



SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING



QUESTION BANK

SUBJECT : EC 8073 – MEDICAL ELECTRONICS

SEM / YEAR: V / III year B.E.

UNIT I - ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING			
Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics.			
PART A			
Q. No	Questions	BT Level	Competence
1.	List the types of bioelectric potentials.	BTL 1	Remembering
2.	Summarize electrode and the types of electrodes used in the bipolar measurement.	BTL 2	Understanding
3.	Define Lead. Name the type of leads used for ECG.	BTL 1	Remembering
4.	Differentiate micropipette and metal microelectrode.	BTL 2	Understanding
5.	How would you describe the term Conduction velocity?	BTL 1	Remembering
6.	List out the disadvantages of surface electrodes.	BTL 4	Analyzing
7.	Name the electrodes used for recording EMG and ECG?	BTL 1	Remembering
8.	Construct the typical ECG waveform and mention the cause for first & second heart Sounds.	BTL 3	Applying
9.	Examine the term phonocardiogram.	BTL 4	Analyzing
10.	Assess the important bands of frequencies in EEG & their importance.	BTL 5	Evaluating
11.	Distinguish the signal characteristics of ECG and PCG.	BTL 4	Analyzing
12.	Show the EMG signal characteristics.	BTL 2	Understanding
13.	Define relative refractory period.	BTL 6	Creating
14.	Describe the latency related to EMG.	BTL 2	Understanding
15.	Compose biological amplifier.	BTL 6	Creating
16.	Name the 10-20 lead system used in ECG recording.	BTL 1	Remembering
17.	State the importance of PCG signals.	BTL 1	Remembering
18.	Justify the use of Einthoven triangle.	BTL 5	Evaluating
19.	Choose the various EEG signals with amplitude and frequencies.	BTL 3	Applying
20.	Identify the importance of biological amplifier.	BTL 3	Applying
PART – B			
1.	(i) What should be the characteristics of bio potential amplifier? (ii) Show with necessary diagram the origin of bio potential.	(8) (5)	BTL 1 Remembering
2.	(i) Analyze in detail about the 10-20 lead system of recording EEG. (ii) List the typical ECG waveform and mark the important features and their associated function of the heart.	(8) (5)	BTL 4 Analyzing

3.	(i) Give an account on surface electrode and state its application. (5) (ii) Explain different lead system used in an ECG recorder. (8)	BTL 2	Understanding
4.	Identify and describe the different types of bio potential electrodes used in measurement of bio signals. (13)	BTL 1	Remembering
5.	(i) Compare the signal characteristics of ECG and EMG. (7) (ii) Measure the heartbeat using ECG recording system in detail. (6)	BTL 5	Evaluating
6.	(i) How a metal microelectrode is formed? Draw its electrical equivalent circuit and explain. (7) (ii) Show the circuit diagram of Darlington pair isolation amplifier and explain. (6)	BTL 1	Remembering
7.	Construct the characteristics of EMG and EOG signals with typical waveform. (13)	BTL 3	Applying
8.	(i) Explain the medical use of Chopper amplifier? Draw the diagram of mechanical Chopper amplifier and explain its working? (7) (ii) Illustrate the ECG curves for normal adult, myocardial infarction, coronary insufficiency and ventricular fibrillation. (6)	BTL 2	Understanding
9.	Develop the EEG waveform in detail and its signal frequency bands. (13)	BTL 6	Creating
10.	(i) Point out the different requirements for biomedical amplifiers? (4) (ii) Examine the characteristics of a medical preamplifier with neat diagram and deduce an expression for its net gain. (9)	BTL 4	Analyzing
11.	(i) Examine the action potential waveform and discuss about polarization and repolarization. (8) (ii) Show the bipolar limb lead system of an ECG. (5)	BTL 1	Remember
12.	(i) Draw the equivalent circuit of biopotential electrode interface and explain about half cell potential. (5) (ii) List out the advantage and disadvantage of biopotential measurement. (8)	BTL 2	Understanding
13.	Infer the physiology of heart and lungs and derive an approximate engineering system equivalent to the same. (13)	BTL 4	Analyzing
14.	Illustrate an ultrasonic transducer is applied in clinical diagnostic circuit. (13)	BTL 3	Applying
PART – C			
1.	Design a suitable amplifier that can be used in the front end of an ECG machine. Justify your by specifying the features of the selected amplifier. (15)	BTL 5	Evaluating
2.	(i) Summarize the instrumentation amplifier with circuit diagram. (8) (ii) Evaluate the origin of brain waves. (7)	BTL 5	Evaluating
3.	(i) Generalize the international standard 12 lead system used to record ECG. (10) (ii) Formulate the list and discuss the important characteristics of bio-amplifier. (5)	BTL 6	Creating
4.	(i) Invent the different types of surface electrodes and discuss its applications. (10) (ii) Elaborate the steps for the typical recording setup of EMG with diagram. (5)	BTL 6	Creating

