

Total No. of Questions :7]

SEAT No :

P4276

[4860] - 1098

[Total No. of Pages : 2

M.E. (Mechanical) (Energy Engineering)
NUCLEAR MATERIALS AND REACTOR FUNDAMENTALS
(2013 Coures) (Semester-III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1) a)** Plot the radioactive decay curve for nitrogen- 16 over a period of 100 seconds. The initial activity is 142 curies and the half-life of nitrogen- 16 is 7.13 seconds. Plot the curve on both linear rectangular coordinates and on a semi-log scale. **[6]**
- b) Why uranium-235 fissions with thermal neutrons and uranium-238 fissions only with fast neutrons? Explain in detail. **[4]**
- Q2) a)** Describe the following scattering interactions between a neutron and a nucleus: **[6]**
- i) Elastic scattering.
 - ii) Inelastic scattering.
- b) Explain the hardening and embrittlement of nuclear materials due to exposure of nuclear radiations. **[4]**
- Q3) a)** Why only the heaviest nuclei are easily fissioned?. Explain in detail. **[5]**
- b) Describe the curve of Binding Energy per Nucleon versus mass number and give a qualitative description of the reasons for its shape. **[5]**
- Q4) a)** Explain the following processes of nuclear fuel enrichment. **[6]**
- i) Gaseous diffusion.
 - ii) Centrifuge process.

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- b) Define the following terms: (Any two) [4]
- i) Fissile material.
 - ii) Fissionable material.
 - iii) Fertile material.
- Q5)** a) Explain the moderators used in the nuclear reactor. [5]
- b) What is In-situ leaching? Explain in detail. [5]
- Q6)** a) How nuclear fuel rods are manufactured? Explain in detail. [5]
- b) Differentiate between Boiling water reactor (BWR) Pressurized heavy water reactor (PWR) with neat sketch. [5]
- Q7)** Describe the following reactions where a neutron is absorbed in a nucleus:[10]
- a) Radioactive capture.
 - b) Particle ejection.

