

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

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 A neutron interaction experiment has been carried out on two different fertile nuclei A and B respectively. The final products obtained are fissile nuclides U-233 and Pu-239. Name the reaction and explain the steps involved in the reactions. Identify A and B species involved in the experiment. Write any application of this reaction. (10)
- 2 Define neutron cross section. Examine the variation of fission cross section with neutron energy in U-235 using a suitable curve. Give the reasons for resolved and unresolved resonances in the above curve. (10)
- 3 a) Derive from first principles the basic diffusion equation for neutrons. (6)
b) What is the condition for a sustained chain reaction (4)
- 4 Sketch the neutron life cycle for a critical reactor of finite size with initial neutron population of 2500 neutrons with reasonable values for the factors involved. Explain the factors involved in the formulation. (10)

PART B

Answer any three full questions, each carries 10 marks.

- 5 With the help of a neat sketch, explain the components and working of a BWR (boiling water) type nuclear reactor. (10)
- 6 A boiling water reactor is under loss of coolant accident (LOCA). Propose the safety system that is to be operated to save the reactor from the given scenario (10)
- 7 a) Explain the enrichment processes implemented in the nuclear industry. (5)
b) Define reprocessing. Name and explain the process employed for the simultaneous recovery of Uranium and Plutonium from the spent fuel. (5)
- 8 List out the requirements of materials which are to be used as fuel and moderator in nuclear reactors. Mention the advantages and disadvantages of any two materials each, which are being used as fuel and moderator. (10)

PART C

Answer any four full questions, each carries 10 marks.

- 9 Derive the temperature distribution for a cylindrical fuel rod with one dimensional steady state heat conduction and internal heat generation and convective boundary condition. (10)
- 10 a) Describe briefly about ALARA Program (4)
b) Discuss the various biological effects of radiation and their prevention methods. (6)
- 11 Explain the pool boiling phenomenon occurring in a nuclear reactor. (10)
- 12 Elucidate the defense in depth concept employed for safeguarding the employees and general public of the nuclear power plant. (10)
- 13 a) Describe the philosophy of the working of different safety system (8)
b) Explain nuclear proliferation (2)
- 14 You are a nuclear waste disposal expert and you are given a mixture of wastes. On what basis you will classify the wastes. Propose a waste conditioning and treatment methodology for the same. (10)