UNIT II - BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT			
pH, PO ₂ , PCO ₂ , Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.			
PART A			
Q.No	Questions	BT Level	Competence
1.	State the principle behind Rheographic method of blood pressure measuring technique.	BTL 1	Remembering
2.	Justify the meaning of pH value of blood.	BTL 5	Evaluating
3.	Infer the measurement method of PO ₂ and PCO ₂ .	BTL 2	Understanding
4.	Define stroke volume of heart.	BTL 1	Remembering
5.	Identify the use of auto analyzer in medical field and types of test performed using it.	BTL 3	Applying
6.	Elaborate the principle used in pulse rate measurement.	BTL 6	Creating
7.	What is colorimeter? State its use.	BTL 1	Remembering
8.	Summarize the merits & demerits of electromagnetic blood flow meter.	BTL 2	Understanding
9.	Examine auto fiber optic temperature sensor.	BTL 4	Analyzing
10.	Name any 4 physical principles based on which blood flow meters are constructed.	BTL 2	Understanding
11.	What are the typical values of blood pressure and pulse rate of an adult.	BTL1	Remembering
12.	Develop the stroke volume in millimeters if the cardiac output is 5.2 litres/minute and heart rate is 76 beats/minute.	BTL 3	Applying
13.	Demonstrate the methods of measurement of cardiac output.	BTL 2	Understanding
14.	List out the components of blood.	BTL 4	Analyzing
15.	Assess the use of Flame photometer.	BTL 5	Evaluating
16.	Describe the cardiac output. What are the methods used to measure cardiac output?	BTL 1	Remembering
17.	Compile the demerits of indirect method of blood pressure measurement.	BTL 6	Creating
18.	Organize the importance of Plethysmographs.	BTL 3	Applying
19.	How is the respiration rate measured?	BTL 1	Remembering
20.	Analyze the term “Korotkoff sounds” and total lung capacity.	BTL 4	Analyzing
PART – B			
1.	Examine the principle of following: (i) Filter Photometer (7) (ii)PO ₂ measurement (6)	BTL 4	Analyzing
2.	Explain the following techniques with necessary diagram: (i) pCO ₂ measurement principle (7) (ii) Dye dilution (6)	BTL 2	Understanding

3.	Discuss about the measurement of pH and pO ₂ of the blood with the help of neat diagram. (13)	BTL 6	Creating
4.	How would you describe about spirometer and blood cell counter with neat block diagram. (13)	BTL 1	Remembering
5.	Interpret the working principle of electromagnetic blood flow meter. What are its advantages and disadvantages? (13)	BTL 2	Understanding
6.	Explain the different techniques used in the measurement of pulse rate. (13)	BTL 2	Understanding
7.	Describe in detail the principle of calorimeter with neat diagram. (13)	BTL 1	Remembering
8.	Explain the working principle of conductive method blood cell counter with its construction details. (13)	BTL 5	Evaluating
9.	(i) Analyse the measurement of pH of blood using PH meter. (7) (ii) Classify the temperature measurement methods. (6)	BTL 4	Analyzing
10.	Inspect the parameter with suitable figures and explain how pH, pCO ₂ and pO ₂ are measured? (13)	BTL 4	Analyzing
11.	(i) Identify the method for cardiac output measurements. (9) (ii) Construct the need for blood pH measurement. (4)	BTL 3	Applyv
12.	How would you use the ultrasonic waves in measuring, (i) Blood Flow (7) (ii) Blood pressure (6)	BTL 3	Applying
13.	(i) Which device is used to measure the Lung capacity and volume with neat diagram and explain its operations? (7) (ii) Show the measurement of heart sound with suitable diagram. (6)	BTL 1	Remembering
14.	(i) What is the principle of sphygmomanometer and explain the operation? (7) (ii) How is the pulse rate measured? (6)	BTL 1	Remembering

PART – C

1.	Assess the principle of coulter counter and with block diagram explain multi parameter coulter counter. (15)	BTL 5	Evaluating
2.	Summarize the different types of ultrasonic blood flow meter? Explain each in detail. (15)	BTL 5	Evaluating
3.	Invent the term “Cardiac output”. How is Cardiac output measured by dye dilution technique? Explain. (15)	BTL 6	Creating
4.	Develop auscultatory blood pressure measurement and write its advantages and disadvantages. (15)	BTL 6	Creating

