UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018
Course: B.Tech (ET+IPR) **Semester: 6th**
Program: Nuclear Power Generation **Code: PSEG 433**
Time: 03 hrs. **Max. Marks: 100**
Instructions: Choice only in Question 10 & 11. Assume value if any requirement to solve numerical. (Assume only if the value does not mention in question)

SECTION A

S. No.		Marks	CO
Q 1	What is nuclear stability? Why are elements of a higher mass number not stable?	**4**	**CO1**
Q 2	List down the nuclear waste disposal method.	**4**	**CO1**
Q3	What are the advantages of reheat cycle over the simple ranking cycle?	**4**	**CO2**
Q4	Define the term "Breeding"	**4**	**CO1**
Q5	Explain "nuclear crosssection".	**4**	**CO2**
	SECTION B		
Q 6	Explain different types of reactors and the various applications, advantages & disadvantages?	**10**	**CO5**
Q7	Explain the working of nuclear reactors and the safety system precautionary steps taken in a reactor.	**10**	**CO4**
Q8	Tritium (H_3) decays by negative beta decay with a half-life of 12.33 years. The atomic weight of H_3 is 3.016. Determine mass in grams of 1 mCi of tritium?	**10**	**CO3**
Q9	The fission product I^{131} has a half-life of 8.05 days and is produced with a yield of 2.9% (0.029 atoms per fission). Calculate the equilibrium activity of this isotope in a reactor operating at a thermal power of 3300 MW. (Assuming 200MeV / fission)	**10**	**CO3**
	SECTION-C		
Q 10	a) Assuming that the fissioning nucleus is U^{235}, compute the value of β, defined as the mass of the fuel consumed per unit energy release. You may assume that 200 MeV is released per fission and the value of capture to fission ratio is 0.17.	**10**	**CO3**
	b) A monoenergetic beam of neutrons having an intensity of 4 x 1010 neutrons/ cm^2-s impinges on a target 1 cm^2 area and 1 mm thick. There are 0.048 x 1024 atoms per cm3 in the target and the total cross section at an energy of the beam is 0.45 b. calculate (a) macroscopic total cross section? (b) How many neutron interactions per second occur in the target? (c) collision density	**10**	**CO3**
	OR		
Q10	a) The radioisotope battery is fuelled with 500g of $Pu^{238}C$ (Plutonium-238 carbide), which has a density of 12.5 g/cm^3. The Pu^{238} has a half-life of 89 years, and emits 5.6 MeV per disintegration, all of which may be assumed to be absorbed in the generator. The thermal to electrical efficiency of the system is 6 percent. Calculate (a) the specific power in watts (thermal) per	**20**	**CO1,3**

	gram of fuel; (b) the power density in watts (thermal) per cm3; (c) the fuel efficiency in curies per watt (thermal); (d) the total electrical power of the generator.		
Q11	a) Assume of an error in its design, a thermal reactor that was supposed to breed on the Th^{232}-U^{233} cycle, unfortunately, has a breeding ratio of only 0.96. If the reactor operates at a thermal power level of 500 MW, how much Th^{232} will it convert in one year? Capture to fission ratio for U^{233} = 0.09 (E_R = 200 MeV/fission)	**10**	**CO3,5**
	b) Discuss briefly the future scenario of the nuclear power plant.	**10**	**CO4,5**
	OR	**10**	
Q11	a) Discuss types of moderator and coolant, also elaborate the advantageous use for each of them. & also draw and discuss the layout of the gas-cooled nuclear power plant.	**10**	**CO4**
	b) Discuss multiple layers of safety at the nuclear power plant.	**10**	**CO4,5**