ISM

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

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (OPEN ELECTIVE)

END SEMESTER (MAKE UP) EXAMINATIONS, JULY 2016 - Make up

SUBJECT: RADIATION PHYSICS [PHY 322]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. Explain the different available methods to obtain *fast electrons* and *heavy charged particles*. **5**

1B. A radioactive sample contains 3.50 μg of pure $_6C^{11}$, which has a half-life of 20.4 min. **3**

(a) Determine the number of nuclei in the sample at t = 0.

(b) What is the activity of the sample initially and after 8.00 h?

1C. What is the minimum gamma-ray energy required to produce photo-neutrons in water from the trace heavy water content? **2**

2A. Discuss the different interaction mechanisms of gamma radiation with matter. **5**

2B. Explain the *Bragg Curve* and *Range* of heavy charged particle **3**

2C. Estimate the time required for a 5MeV alpha particle with a range of 25μm to slow down and stop in silicon. **2**

3A. Explain the interaction of *fast electrons* in an absorbing medium. **5**

3B. Sketch the transfer curve for a p-channel JFET with I_{DSS} = 4 mA and V_P = 3 V. **3**

3C. What are the differences between D-MOSFET and E-MOSFET ? **2**

4A. Discuss the fabrication, working and characteristics of *n-channel* D-MOSFET. 5

4B. Explain the process of production of scintillation in inorganic scintillators. 3

4C. If an inverting amplifier has R_{in} = 100 kΩ and R_f = 500 kΩ then what output voltage results for an input of 2 V? 2

5A. Explain the construction and working of proportional counter. 5

5B. A GM tube with a cylindrical cathode 5cm in diameter and a central wire of diameter 0.012cm is filled with Argon to a pressure such that the mean free path is 7.8×10^{-4}cm. Calculate the value of the voltage that must be applied to just produce an avalanche. (The ionisation potential of Argon is 15.7volt). 3

5C. What are the different geometries of gas filled detector? Explain. 2

6A. Describe the method of thickness measurement using nuclear measurement system. 5

6B. Consider a tank of height 1.5m in a nuclear radiation 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. Let the measurement system be compensated by a voltage of 2V with reverse polarity yielding 0V for empty tank. Determine the level position and the measurement accuracy when the output fluctuation is ±0.5V for mean value of 21V (at unknown level). 3

6C. Draw the schematic labelled diagram of an isotopic belt weigher system for quantity measurement. 2

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