BME ⑤

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	List the major sources of medical waste.	2	K1	CO1
2.	What is waste minimization? How it is to be done?	2	K2	CO1
3.	What is Hazardous Material?	2	K2	CO2
4.	When Respiratory Protection is given to the patient?	2	K3	CO2
5.	How to prevent lip, Trip, and Fall Prevention?	2	K3	CO3
6.	Describe the method of providing electrical safety with example.	2	K3	CO3
7.	List the types of incinerators.	2	K2	CO4
8.	Describe Dry Thermal Treatment and give example.	2	K2	CO4
9.	What are the Disinfectants applied in Hospital?	2	K2	CO5
10.	How dos infections will spread in hospital?	2	K2	CO5

1

PART – B

Q.No.		Questions	Marks	KL	CO
11.	a)	Explain in detail on categories and classification of biomedical waste.	13	K2	CO1
		(OR)			
	b)	Explain the process of collection, storage, transportation, treatment and disposal of biomedical waste.	13	K3	CO1
12.	a)	Describe			
		i. OSHA Hazard Communication Standard	6	K3	CO2
		ii. DOT Hazardous Material Regulations	7		
		(OR)			
	b)	Explain the operation of Medical Gas Systems very big Hospital.	13	K2	CO2
13.	a)	Discuss in detail on Facility safety Guidelines in hospital.	13	K3	CO3
		(OR)			
	b)	Explain how to provide Heating, Ventilating, and Air-Conditioning Systems in hospital.	13	K3	CO3
14.	a)	i. Differentiate open burning and incineration	5	K2	CO4
		ii. Describe the waste Characteristics for Incineration.	8		
		(OR)			
	b)	Describe the Managing Waste Water from Health Care Facilities.	13	K2	CO4
15.	a)	Explain method of infection control in hospital.	13	K3	CO5
		(OR)			
	b)	Explain the method of providing patient safety in hospital.	13	K3	CO5

PART – C

Q.No.		Questions	Marks	KL	CO
16.	a)	Describe the management of Wastes from Immunization.	15	K2	CO2
		(OR)			
	b)	Discuss the operation of different types incinerators used for hospital waste incineration.	15	K2	CO2

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12005

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fifth Semester
Biomedical Engineering
U19BM510 – BIOMEDICAL INSTRUMENTATION
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define biopotential electrodes and its types, also draw its equivalent circuits.	2	K1	CO1
2.	What is half-cell potential?	2	K2	CO1
3.	Draw Einthoven triangle and mention the electrode position.	2	K2	CO2
4.	Can we perform defibrillation if the person has a pacemaker?	2	K3	CO2
5.	What is bio-amplifier and what are its types?	2	K2	CO3
6.	State the need for impedance matching.	2	K2	CO3
7.	Define pH. Give its range for human blood.	2	K4	CO4
8.	What is the average resting cardiac output of human male and female?	2	K2	CO4
9.	What is a biosensor explain its principles?	2	K1	CO5
10.	What is the need of blood gas analyzers?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	What are the different types of biopotential electrode and explain any two with diagram?	13	K2	CO1

(OR)

	b)	Briefly, explain about Nernst Relation and draw the Equivalent circuit for bio-potential electrode?	13	K2	CO1
12.	a)	Illustrate about the 10-20 electrode system implemented for EEG signal recording.	13	K2	CO2
		(OR)			
	b)	Write down the working mechanism of electromyography with block diagram.	13	K2	CO2
13.	a)	Explain the Mechanical Chopper Amplifier and Non-Mechanical Chopper Amplifier and its advantages.	13	K2	CO3
		(OR)			
	b)	Demonstrate the right leg driven ECG amplifier with circuit diagram?	13	K2	CO3
14.	a)	What is the principle, applications, and limitations of electromagnetic blood flow meters?	13	K2	CO4
		(OR)			
	b)	Briefly explain the indirect methods of measuring blood pressure?	13	K2	CO4
15.	a)	What are the amperometric and voltametric techniques and explain with example?	13	K2	CO5
		(OR)			
	b)	What is the Ion selective Field effect Transistor pH sensor (ISFET) and its working principle also draw the block diagram?	13	K2	CO5

