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**MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL**

DEPARTMENT OF PHYSICS

Sixth Semester B.E (Open Elective)
End Semester Examination (Make-up) - July 2014



PHY 322: Radiation Physics

Time: 3 hrs.

Max. Marks: 50

- Note :**
- Answer any FIVE FULL questions.
 - 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.

1.
 - A) Explain the different methods available to obtain neutron radiation.
 - B) An accident occurs in a laboratory in which large amount of radioactive material with a known half-life of 20 days gets embedded in floor and walls. Tests show that the level of radiation is 32 times the permissible level of normal occupancy of the room. Assuming that the last statement is correct, find after how many days can the laboratory be safely used ?
 - C) Explain the Bragg Curve for heavy charged particle.

(5 + 3 + 2)
2.
 - A) Discuss the different interaction mechanisms of gamma radiation with matter.
 - B) Explain the terms: (i) Exposure (ii) Absorbed dose (iii) Equivalent dose
 - C) Estimate the time required for a 5MeV alpha particle with a range of 25μm to slow down and stop in silicon.

(5 + 3 + 2)
3.
 - A) Explain the interaction of fast electrons in an absorbing medium.
 - B) Sketch the transfer curve for a *p*-channel JFET with $I_{DSS} = 4 \text{ mA}$ and $V_p = 3 \text{ V}$.
 - C) What are the differences between BJT and FET ?

(5 + 3 + 2)
4.
 - A) Discuss the fabrication, working and characteristics of *n*-channel D-MOSFET.
 - B) Discuss the process of measuring radiation exposure using TLDs.
 - C) An air-filled ion chamber is operated at a pressure of 3 atm and a temperature of 100°C. If its active volume is 2500 cm³, find the saturated ion current corresponding to a gamma-ray exposure rate of 100 pC/kg.s. [Pressure, 1 atm = 101.3kPa, Temperature, 0°C = 273.15K]

(5 + 3 + 2)

5. A) Discuss the construction and working of GM Counter.
B) Explain the process of production of scintillation in inorganic scintillators.
C) A GM counter has a metal cylinder 5cm in diameter along whose axis there is a stretched wire of diameter 2.5×10^{-4} cm. If the potential difference between them is 800V then what is the maximum electric field inside the counter?
- (5 + 3 + 2)
6. A) Discuss the method to measure density of materials by nuclear measurement technique.
B) Explain the principal elements of nuclear measuring system using the alternative structural schemes.
C) Draw the schematic labelled diagram of an isotopic belt weigher system for quantity measurement.

(5 + 3 + 2)