UNIT III ASSIST DEVICES			
Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.			
PART A			
Q.No	Questions	BTL Level	Competence
1.	Interpret the need for using a cardiac pacemaker.	BTL 2	Understanding
2.	What are the two parts of pacemaker?	BTL 1	Remembering
3.	Classify the types of Pacemaker.	BTL 2	Understanding
4.	List the types of batteries used for implantable pacemaker.	BTL 1	Remembering
5.	Why do we require a synchronization function in defibrillator?	BTL 1	Remembering
6.	Differentiate internal and external defibrillator.	BTL 4	Analyzing
7.	Draw the schematic diagram of a d.c defibrillator.	BTL 3	Applying
8.	Define LVAD.	BTL 1	Remembering
9.	State dialysate and mention its composition.	BTL 1	Remembering
10.	Infer the function of membrane in the dialysis process.	BTL 2	Understanding
11.	Inspect the mechanism of respiration and need for use of artificial ventilation.	BTL 4	Analyzing
12.	Write the function of a ventilator.	BTL 1	Remembering
13.	Calculate the energy stored in $16 \mu\text{F}$ capacitor of a DC defibrillator that is charged to a potential of 5000Vdc.	BTL 5	Evaluating
14.	Identify the types of imaging sequences.	BTL 3	Applying
15.	Deduct the basic components of an NMR imaging system.	BTL 6	Creating
16.	Evaluate the biological effects of MRI imaging modality.	BTL 5	Evaluating
17.	List the advantages of Nuclear Magnetic Resonance and ultrasonic imaging system.	BTL 4	Analyzing
18.	Express characteristic impedance in ultrasound.	BTL 3	Applying
19.	Summarize the advantages of an ultrasound imaging system.	BTL 2	Understanding
20.	Explain the role of frequency, focusing and active element diameter with reference to ultrasound transducers.	BTL 6	Creating
PART B			
1.	(i) How pacemakers are classified based on the modes of operation? (6) (ii) Show the block diagram of stand by and demand pacemakers and explain its working principle. (7)	BTL 1	Remembering
2.	Illustrate the following types of pacemakers with diagram. (i) Demand pacemaker. (6) (ii) Atrial Synchronous pacemaker. (7)	BTL 2	Understanding

3.	Explain the heart lung machine with neat block diagram and discuss about the different types of oxygenators. (13)	BTL 3	Applying
4.	(i) Propose the difference between haemodialysis and peritoneal dialysis. (6) (ii) Elaborate about a haemodialysis machine with the help of block diagram. (7)	BTL 6	Creating
5.	(i) Demonstrate the principle and operations of DC defibrillators. (8) (ii) Identify the advantages and disadvantages of DC defibrillator. (5)	BTL 3	Applying
6.	Write a brief note on: (i) Implantable defibrillator. (6) (ii) LVAD. (7)	BTL 1	Remembering
7.	Elaborate the principle of Nuclear Magnetic Imaging system with the help of appropriate illustrations. (13)	BTL 6	Creating
8.	Draw a block diagram of microprocessor controlled ventilator and analyze the importance of each block. (13)	BTL 4	Analyzing
9.	(i) Interpret the image reconstruction techniques used in NMR imaging. (8) (ii) What is the commonly used method in modern scanners. (5)	BTL 4	Analyzing
10.	(i) Estimate the various imaging modes of ultrasound imaging system. (8) (ii) Distinguish between 'A' and 'B' mode of ultrasound imaging system. (5)	BTL 5	Evaluating
11.	Write the function of a ventilator. How many types of ventilators are there? Explain with the help of diagrams. (13)	BTL 1	Remembering
12.	(i) Outline the significance of relaxation process in MRI imaging and compare T_1 and T_2 relaxation times. (7) (ii) Discuss about FID. (6)	BTL 2	Understanding
13.	Describe with the help of a diagram the various building blocks of a basic pulse-echo apparatus. (13)	BTL 2	Understanding
14.	Discuss the working principle of linear array scanner with the help of a block diagram. (13)	BTL 4	Analyzing
PART C			
1.	(i) Deduct the various types of implantable pacemakers and explain their functions with necessary diagrams. (10) (ii) Demonstrate the two types of electrode system used in implantable pacemaker. (5)	BTL 5	Evaluating
2.	Evaluate the principle of dialysis in the artificial kidney. What are the different types of dialyzers? Explain their construction and principle of operation. (15)	BTL 5	Evaluating
3.	Elaborate a real time ultrasound imaging system. What are the special requirements of real time imaging systems? (15)	BTL 6	Creating