PART- C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	You are employed by a hospital research unit on a certain project to measure blood pressure and flow in the artery of an anesthetized dog lying on an operating table. Considering this situation, describe the transducers used and necessary instrumentation systems to support them, the medical methods used to ensure appropriate physiological measurements and comment on calibration of blood pressure measurement system suggested by you.	15	K4	CO2
		(OR)			
	b)	You are a biomedical engineer tasked with designing a biosensor for continuous glucose monitoring in diabetic patients. Discuss the principles behind biosensors, including the type of recognition elements and transducers commonly used in glucose biosensors. Describe the design considerations and challenges specific to glucose monitoring, and propose a hypothetical roadmap for the development, testing, and commercialization of this biosensor.	15	K5	CO3

2

Reg.No.: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12004

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Seventh Semester
Biomedical Engineering
U19BM717 – RADIOLOGICAL EQUIPMENTS
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	How does an X ray tube operate?	2	K2	CO1
2.	Identify the relationship of line focus principles with anode heel effect.	2	K2	CO1
3.	Helical CT is most preferred over conventional CT scan- Justify the statement.	2	K4	CO2
4.	List the different generations of CT scan.	2	K1	CO2
5.	Differentiate between longitudinal and transverse magnetization in MRI.	2	K2	CO3
6.	Relate the role of fMRI in brain scan technique.	2	K2	CO3
7.	List the components of an Anger scintillation camera.	2	K1	CO4
8.	Predict a suitable method to estimate total body potassium.	2	K4	CO4
9.	Infer the role of LINAC machine in radiotherapy.	2	K2	CO5
10.	Write a short note on ALARA principle.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Elaborate the various causes of X-ray tube failure.	13	K2	CO1

(OR)

1

	b)	i.	Compare and contrast Cine Angiography and Digital subtraction Angiography.	8	K4	CO1
		ii.	Exemplify the principle and applications of Digital fluoroscopy.	5	K2	
12.	a)	i.	Outline the basic physical principles and clinical applications of Computed tomography.	8	K2	CO2
		ii.	Interpret the different reasons behind why computed radiography is most preferred over film screen radiography.	5	K4	

(OR)

	b)	i.	Tabulate the major differences between conventional imaging equipment and digital imaging equipment.	5	K2	CO2
		ii.	Depict the back projection algorithm in image reconstruction.	8	K2	
13.	a)	i.	Paraphrase the basic concept and fundamental principle of magnetic resonance in medical imaging.	8	K2	CO3
		ii.	Comment on T1 and T2 relaxation process in MRI.	5	K2	

(OR)

	b)	i.	Classify the different system magnets employed in MRI and brief each.	8	K2	CO3
		ii.	Express the importance of RF shimming in MRI.	5	K2	
14.	a)	i.	Narrate the procedure of radionuclide myocardial perfusion imaging.	5	K2	CO4
		ii.	Suggest some of the suitable non imaging techniques to investigate glomerular filtration rate and explain any ONE in detail.	8	K4	

(OR)

	b)	i.	Explain the role of SPECT in nuclear medicine. Brief on its merits and demerits.	10	K2	CO4
		ii.	Tabulate the applications of Radionuclide imaging in nuclear medicine.	3	K2	
15.	a)	i.	Demonstrate the different modern approaches employed in radiation therapy.	10	K2	CO5
		ii.	Substantiate the advantages of Radiation therapy over conventional treatment techniques.	3	K4	

(OR)

	b)	i.	Illustrate the working principle of Thermo Luminescent dosimeters.	8	K2	CO5
		ii.	Predict the mechanism of Telegamma machine in detecting localized tumours.	5	K4	

PART – C

Q.No.	Questions	Marks	KL	CO
16. a)	With a neat schematic diagram, explain the working principle of mammography.	15	K4	CO1
	(OR)			
b)	With an example case study, explain the application of computed tomography in 3D imaging.	15	K4	CO2

Reg.No.: | | | | | | | | | | | | |

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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12007

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fifth Semester
Biomedical Engineering
U19BMV18 – MACHINE LEARNING TECHNIQUES IN MEDICINE
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define machine intelligence.	2	K1	CO1
2.	List three types of algorithms commonly used in machine learning.	2	K1	CO1
3.	What is data privacy?	2	K2	CO2
4.	What are the key components of the machine learning cycle?	2	K2	CO2
5.	What is the use of Bayesian network in machine learning?	2	K2	CO3
6.	Define decision trees.	2	K1	CO3
7.	List little advancement in radiotherapy through machine learning.	2	K2	CO4
8.	Name the methods used to compensate for breathing motion during radiation therapy.	2	K1	CO4
9.	What is a fully automated blood smear analysis system?	2	K2	CO5
10.	Name few applications where machine learning detects objects in hematological cytology.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Explain the significance of data preprocessing in machine learning and how it contributes to model performance. Discuss about its techniques.	13	K3	CO1

