedical Engineering

Code: 317416 (14)

Total Tutorial Periods: 12

Unit – 1

Errors in numerical computation, Error types, analysis and estimation .
Error propagation.

Roots of Equations- Including relevant engineering applications.
Bracketing Methods – The Bisection method, The False position method.
Open methods – The Newton-Raphson Method, The Secant Method.

Unit – 2

Systems of Linear Algebraic equation – (Including relevant engineering applications).
Gauss-Elimination method – Technique, pitfalls, improvement. Gauss-Jordan method, LU decomposition and matrix inversion, Gauss-Seidel method.

Curve fitting – (Including relevant engineering applications).
Interpolation – Newton's divided difference, Lagrange interpolating polynomials.
Approximation- Least square approximation technique, linear regression and Polynomials regression.

Unit – 3

Numerical differentiation (including relevant engineering applications) Methods based on interpolation and finite differences.
Numerical Integration (including relevant engineering applications) The Trapezoidal rule, Simpson's 1/3 rule, Simpson 3/8 rule.

Unit – 4

Solution to Ordinary differential equations (including relevant engineering applications) Toler series method. Picard's method of successive approximation. Runge – Kutta method – Euler's method, Euler's predictor-corrector method, Runge-Kutta method of second and fourth order. Boundary – value problems, Eigen value problems.

Unit – 5

Optimization –(including relevant engineering applications and transportation problems)
One-dimensional unconstrained – Golden- section Search, quadratic Interpolation, Newton's method.
Multidimensional unconstrained- direct method, Interpolation, Gradient method. Linear programming – Graphical solution and simplex method.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: **IVth**
Subject: Analog and Digital Electronics Lab
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Branch: Biomedical Engineering
Code: 317421 (28)

Experiments to be performed (Minimum 10 experiments)

1.
 - To determine experimentally the Drain characteristics of a given MOSFET (MOSFET CHARACTERISTICS)
 - To study the use of MOSEFT as an amplifier and to measure its voltage gain in common source configuration
2.
 - Study of Zener Diode as Voltage Regulator
 - Study of Static Emitter Characteristics of UJT-Uni junction Transistor on oscilloscope
 - Study of effect of VBB on peak point voltage and valley point current.
 - Operation of UJT Relaxation Oscillator and its use as SCR trigger circuit.
 - Control of UJT trigger Pulses with shunt transistor
 - Study of Variations in gate resistance & capacitance , resistance of source & drain and their effect on trigger pulse characteristics of UJT relaxation oscillator.
 - Various Configuration of UJT relaxation oscillator type (low output impedance), type 2 (moderate output impedance) and type 3 (high output impedance)
3.
 - To study and plot the Transistor input and output Characteristics in the following configurations :
 - Common Emitter Mode
 - Common Emitter Mode
 - Common Base Mode
 - Common Collector Mode
4.
 - Study of Common Emitter (CE) transistor amplifier circuit and evaluation of its input and output resistance , voltage gain , Current gain and power gain
 - Study of Common Base(CB) transistor amplifier circuit and evaluation of its input and output resistance, voltage gain, current gain and power gain
 - Study of common Collector (CC) transistor amplifier circuit and evaluation of its input and output resistance voltage gain , current gain and power gain.
5.

To Study diode clipping circuits
6.

To Study the characteristics of Field Effect Transistor

 - Measurement of IDSS
 - Plot the static drain characteristics of FET
 - Drain Current V/s Drain Voltage Characteristics for different fixed values of VGS

- Drain Current V/s Gate Bias Characteristics for different fixed values of V_{DS}
- Calculate the FET parameters (drain dynamic resistance r_d , mutual conductance g_m , and amplification factor) at a given operating point

7. To study diode clipping circuits.

8.

- To determine experimentally the Drain characteristics of a given MOSFET
- To study the use of MOSFET as an amplifier and to measure its voltage gain in common source configuration

9.

To study the operation of 4-bit binary full adder and sub tractor for :

- Addition of two 4bit-binary numbers.
- Subtraction of two 4bit-binary numbers.
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10.

- To study and plot the forward & reverse bias characteristics of a Germanium semiconductor Diode.
- To study and plot the forward & reverse bias (breakdown). Characteristics of a Zener Diode.

11.

- To draw the characteristics of a P-N junction diode for reverse saturation current and temperature.
- To determine the Band Gap in a Semiconductor using a Junction Diode.

12.

- To study the EX-OR logic gate verify its truth table.
- To construct the EX-OR logic gate using NAND gates and verify its truth table.
- To study the EX-NOR logic gate verify its truth table.
- To construct the EX-NOR logic gate using NAND gates and verify its truth table.
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13.