4.	Discuss the following in detail (i) Intravascular imaging. (ii) Tissue harmonic imaging.	(7) (8)	BTL 6	Creating
UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY				
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.				
PART A				
Q.No	Questions		BTL Level	Competence
1.	Write the principle of high frequency heat therapy.		BTL 1	Remembering
2.	State the term Diathermy.		BTL 1	Remembering
3.	Draw a circuit diagram of a short wave diathermy unit.		BTL 4	Analyzing
4.	Why do require automatic tuning in a short wave diathermy machine?		BTL 6	Creating
5.	Analyze the features of Ultrasonic type diathermy.		BTL 4	Analyzing
6.	Define desiccation and haemostasis.		BTL 1	Remembering
7.	Show a block diagram of an ultrasonic therapy unit.		BTL 2	Understanding
8.	List the applications of diathermy.		BTL 1	Remembering
9.	Identify two main circuits in a short wave diathermy machine.		BTL 2	Understanding
10.	Interpret the various ways of regulating the intensity of current supplied to the patient from a short wave diathermy machine.		BTL 3	Applying
11.	Classify shortwave and microwave diathermy.		BTL 4	Analyzing
12.	What are the two designs of applicators in microwave diathermy?		BTL 1	Remembering
13.	Compare the heat distribution in the body tissues with short wave and microwave Diathermy.		BTL 5	Evaluating
14.	Evaluate the common modulation methods used in biotelemetry system.		BTL 5	Evaluating
15.	Discuss the applications of Bio-Telemetry.		BTL 6	Creating
16.	Organize the choices of radio carrier frequency for medical telemetry purposes.		BTL 3	Applying
17.	Construct a block diagram of ECG telemetry transmitter.		BTL 3	Applying
18.	Outline various components of the radio telemetry system.		BTL 2	Understanding
19.	Summarize the different elements in Bio-Telemetry.		BTL 2	Understanding
20.	How do we control the dosage in ultrasonic therapy units?		BTL 1	Remembering
PART B				
1.	Define diathermy. Draw the circuit diagram of a short-wave diathermy unit and discuss its impact on therapy purpose in detail. Also briefly describe how it can be applied to human subjects?	(13)	BTL 1	Remembering

2.	(i) Interpret the application techniques in short- wave diathermy machines. (8) (ii) Why the pulsed therapy is preferred? (5)	BTL 2	Understanding
3.	(i) Explain the principle of heating using microwaves. (5) (ii) Elaborate the working of microwave diathermy machine with the help of a simplified circuit diagram. (8)	BTL 6	Creating
4.	(i) With a block diagram, evaluate the working function of ultrasonic therapy. (8) (ii) what are the advantages of using ultrasonic for therapeutic purposes? (5)	BTL 5	Evaluating
5.	Illustrate the following with respect to ultrasonic therapy unit (i) Dosage control. (6) (ii) Application technique. (7)	BTL 2	Understanding
6.	(i) Summarize the modulation and coding techniques used in bio-telemetry system. (5) (ii) Demonstrate the working of pulse width modulator system with a help of circuit diagram. (8)	BTL 2	Understanding
7.	Describe the working principle of single channel ECG telemetry system with a block diagram. (13)	BTL 1	Remembering
8.	(i) Analyze which type of modulation system is used in a multichannel bio-telemetry system? (5) (ii) Explain the multiplexing methods commonly used in multichannel bio-telemetry systems. (8)	BTL 4	Analyzing
9.	How to transmit bio-signals over telephone lines? Explain a single channel telephone telemetry system with the help of a diagram. (13)	BTL 1	Remembering
10.	Write a brief note on: (i) Telemetry of ECG and Respiration. (6) (ii) Multi Patient Telemetry. (7)	BTL 1	Remembering
11.	Draw a block diagram of a generalized FM telemetry transmitter and receiver and discuss the working in detail. (13)	BTL 3	Applying
12.	Experiment an implantable blood flowmeter based on ultrasonic Doppler shift principle. (13)	BTL 3	Applying
13.	Examine the various components of the radio telemetry system with a block diagram of the internal radio telemetry capsule. (13)	BTL 4	Analyzing
14.	Inspect biotelemetry application on WIMAX networks with necessary diagrams. (13)	BTL 4	Analyzing
PART C			
1.	Evaluate the various types of High frequency heat therapy for healing injured tissues. (15)	BTL 5	Evaluating
2.	Explain the different methods of applying electrodes in shortwave diathermy treatment. (15)	BTL 5	Evaluating
3.	Develop an implantable telemetry system for flow, pressure and ECG measurements. (15)	BTL 6	Creating

4.	Elaborate the working of three channel telephone transmitter and receiver with the help of a block diagram. (15)	BTL 6	Creating
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UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION

Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine.