(OR)

b)	Compare and contrast Classification and regression in machine learning. Mention various algorithms under them and provide examples of real-world applications for each.	13	K3	CO1

1

12.	a)	Create a step-by-step guide for building an effective data team for a machine learning project, defining roles and responsibilities.	13	K6	CO2
		(OR)			
	b)	Explain the different data storage solutions for machine learning, highlighting their advantages and disadvantages.	13	K2	CO2
13.	a)	Analyze the decision-making capabilities of decision trees, considering their advantages and limitations.	13	K4	CO3
		(OR)			
	b)	Explain the concepts of Bayes' theorem and graph theory as they relate to Bayesian networks, with examples to clarify their significance.	13	K2	CO3
14.	a)	Explain the role of machine learning in detecting and predicting errors in radiotherapy. Discuss how machine learning models can enhance patient safety and treatment accuracy.	13	K3	CO4
		(OR)			
	b)	Explain in detail about the concept of image-based motion correction in radiotherapy.	13	K3	CO4
15.	a)	Evaluate the contributions of machine learning to the accuracy and efficiency of hematological cytology applications. Provide examples of how automation benefits clinical practice.	13	K2	CO5
		(OR)			
	b)	Explain recent advances in automated analysis steps within hematological cytology applications using machine learning.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Imagine you are a radiation therapist at a cancer treatment center. You have been tasked with implementing a machine learning system to detect and prevent errors in the radiotherapy process. Develop a case study detailing the challenges in radiotherapy error detection, the types of data needed, and the machine learning techniques that can be applied to achieve this goal. Provide examples of how machine learning has been successfully used in similar healthcare settings.	15	K4	CO4
		(OR)			
	b)	You work for a medical laboratory that specializes in hematological cytology. Your laboratory wants to transit to a fully automated blood smear analysis system using machine learning. Create a case study outlining the objectives of this transition, the technical requirements, and the potential benefits to patient care and laboratory efficiency. Include a discussion on the challenges and considerations involved in implementing such a system.	15	K4	CO5

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Question Paper Code: 12011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fourth Semester
Biomedical Engineering
U19BM406 – MEDICAL PHYSICS
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	State the physiological property of Electromagnetic waves.	2	K2	CO1
2.	Mention any four applications of electromagnetic spectrum.	2	K1	CO1
3.	List the different types of senses.	2	K1	CO2
4.	Define color blindness.	2	K1	CO2
5.	Define the term specific ionization.	2	K1	CO3
6.	What is meant by half-life period?	2	K2	CO3
7.	How does pair production occur?	2	K2	CO4
8.	What is Compton scattering?	2	K1	CO4
9.	What is meant by scintillation decay time?	2	K1	CO5
10.	State the purpose of a Geiger–Muller Counter.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Explain the different types of Non-Ionizing radiation in detail.	13	K2	CO1
	(OR)			
b)	Explain the various biological effects of low frequency non-ionizing radiations.	13	K3	CO1

12.	a)	Explain the physics of cutaneous sensation and its characteristics in detail.	13	K3	CO2
		(OR)			
	b)	Explain the physics of vision and its characteristics in detail.	13	K2	CO2
13.	a)	What is radionuclide generator? Explain radionuclide Generator and Technetium generator.	13	K2	CO3
		(OR)			
	b)	What is radioactive decay? Explain alpha, beta and gamma decay with suitable examples.	13	K3	CO3
14.	a)	Explain briefly about 　i.　Photoelectric effect 　ii.　Compton Scattering, 　iii.　Pair production and 　iv.　Attenuation of Gamma Radiation.	13	K2	CO4
		(OR)			
	b)	Write in detail about the interaction of neutron with matter and their clinical significance.	13	K2 K3	CO4
15.	a)	Describe the operational principles of a gamma camera using a neat block diagram.	13	K2	CO5
		(OR)			
	b)	Describe the principles of gas-filled detectors with a neat diagram.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Explain the construction and working of cyclotron particle accelerator with neat diagram.	15	K3	CO3
		(OR)			
	b)	Explain in detail about the methods, principles involved and standards followed in measuring Human's audition, vision and psychophysics levels.	15	K4	CO2