- To draw the characteristics of a P-N junction diode for reverse saturation current and temperature.
- To determine the Band Gap in a Semiconductor using a Junction Diode .

14.

To study and plot the Transistor input and output Characteristics in the following configuration:

- Common Emitter Mode
- Common Base Mode
- Common Collector Mode

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: IVth
Subject: Bio Medical Transducer Lab
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Branch: Bio Medical Engineering
Code: 317422 (17)

Experiments to be performed (Minimum 10 experiments)

- (i) Measure the pressure using strain gauge
- (ii) Measure the displacement using Resistive Potentiometer
- (iii) Study the LVDT . Measure the displacement using LVDT
- (iv) Measure the Temp. using Thermocouple
- (vi) Measure the blood flow using Methysmography Measure the Temp. using Thermocouple
- (vii) Study the Resistive temp. Detector
- (viii) Measure the pressure using burden tube / bellows
- (ix) Study of different types of electrodes
- (x) Study the Bio electric transducer .
- (xi) Study the different types of chemical transducers
- (xii) Study the Radiation on thermometry

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: IVth

Subject: Microbiology Lab

Total Practical Periods: 40

Total Marks in End Semester Exam: 40

Branch: Biomedical Engineering

Code: 317423 (17)

List of Experiments to be performed: -

1. Pure culture of Bacteria.
2. Pure culture of fungi.
3. Isolation & identification of bacteria.
4. Isolation & identification of fungi.
5. Permanent slide identification of bacteria & fungi.
6. Growth curve study of bacteria.
7. Growth curve of fungi.
8. Thermal Death point (TDP).
9. Thermal death time (TDT).

Equipment: -

1. Hot air oven.
2. Incubator 37⁰ C & 42⁰ C
3. Laminar flow
4. Water Bath

Requirements & Material: -

1. Petri dish
2. Conical flask
3. Test tube
4. Cotton
5. Involution Loop
6. Aluminum foil

Material :-

1. Dextrose
2. Agar
3. Pepton
4. Nacl
5. Beef Extract

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

Semester: IVth
Subject: Bio Signals And Systems Lab
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Branch: Biomedical Engineering
Code: 317424 (17)

List of Experiments to be performed: -

1. Frequency- domain analysis of the ECG
2. Real time ECG processing algorithm
3. Turning point algorithms
4. IIR digital filter for ECG analysis
5. FIR filters design
6. Analog filters, ECG amplifier, and QRS detector.
7. Signal Conversion.

Equipment Required:

Computer system with MATLAB Software
Digi Oscilloscope

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester : **IV Sem.**

Subject : **HEALTH, HYGIENE & YOGA**

No. of Periods : 2 pds/week

Total Marks in End Semester Exam. : NIL

Minimum number of class tests to be conducted: Two

Branch: Common for all branches

Code : 300425 (46)

Tutorial Periods : NIL

Teacher's Assessment: 40 Marks

UNIT- I

HEALTH & HYGIENE: Concept of health, Physical health and mental health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and undereating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food vs nutritious food; fruits, vegetables cereals and qualities of each of these.

UNIT- II

INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE: History, development, basic concepts, modes of operation of Allopathy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Acupuncture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.

UNIT- III

YOGASANS: Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasan, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Sinhasan, Shashankasan, Surya Namaskar, Halasan, Janushirasan, Utshep Mudra,

UNIT- IV

YOGASANS FOR COMMON DISEASES: From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

- **Modern silent killers:** High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomach disorders, such as, indigestion, acidity, dysentery, piles and fissures, arthritis, its causes, prevention and cure.
- **Asans for relaxation:** Shavasana, Makarasana, Matsyarakrisana, Shashankasana.
- **Asans to increase memory and blood supply to brain :** Shirshasana, Shashankasana.
- **Asans for eye sight:** Tratak, Neti Kriya .
- **Pranayam :** Definition and types : Nadi Shodhan, Bhastrika, Shitakari, Bhramari useful for students

UNIT V

CONCENTRATION: Concentration of mind and how to achieve it. Tratak $\frac{1}{4} = \frac{1}{4} \text{Vd}$ Concentration on breath, Japa $\frac{1}{4} \text{ti}$ Ajapajap $\frac{1}{4} \text{tikti}$ internal silence $\frac{1}{4} \text{urek}$ visualization in mental sky $\frac{1}{4} \text{pnkd'k}$ $\frac{1}{4} \text{kk}$ Concentration on point of light $\frac{1}{4} \text{;kr /; ku}$ Concentration on feeling $\frac{1}{4} \text{ko /; ku}$ Concentration on figure $\frac{1}{4} \text{wk /; ku}$

REFERENCES

- (1) Yogic Materia Medica
- (2) Asana, Pranayam and Bandha