Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2020

Course Code: ME371

Course Name: NUCLEAR ENGINEERING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 Derive the expression for the number of radioactive nuclides left after time, t (law of radioactive decay). Define decay constant (λ), half-life ($t_{1/2}$) and average life (T_{av}). Prove that $t_{1/2}=0.693\ T_{av}$. (10)

2 a) Comment atomic structure of an element using classical model of atoms. (6)

b) State and explain the relationship connecting mass defect and binding energy. (4)

3 a) Explain the criticality condition for nuclear reactors. (5)

b) Define the basic features of Reactor control. (5)

4 a) Explain the concept of chain reaction with a suitable example. (6)

b) Summarize the neutron life cycle with diagram. (4)

PART B

Answer any three full questions, each carries 10 marks.

5 a) List out the coolants being used in a Boiling Water Reactor (BWR) and mention the reasons for choosing the same. (6)

b) Illustrate and explain the nuclear fuel cycle. (4)

6 a) Identify the merits for using concrete as a structural material for nuclear reactors. (6)

b) Describe with the help of a diagram, functions of cladding in fuel assembly. (4)

7 a) List out features of fuel assembly in BWR to minimize radiation damage with their roles. (5)

b) Compare PUREX and UREX process for extraction of Uranium. (5)

8 a) Discuss the role of centrifuges in fuel enrichment. (5)

b) Illustrate and explain processes involved in extraction of uranium from its ore. (5)

PART C

Answer any four full questions, each carries 10 marks.

9	a)	Describe the heat generation after shutdown of a reactor with its source.	(6)
	b)	Comment on the different types of heat losses from nuclear reactor.	(4)
10	a)	Define radiation dose? How radiation dose quantities are quantified?	(5)
	b)	Mention why shielding of a reactor is necessary. List out desirable properties of a good shielding material.	(5)
11		Derive an expression for heat conduction in cylindrical fuel rod with heat generation.	(10)
12		Discuss the design concept employed for safeguarding the employees and general public from the risks associated with operation of nuclear power plants.	(10)
13	a)	State the reasons for avoiding incineration of nuclear wastes.	(5)
	b)	List out the protocols for an accident management programme in a nuclear power plant.	(5)
14	a)	Explain different types of nuclear wastes and list any five methods of its disposal.	(6)
	b)	State the need for reprocessed fuel with regard to nuclear waste management.	(4)

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