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Reg.No.: ☐☐☐☐☐☐☐☐☐☐☐☐☐

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12012

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fourth Semester
Biomedical Engineering
U19BM407 – PATHOLOGY AND MICROBIOLOGY
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define Cell injury	2	K1	CO1
2.	Define Neoplasia.	2	K1	CO1
3.	What is meant by ischemia?	2	K1	CO2
4.	What is coagulation?	2	K1	CO2
5.	Draw the structure of bacteria and label its parts.	2	K2	CO3
6.	Define the term growth curve.	2	K1	CO3
7.	Differentiate between light field and dark field microscope.	2	K1	CO4
8.	What is phase contrast? Give its uses.	2	K3	CO4
9.	Define the term: Auto-immune disorder.	2	K1	CO5
10.	Define the term opsonization.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Elaborate in the types of pathological calcification.	13	K1	CO1

(OR)

1

	b)	Explain the following with its types:
		   i. Autopsy
		   ii. Biopsy
			13	K1	CO1

12.	a)	Define and explain in detail about Bleeding disorders.	13	K1	CO2
		(OR)			
	b)	Define and explain in detail about Chronic venous congestion.	13	K1	CO2
13.	a)	Explain in detail about culture media and its types.	13	K2	CO3
		(OR)			
	b)	Define endogenous and exogenous infections. Discuss about them in detail.	13	K1	CO3
14.	a)	Explain the various Staining methods.	13	K1	CO4
		(OR)			
	b)	Explain the process involved in the preparation of samples for electron microscope.	13	K3	CO4
15.	a)	Elaborate on types of Hypersensitivity reactions involved in anaphylactic shock.	13	K2	CO5
		(OR)			
	b)	Discuss in detail about Auto-immune disorders and its concepts and its classification.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	A patient's lung is infected with a respiratory virus. How do you diagnose using microscopy and immunological techniques?	8	K5	CO3
		ii.	Describe the involvement of immunity upon a virus infection.	7	K4	
			(OR)			
	b)		Describe the process of fracture healing.	15	K2	CO1

2

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Compare deterministic and random signal.	2	K3	CO1
2.	Check the dynamicity and causality of the system $y(n) = x(2n)$.	2	K4	CO1
3.	State the condition for convergence of Fourier series.	2	K1	CO2
4.	Find the Laplace transform of the signal $x(t) = e^{-at}u(t)$.	2	K3	CO2
5.	List the properties of convolution integral.	2	K2	CO3
6.	Determine the impulse response of the system $H(s) = \frac{1}{(s+9)}$.	2	K3	CO3
7.	Find the Nyquist rate of the signal $x(t) = \sin(200\pi t) + 3sin^2(100\pi t)$ in Hz.	2	K3	CO4
8.	State the relation between DTFT and Z-transform.	2	K2	CO4
9.	Convolve the two sequences $x(n) = \{1, 2, 3\}, h(n) = \{5, 4, 6, 2\}$.	2	K3	CO5
10.	What are the advantages of states pace model over that of transfer function model?	2	K1	CO5

PART – B

Q. No.		Questions	Marks	KL	CO

11. a) i. Find the fundamental period T of the continuous time signals mentioned below. — K2 CO1

a. $y(t) = 20\cos(10\pi t + \frac{\pi}{4})$ — 4

b. $x(n) = 2\cos\left(\frac{\pi n}{4}\right) + \sin\left(\frac{\pi n}{8}\right) - 2\cos\left(\frac{\pi n}{2} + \frac{\pi}{6}\right)$ — 4

ii. Find the power and RMS value of the following signals — 5

a. $y(t) = 5\cos(50t + \frac{\pi}{3})$

b. $y(t) = 10\cos 5t * \cos 10t$

(OR)

b) Show that the following system are linear or nonlinear, time invariant or variant , causal or non causal, stable or unstable — K3 CO1

a. $y(n) = x(n) - x(n-1)$ — 6.5

b. $y(t) = \frac{d}{dt}x(t)$ — 6.5

12. a) Find the trigonometric Fourier series representation of a periodic signal $x(t) = t , 0 \le t \le 1$ and repeats every1 sec. — 13 K3 CO2

(OR)

b) i. Find the Fourier transform of $x(t) = e^{-at}u(t), a > 0$. Plot the magnitude and phase spectrum. — 7 K3 CO2

ii. Find the inverse Laplace transform for the function — 6

$X(s) = \frac{1}{s(s+1)}$.

