Master of Biomedical Engineering Examination, 2025

(1st Year, 2nd Semester)

Advanced Biomedical Instrumentation

Time: Three hours **Full Marks: 100**

Answer **any five** questions

Q-1) [CO1]	(a)	Explain briefly the importance of multiplexing in a biotelemetry system	2 Marks
Q-1) [CO4]	(b)	Describe and explain with neat sketches and circuit diagrams how does Time Division Multiplexed (TDM) system operate for the transmission and reception of biosignals	18 Marks
Q-2) [CO2]	(a)	Describe and explain the operations of circle ventilation system and to and fro ventilation system of anaesthesia machine. Include necessary sketches in your answer	18 Marks
Q-2) [CO4]	(b)	Discuss briefly the advantages and disadvantages of circle ventilation and to-and-fro ventilation systems of anaesthesia machine	2 Marks
Q-3) [CO1]	(a)	Obtain a relation between the transition probabilities for "spontaneous emission" and "stimulated emission" of radiation	6 Marks
Q-3) [CO2]	(b)	Describe Nd-YAG LASER and explain its principle of operation. Draw energy level diagram of this LASER. Mention some of its applications	12 Marks
Q-3) [CO3]	(c)	Explain briefly the underlying principle of operation of Colour Centre LASER	2 Marks
Q-4) (a) [CO1]		Discuss and describe briefly with neat sketches different types of current waveforms used in electrotherapy. Mention applications of each type of these current waveforms	8 Marks
Q-4) (b) [CO2]		Explain how the current waveforms used in electrotherapy are generated	5 Marks
Q-4) (c)		Explain the importance of biphasic stimulation	2 Marks

Q-4) (d) [CO2]	Draw analog fibre optic driver circuit and explain its operation.	5 Marks
Q-5) (a) [CO2]	Explain with circuit diagram how radiofrequency power amplification done in electrosurgery machine?	10 Marks
Q-5) (b) [CO4]	Explain a method with circuit diagram how does an electrosurgery machine tester work	5 Marks
Q-5) (c) [CO1]	Explain the effect of intermodal dispersion on a digital signal applied to an optical fibre. Suggest solutions for overcoming this problem	5 Marks
Q-6) (a) [CO3]	Explain with neat sketch the underlying principle for shock wave generation and how these waves are focused in a lithotripsy machine	10 Marks
Q-6) (b) [CO2]	Explain how dialysate conductivity monitors in haemodialysis machine work. Include circuit diagram in your answer	10 Marks
Q-7) (a) [CO2]	Describe with neat block diagram a medical linear accelerator machine used in radiotherapy.	10 Marks
Q-7) (b) [CO3]	Explain the principle of functioning of each block of a medical linear accelerator machine used in radiotherapy	10 Marks
Q-8) (a) [CO5]	A filter operating at a sampling frequency of 1000 samples/sec has a pole at $Z = 1$ and a zero at $Z = 2$. What is the magnitude of its amplitude response at 500 Hz?	5 Marks
Q-8) (b) [CO5]	A digital filter has the following transfer function $H(Z) = \frac{1}{4}\ [1 + 2Z^{-1} + Z^{-2}]$ Find and plot the amplitude response and phase response of this filter	15 Marks