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

PART A

Q. No	Questions	BT Level	Competence
1.	Define BMI.	BTL 1	Remembering
2.	Analyze the principle of BMI method and list its applications.	BTL 4	Analyzing
3.	Give the advantages of Insulin pumps.	BTL 2	Understanding
4.	List out the feature of lab on chip.	BTL 1	Remembering
5.	Develop some few applications BMI based system.	BTL 3	Applying
6.	Label the parts of an endomicroscopy.	BTL 1	Remember
7.	Summarize the necessary Parameters of cell signaling in the CNS.	BTL 2	Understanding
8.	Identification the framework of BMIs.	BTL 3	Applying
9.	Mention the advantages of performance of lab on chip module.	BTL 4	Analyzing
10.	Show any one of the implantable infusion system.	BTL 1	Remembering
11.	Illustrate the uses of component used in an implantable insulin pump.	BTL 2	Understanding
12.	Can you recall the principle of telemedicine?	BTL 1	Remembering
13.	Write the working principle of radio pill.	BTL 1	Remembering
14.	Illustrations of condition number and nonstationary properties of the input autocorrelation matrix.	BTL 3	Applying
15.	Discuss the applications passive pumping device of LOC.	BTL 6	Creating
16.	Compare the merits and demerits of various feature of BMI.	BTL 5	Evaluating
17.	Outline the simplified block diagram of insulin pump equipment.	BTL 2	Understanding
18.	Point out the applications of Endomicroscopy method.	BTL 4	Analyzing
19.	Conclude the applications of telemedicine in health care.	BTL 6	Creating
20.	Justify the term Telemedicine for remote diagnosis and treatment in hospital.	BTL 5	Evaluating

PART – B

1.	Explain the telemedicine based communication method with a suitable block diagram. (13)	BTL 5	Evaluating
2.	Describe the working principle of implantable type infusion system. (13)	BTL 1	Remembering
3.	Summarize the need for each of the essential components in an endmicroscope & its applications. (13)	BTL 2	Understanding
4.	Discuss on the design procedure involve in the BMI with neat diagram. (13)	BTL 6	Creating
5.	Categorize the detailed description of about infusion pumps system. (13)	BTL 4	Analyzing

6.	(i) Demonstrate about radio pills explain with necessary diagram. (9) (ii) Give some applications radio pills in recent trend medicine field.(4)	BTL 2	Understanding
7	(i) Illustrate the different operations performed using endomicroscopy. (5) (ii) Develop and explain the block diagram of LOC. (8)	BTL 3	Applying
8.	Show the various component used in an implantable insulin pump. (13)	BTL 1	Remembering
9.	(i) Define the nonlinear mixture of competitive linear models in BMI. (7) (ii) Can you recall about Reaching task neuronal sensitivities sorted from minimum to maximum for a movement in Sensitivity-Based Pruning. (6)	BTL 1	Remembering
10.	(i) List out the LOC applications. (8) (ii) Inspect the salient features of Insulin pumps. (5)	BTL 4	Analyzing
11.	Write brief notes on the working principle of: (i) Programmable volumetric infusion pump. (7) (ii) Drop rate counter type infusion system (6)	BTL 1	Remembering
12.	Construct and discuss the working of an endomicroscopic unit. (13)	BTL 3	Applying
13.	A LOC how to diagnosis HIV. Find out design procedure for HIV test using LOC. (13)	BTL 4	Analyzing
14.	i) Write notes on BMI. (5) ii) Explain how telemedicine helps the patients and medical practitioners. (8)	BTL 2	Understanding
PART – C			
1.	(i) Explain the various type of insulin pups system in recent trend medicine. (10) (ii) Conclude the specific advantages of insulin pumps. (5)	BTL 5	Evaluating
2.	(i) Summarize the benefits and limitations of telemedicine. (7) (ii) Assess the importance of LOC in recent trend medicine. (8)	BTL 5	Evaluating
3.	Elaborate the principle of operation and application of Radio pill. (15)	BTL 6	Creating
4.	Compile the basic application of BMI to implement different motor function interconnection between brains to hand and leg. (15)	BTL 6	Creating