13. a) Compute and plot the convolution of the given signals — K4 CO3

i. $x(t) = u(t-3) - u(t-5),\ h(t) = e^{-3t}u(t)$ — 7

ii. $x(t) = u(t), h(t) = e^{-t}u(t)$ — 6

(OR)

b) i. The input and output of causal continuous time LTI system is related by the differential equation — 8 K3 CO3

$\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = 2x(t)$

Find the impulse response of the system.

ii. Explain the state space response of the system. — 5

14. a) State and prove the sampling theorem and discuss about the aliasing effect. — 13 K1 CO4

(OR)

b) Find the inverse Z-Transform of — 13 K3 CO4

$X(z) = \frac{z(z-1)}{(z+1)(z+2)^3}$ $ROC\ |z| > 2$.

15. a) A difference equation of a discrete time system is given by — 13 K4 CO5

$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$

Draw direct form-I and direct form-II structure.

2

(OR)

b) An LTI system characterized by the system function   13   K3   CO5

$$H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}-1.5z^{-2}}.$$

Specify ROC of H(Z) and determine h(n) for the following conditions

    i.   The system is causal b) The system is stable
    ii.   ii) The system is non causal.

PART – C

(1 x 15 = 15 Marks)

Q. No.	Questions	Marks	KL	CO
16. a)	Sketch the following signals		K4	CO1

    i.   *u(-t+2)*   3.5
    ii.   *r(-t+3)*   3.5
    iii. *2δ(n+2)+δ(n)-2δ(n-1)+ 3δ(n-3)*   4
    iv. *u(n+2)u(-n+3)*   4

where u(t), r(t), δ(n), u(n) represent continuous time unit step, ramp, discrete time impulse and unit step functions respectively.

(OR)

b) The state variable description of the system is given as   15   K4   CO5

$$A = \begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0 \\ 2 \end{pmatrix} \quad C = [3\ 0] \quad D = [0]$$

determine the transfer function of the system.

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fifth Semester
Biomedical Engineering
U19BM509 - BIO CONTROL SYSTEMS
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

| Q.No.	Questions	Marks	KL	CO
1.	Compare the open loop and closed loop system.	2	K2	CO1
2.	Write the Mason's gain formula.	2	K1	CO1
3.	State the condition for stability.	2	K1	CO2
4.	Draw the impulse response of the following system $G(S) = \dfrac{A}{S^2 + b^2}$.	2	K3	CO2
5.	Write the Nyquist stability criterion.	2	K2	CO3
6.	What is constant M circle?	2	K1	CO3
7.	State the need for physiological modeling.	2	K2	CO4
8.	Draw the simple electrical model of Lung.	2	K2	CO4
9.	Draw the model of neuromuscular reflex motion.	2	K2	CO5
10.	Differentiate transient response and steady state response.	2	K1	CO5

PART – B
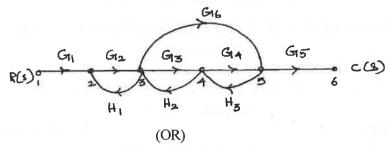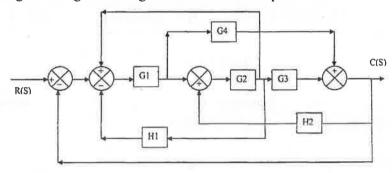
Q.No.		Questions	Marks	KL	CO
11.	a)	Determine the overall gain of the system whose signal flow graph is as shown.	13	K3	CO1

(OR)

| | b) | Obtain the transfer function of the system shown by the block diagram using block diagram reduction techniques. | 13 | K3 | CO1 |

| 12. | a) | A unity feedback control system has an open loop transfer function $G(S) = \frac{10}{s(s+2)}$. Find the rise time, percentage overshoot, peak time, time delay and settling time for a step input of 12 units. | 13 | K3 | CO2 |

(OR)

| | b) | Using Routh criterion, determine the stability of the system represented by the characteristic equation, $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Comment on the location of the roots of characteristic equation. | 13 | K3 | CO2 |

| 13. | a) | A unity feedback system has $G(S) = \frac{400}{S(S+4)(S+10)}$. Draw the Bode plot. Determine the phase margin and gain margin. | 13 | K3 | CO3 |

