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

C 3365

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Seventh Semester

(Regulation 2004)

Mechanical Engineering

ME 1010 — NUCLEAR ENGINEERING

Time : Three hours Maximum : 100 marks

Approved Thermodynamic tables and charts permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What do you infer from the concept of mass – energy equivalence?

2. What is radioactivity and mention what type of radiations emitted from radio – active substances?

3. Distinguish between nuclear fission and fusion.

4. What is the chain reaction in nuclear fission?

5. What is the role of solvent extraction in reprocessing fuel?

6. Mention any two characteristics of the nuclear fuel.

7. What is known as breeding cycle?

8. Mention the types of materials used for reactor shielding. Why?

9. Mention any two safety measures while working in Nuclear reactors.

10. What are the different types of nuclear waste disposal methods?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Describe the liquid drop model of the nucleus. (10)

(ii) Calculate the binding energy of a neutron in $_3Li^7$ nucleus. Given the following isotopic masses.

$_3Li^7$ = 7.016004 amu

$_3Li^6$ = 6.015125 amu.

$_0n^1$ = 1.008665 amu.

Express the result in MeV. (6)

Or

(b) (i) Explain the main features of radioactivity. (8)

(ii) Write a note on half life period of the radioactive material and neutron cross section. (8)

12. (a) (i) What are called controlled and uncontrolled chain reactions and describe on what factors does the chain reaction depend and the general condition for a self sustained chain reaction. (10)

(ii) Give an account of nuclear fusion. (6)

Or

(b) (i) Explain in brief how uranium material is produced and purified. (10)

(ii) Write a short note on the purification of thorium and beryllium materials. (6)

13. (a) Explain how nuclear fuel is reprocessed mentioning the nuclear fuel cycles and its characteristics. (16)

Or

(b) Describe the solvent extraction equipment and explain the role of solvent extraction in reprocessing. (16)

14. (a) Define the term "breeding ratio". Explain the construction and working of fast – breeding reactor. Mention the merits of the reactor. (16)

Or

(b) Explain the heat transfer technique in detail in nuclear reactors and describe its function. (16)

15. (a) Explain the different safety systems used in the nuclear reactors and the nature of criteria adopted for the safety. (16)

Or

(b) (i) Explain the different types of nuclear wastes and how are they disposed. (10)

(ii) Write a note on the radiation hazards and the preventive measures to be adopted. (6)

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