

B.Sc. 5th Semester (Honours) Examination, 2022 (CBCS)**Subject : Physics****Course : DSE-1(2)****(Medical Physics)****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Symbols and abbreviations have their usual meanings.***Section-I****1. Answer any five questions:****2×5=10**

- (a) Give example of one 1D and one 2D synovial joints in human body.
- (b) Find out the degrees of freedom of human thumb joints.
- (c) What is 'tachycardia'?
- (d) What is Residual Volume (RV) of human lungs? How it is related with TLC?
- (e) The heart rate of a person is 120 pulses/min. Calculate the action time and resting time of heart muscle.
- (f) What do you mean by 1 seivert?
- (g) What are K-alpha and K-beta emission lines in case of characteristic X-ray?
- (h) What is NMR imaging?

Section-II**2. Answer any two questions:****5×2=10**

- (a) A person has a systolic pressure 150 mmHg, diastolic pressure 100 mmHg, heart rate 90/min. Calculate the work done by the heart and the efficiency of the heart (lower left half) if the energy consumed is 6 watt. **5**
- (b) The mass of the pulmonary blood of a person is 1.5 kg. Find the approximate mass of that person and the mass of his systematic blood. **5**
- (c) Write down short notes (*any two*):
 - (i) Conformal Radiation Therapy (CRT)
 - (ii) Brachytherapy
 - (iii) Radioactive tracers **2.5+2.5=5**
- (d) What do you mean by visual field loss in case of glaucoma? A person can clearly see the objects lying between 25cm and 2m from his eyes. Find out the nature and power of lenses that can be used for his corrected vision. **1+4=5**

Section-III

3. Answer any two questions:

10×2=20

- (a) Find the expression of power exerted during a throw using elbow motion (in case of human body). If the torque generated is 36.45 N-m in the case with a 3 inch diameter muscle, then calculate the average power generated during a throw. 6+4=10
- (b) What is ultrasound imaging? The velocity of ultrasound in a commercial transducer probe is 4000 m/s. If a vibration frequency of 5 MHz is desired, what would be the crystal thickness? Define resting potential and action potential. Draw the electrical circuit analogues to small axon, hence find out the energy required to recharge 1 meter length of non-myelinated axon. Where, $C = 3 \times 10^{-7} \text{F/m}$. 1+3+2+4=10
- (c) What is bremsstrahlung? Calculate the wavelength of X-ray that undergoes second order reflection at 15° from the face of a cubic crystal of KCl. Where crystal density = 1.98 gm/cm^3 and Avogadro No. = 6.02×10^{23} . In a self-rectified X-ray machine circuit, line voltage is 220V. If voltage is stepped by a transformer of turn ratio 500 : 1, then what will be the resultant peak voltage (applied) of X-ray tube? What is the disadvantage of self-rectified X-ray machine? 1+4+3+2=10
- (d) What is respiratory cycles? Describe PSV and SIMV in case of mechanical ventilator. Explain the basic principle of computed Tomography Scan (multiple sclice). How it is different from X-ray imaging? 2+4+3+1=10
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