(OR)

| | b) | The open loop transfer function of a unity feedback system is given by G(S) = 1 / s (1+s) (1+2s). Sketch the polar plot, determine the gain margin and phase margin. | 13 | K3 | CO3 |

2

14.	a)	Describe the linear model of respiratory mechanics.	13	K3	CO4
		(OR)			
	b)	Explain the block diagram model of blood pressure control system.	13	K3	CO4
15.	a)	With the help of suitable diagram, explain in detail about regulation of cardiac output.	13	K3	CO5
		(OR)			
	b)	Draw the schematic block diagram of circulatory control model and analyze its frequency response.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	Draw the block diagram representation of muscle stretch reflex system and explain.	15	K3	CO5
	(OR)			
b)	Explain in detail the feedback mechanism associated with Cortisol regulation in endocrine system.	15	K3	CO5

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Seventh Semester
Biomedical Engineering
U19BM716 – DIAGNOSTIC AND THERAPEUTIC EQUIPMENT - II
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	State the importance of infusion pump in an ICU.	2	K1	CO1
2.	Mention the primary advantage of radiotelemetry over traditional wired monitoring systems.	2	K2	CO1
3.	Identify the advantages of diathermy over other heating modalities, like hot packs or warm compresses.	2	K2	CO2
4.	Provide examples of conditions where microwave diathermy is particularly effective.	2	K4	CO2
5.	How does ultrasound differ from other medical imaging techniques like X-rays or MRI?	2	K2	CO3
6.	Given that the speed of sound in soft tissue is approximately 1540 meters per second (m/s), calculate the time it takes for an ultrasound wave to travel 5 centimeters (cm) into the tissue and return to the transducer.	2	K3	CO3
7.	State the purpose of the oxygenator in the heart-lung machine, and how does it work.	2	K2	CO4
8.	During a lithotripsy procedure, the shock wave generator emits 2,000 shock waves per minute. How many shock waves are emitted in one hour?	2	K3	CO4
9.	Define macroshock and its potential impact on patient safety.	2	K2	CO5
10.	Identify the key objectives of the IEC 60601-1:2005 standard in terms of ensuring patient and operator safety during the use of medical electrical equipment.	2	K2	CO5

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Identify the essential components of a patient monitoring system. Describe how these components work together to monitor and display patient data.	7	K2	CO1
		ii.	Describe the Applications of ECG Transmission in Telemedicine.	6	K3	
			(OR)			
	b)	i.	A critically ill patient requires continuous intravenous medication in the ICU. Explain the design and operation of infusion pumps for precise medication delivery and monitoring.	7	K4	CO1
		ii.	In a rural healthcare setting, there's a shortage of critical care specialists. Explore the use of telemedicine technology and remote monitoring equipment to provide expert consultation and support for ICU patients.	6	K3	
12.	a)		Create a block diagram illustrating the feedback control mechanism in a diathermy system. Explain how sensors, controllers, and actuators work together to maintain the desired therapeutic temperature and power levels during treatment.	13	K3	CO2
			(OR)			
	b)		Describe how shortwave diathermy generates heat in tissues and the physiological effects it has on the body, including its impact on blood flow, tissue elasticity, and pain relief.	13	K4	CO2
13.	a)		Explain the basic principles of echocardiography, including the use of ultrasound waves for cardiac imaging.	13	K2	CO3
			(OR)			
	b)		Compare and contrast the block diagrams of different ultrasound imaging modes, such as B-mode, M-mode and Doppler. Discuss the specific signal processing and transducer features unique to each mode.	13	K3	CO3
14.	a)		Describe the components of a heart-lung machine and their roles in supporting cardiopulmonary bypass during cardiac surgery.	13	K2	CO4
			(OR)			
	b)		Explain the key components and functions of a hemodialysis machine, including the blood pump, dialyzer, and tubing system.	13	K2	CO4

15. a) Discuss the role of ground fault circuit interrupters (GFCIs) and isolation transformers in preventing macroshock hazards. How do these devices work to safeguard patients?   13   K2   CO5

