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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY
VI SEMESTER B.E. END-SEMESTER EXAMINATION–MAY 2013
SUBJECT: RADIATION PHYSICS (PHY322)

KNOWLEDGE IS POWER
MANIPAL INSTITUTE OF TECHNOLOGY

Time: 3 Hrs. **Max. Marks: 50**

Note: Answer any FIVE FULL questions. Each question carries 10 marks.
Answer all the questions in a continuous sequence.
Write specific and precise answers. Any missing data may suitably be assumed.
Write question number within the margin. Draw neat sketches wherever necessary.

Physical Constants:
Speed of light in vacuum = 3.00×10^{8} m/s **Planck's constant = 6.63×10^{-34} J.s**
Electron mass = 9.11×10^{-31} kg **Boltzmann constant= 1.38×10^{-23} J/ K** **Electron charge = 1.60×10^{-19} C**

1A Explain different sources of electromagnetic radiation [5]

1B Describe three major processes by which gamma radiation interact with matter. [5]

2A What is stopping time of charged particle. Get an expression for stopping time for charged particle in an absorbing medium. [5]

2B Give detailed explanation on working principle of proportional radiation counters. [5]

3A Explain Bragg curve and energy straggling for heavy charged particles. [5]

3B A parallel beam of 1 MeV photons normally incident on a 1.2 cm aluminum slab with density 2.70 g cm^{-3} at a rate of 10^{3} per second. The mass attenuation and mass energy coefficients are 0.0620 $cm^{2}g^{-1}$ and 0.0270 $cm^{2}g^{-1}$ respectively. What is the fraction of photons transmitted without interacting and what fraction of incident energy is transmitted by the slab. [5]

4A Explain the term "Scintillation". Give the working principle of photomultiplier tube in a scintillation radiation detector. [5]

4B A halogen quenched GM tube operates at 1kV and has a wire diameter of 0.2mm. The radius of the cathode is 2cm and the tube has a guaranteed life of 10^{9} counts. What is the maximum radial field and how long the counter will last if it is used on an average of 60 hrs. per week at 2000 counts/min. [5]

5A Explain High Purity Germanium gamma ray detector fabrication methods of different configurations. [6]

5B Sketch the transfer characteristics of an n-channel depletion type MOSFET with I_{DSS} = 10 mA and V_P = -4V [4]

6A How radio isotopes are used in industrial environment for level height indication. Explain different configuration of level height indication. [6]

6B Consider a tank of height 1.5m in an absorption measurement system. If the tank is empty, a dose meter coupled to a linear detector indicates a voltage of 32 V proportional to the intensity; for a full tank it reads 2V. Determine the level position and the measurement accuracy when the output fluctuation is ±0.5V for mean value voltage value of 21V (at unknown level). [4]