(OR)

b) Outline the steps that the manufacturer should follow to conduct electrical safety testing and obtain the necessary certifications for their surgical instruments.   13   K2   CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	After cardiac surgery, patients are given portable telemetry devices to monitor their heart rate and rhythm during the post-operative recovery period at home. Describe the role of portable telemetry in early detection of complications and how patients and their caregivers are educated about device usage and alarm response.	7	K3	CO1
		ii.	The bedside monitor is powered on, but the screen remains blank. What steps would you take to diagnose and resolve this problem?	8		

(OR)

| | b) | i. | A pregnant woman presents for her routine prenatal ultrasound examination. Discuss the choice of ultrasound display modes that would be most appropriate for assessing fetal development and maternal health. Consider the use of 2D imaging, Doppler, and other specialized modes. | 8 | K3 | CO3 |
| | | ii. | What are the common factors that can lead to a loss of image quality in ultrasound scans? Describe strategies to troubleshoot and improve image clarity when faced with issues like artifacts, noise, or poor resolution. | 7 | | |

Reg.No.: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12005

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023

Fifth Semester

Biomedical Engineering

U19BM510 – BIOMEDICAL INSTRUMENTATION

(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define biopotential electrodes and its types, also draw its equivalent circuits.	2	K1	CO1
2.	What is half-cell potential?	2	K2	CO1
3.	Draw Einthoven triangle and mention the electrode position.	2	K2	CO2
4.	Can we perform defibrillation if the person has a pacemaker?	2	K3	CO2
5.	What is bio-amplifier and what are its types?	2	K2	CO3
6.	State the need for impedance matching.	2	K2	CO3
7.	Define pH. Give its range for human blood.	2	K4	CO4
8.	What is the average resting cardiac output of human male and female?	2	K2	CO4
9.	What is a biosensor explain its principles?	2	K1	CO5
10.	What is the need of blood gas analyzers?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	What are the different types of biopotential electrode and explain any two with diagram?	13	K2	CO1

(OR)

1

			Marks	KL	CO
	b)	Briefly, explain about Nernst Relation and draw the Equivalent circuit for bio-potential electrode?	13	K2	CO1
12.	a)	Illustrate about the 10-20 electrode system implemented for EEG signal recording.	13	K2	CO2
		(OR)			
	b)	Write down the working mechanism of electromyography with block diagram.	13	K2	CO2
13.	a)	Explain the Mechanical Chopper Amplifier and Non-Mechanical Chopper Amplifier and its advantages.	13	K2	CO3
		(OR)			
	b)	Demonstrate the right leg driven ECG amplifier with circuit diagram?	13	K2	CO3
14.	a)	What is the principle, applications, and limitations of electromagnetic blood flow meters?	13	K2	CO4
		(OR)			
	b)	Briefly explain the indirect methods of measuring blood pressure?	13	K2	CO4
15.	a)	What are the amperometric and voltametric techniques and explain with example?	13	K2	CO5
		(OR)			
	b)	What is the Ion selective Field effect Transistor pH sensor (ISFET) and its working principle also draw the block diagram?	13	K2	CO5

PART- C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	You are employed by a hospital research unit on a certain project to measure blood pressure and flow in the artery of an anesthetized dog lying on an operating table. Considering this situation, describe the transducers used and necessary instrumentation systems to support them, the medical methods used to ensure appropriate physiological measurements and comment on calibration of blood pressure measurement system suggested by you.	15	K4	CO2
		(OR)			
	b)	You are a biomedical engineer tasked with designing a biosensor for continuous glucose monitoring in diabetic patients. Discuss the principles behind biosensors, including the type of recognition elements and transducers commonly used in glucose biosensors. Describe the design considerations and challenges specific to glucose monitoring, and propose a hypothetical roadmap for the development, testing, and commercialization of this biosensor.	15	K5	CO3

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Question Paper Code: 12008

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2023
Fifth Semester
Biomedical Engineering
U19BMV57 - BIOMATERIALS AND ARTIFICIAL ORGANS
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 – Evaluating
	K2 – Understanding	K4 – Analyzing	K6 – Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	State the importance of biocompatibility of Biomaterials.	2	K1	CO1
2.	How the stress of the biomaterials related to the strain?	2	K2	CO1
3.	Suggest any two methods to prevent the corrosion of stainless steel implants.	2	K2	CO2
4.	What is a high temperature shape memory alloy?	2	K1	CO2
5.	What makes a nano-structured metals an excellent choice for fabrication of implants?	2	K2	CO3
6.	Define polymerization.	2	K1	CO3
7.	What are the monomers present in the Chitin and how they are linked?	2	K2	CO4
8.	How structurally complex organs will be regenerated?	2	K2	CO4
9.	Write note on 'maxillofacial replacement'.	2	K2	CO5
10.	List any four applications of soft tissue augmentation.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Describe the classification of the biomaterials based on their mechanical properties with suitable examples.	13	K2	CO1

(OR)

			Marks	KL	CO
	b)	Analyze the tissue response towards the implants and sequence of events in wound healing process.	13	K3	CO1
12.	a)	Summarize the biological tolerance and clinical applications of Ti-based alloys.	13	K2	CO2
		(OR)			
	b)	Examine the Bio-inertness and biodegradability of ceramics and discuss the applications of ceramics in medical field with examples.	13	K2	CO2
13.	a)	Discuss the advantages and disadvantages of using the Polymeric Biomaterials for producing Medical Implants and Devices.	13	K2	CO3
		(OR)			
	b)	Explain the properties, classification and applications of Medical Textiles.	13	K2	CO3
14.	a)	Discuss in detail about the design considerations that have to be followed during organ replacement.	13	K3	CO4
		(OR)			
	b)	Describe about mechanism of working of artificial heart and transplant process.	13	K2	CO4
15.	a)	Explain the various artificial organs related to Gastro Intestinal system that can be implanted into a human body.	13	K2	CO5
		(OR)			
	b)	Name the materials that can be used in dentistry and describe the implantable devices related to dentistry.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Explore advancements in kidney transplant technology and research such as xenotransplantation and bioengineered kidneys.	15	K4	CO4
		(OR)			
	b)	Compare and contrast natural and synthetic polymers in the context of organ regeneration applications.	15	K4	CO3

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Why does the program reside in ROM part of embedded system?	2	K3	CO1
2.	List out the major challenges in designing an embedded system.	2	K3	CO1
3.	What is watch dog timer?	2	K2	CO2
4.	What are the disadvantages of I2C?	2	K2	CO2
5.	List the desirable qualities of RTOS.	2	K3	CO3
6.	Mention how I/O devices are classified for embedded system?	2	K2	CO3
7.	What is the requirement of IoT protocol standardization?	2	K2	CO4
8.	Give the applications of IoT	2	K2	CO4
9.	Mention the Privacy and Security Issues in case of Internet of Medical Things (IoMT)?	2	K3	CO5
10.	List the major advantages of using IoT in healthcare.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Draw and compare von-Neumann and Harvard architecture.	5	K2	CO1
		ii.	Describe the development of a small-scale embedded system design in detail.	8	K3	

(OR)

				Marks	KL	CO
	b)	i.	Differentiate between CISC and RISC Processors.	6	K2	CO1
		ii.	Classify the types of memory in embedded system.	7		
12.	a)	i.	Describe the frame format and working of I2C Protocol with features.	7	K2	CO2
		ii.	With neat sketches explain about Bluetooth technology.	6		
			(OR)			
	b)	i.	Explain the encoding method, frame format and network access protocol used by Ethernet standard.	9	K2	CO2
		ii.	Differentiate between timers and counters.	4		
13.	a)	i.	Explain the role of integrated development environment for embedded software development.	6	K2	CO3
		ii.	Explain how cross-compiler is used for host and target machines?	7		
			(OR)			
	b)		Write short notes on the following.		K3	CO3
		i.	Editor	3		
		ii.	Compiler	4		
		iii.	Linker	3		
		iv.	Debugger	3		
14.	a)	i.	Explain about IoT application layer protocols.	9	K2	CO4
		ii.	Why do IoT systems have to be self-adapting and self-configuring?	4	K3	
			(OR)			
	b)	i.	What is threat analysis in Internet of Things? Explain in detail.	8	K2	CO4
		ii.	Compare Raspberry pi with Arduino.	5	K3	
15.	a)		Design and Explain IoT enabled Personalized Healthcare Systems.	13	K3	CO5
			(OR)			
	b)		Design and explain A Fuzzy- Based expert System to diagnose Alzheimer's Disease.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Discuss the Application Specific Embedded system with an example.	8	K3	CO1
		ii.	Explain the process of loading Embedded Software into the target system.	7	K2	CO3
			(OR)			
	b)	i.	Explain the main components of the IoT architecture.	8	K2	CO4
		ii.	How do IoT devices communicate? Explain with suitable diagrams.	7	K3	