UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech Electrical and PSE **Semester – V**
Subject (Course): Nuclear and Hydro power plant **Max. Marks : 100**
Course Code :ELEG-349 **Duration : 3 Hrs**
No. of page/s:2

SECTION A **(5*4=20)**

Note: Attempt all the questions

Q1. [CO4] Explain briefly the term Radioactivity and Multiplication factor.

Q2. [CO5] How power factor can be improved?

Q3. [CO2] "Power of a nuclear reactor is $4.8*10^{-12}$mnC watt". Describe on which factors the statement is true.

Q4. [CO1] Find the energy equivalence of 1 atomic mass unit.

Q5. [CO3] Describe the function of draft tube in impulse and reaction turbine.

SECTION B **(4*10=40)**

Q6. [CO3,5] Explain the criterion for the selection of type of dam. Also, explain advantage and disadvantage of Embankment dam and Composite Dam with neat diagram.

Q7. [CO2,4] Distinguish between breeder and converter reactor. Derive an expression for maximum conversion of fertile material in a converter reactor. The half-life of radon gas is 3.83 days. What is its radioactive decay constant? What percentage of the radon atoms originally present will decay in a period of 45 days?

Q8. [CO4] Define the following terms with neat diagram or curve: Binding Energy, Mass Defect, Siphon Spillway, and Tariff.

Q9. [CO1,5] (a) A 200 MW of average electrical power is required for a city. If this is to be supplied by a nuclear reactor of 0.20 efficiency, using U^{235} as the nuclear fuel, calculate the amount of fuel required for one day operation. Assume that energy released per fission of U^{235} nuclide=200 MeV.

[CO2,3] (b) A proposed site having an available head of 28 m with catchment are 420 sq. km, rainfall=140 cm per year. The percentage of total rainfall utilised is 0.68 and penstock efficiency=0.94, turbine efficiency=0.80, generation efficiency=0.84 and load factor=0.44. Calculate the power developed.

SECTION C (2*20=40)

Note: Attempt either Q11. or Q12

Q10. [CO5] (a) Draw the schematic different cycle of nuclear power plant and explain the liquid metal cooled reactor with neat diagram.

[CO3] (b) Describe briefly different type of surge tanks with dimension and location.

Q11. [CO1] (a) Draw the block diagram of pumped storage Hydro Power plant and briefly explain the function of each component.

[CO2] (b) A 400 V, three phase delta connected induction motor draws a current of 25 A at 0.8 lagging power factor under full load condition. It is desired to install a bank of capacitors to raise the full load overall power factor to 0.9 lag. Find the kVAR rating of the star connected and the value of each capacitor.

OR

Q12. What do you understand by economics of a nuclear power plant? A load of 1500 kW at 0.71 lagging power factor is taken by a consumer from a utility which charges a demand charge of Rs.400 per kVA of maximum demand per year. The total cost of installation of capacitor for power factor improvement is Rs. 640 per kVAR, the annual interest and depreciation being 10%. Find the most economical power factor for the consumer.

Roll No: ----------

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SECTION A (5*4=20)

Q13. [CO3] Should nuclear power plants be sited under-ground to help in containing radioactive releases? Give suggestions.

Q14. [CO4] Find the U^{235} fuel used in one year in a 235 MW PWR. Assume an overall plant efficiency of 33% and 100% load factor throughout the year.

Q15. [CO1] Define the conversion process parameter in nuclear power plant.

Q16. [CO2] Explain advantage and disadvantage of Buttress dam and Arch Dam with neat diagram.

Q17. [CO1] List down the methods used for the improvement of power factor.

SECTION B (4*10=40)

Q18. [CO4] Derive specific speed. The quantity of water available for hydro plant is 250m^3/sec under a head of 1.6 m. If the speed of the turbine is 50 r.p.m. and efficiency is 82% determine the number of units required. Assume N_s==740.

Q19. [CO1] Explain with the neat diagram of governing regulation of Hydraulic turbine with spear in Pelton turbine.

Q20. [CO2] Define the following terms: Critical size Core, Mass curve, Reflector and Half Life.

Q21. [CO5] Describe the term cavitation and how we can avoid.

SECTION C (2*20=40)

Q22. (a) [CO3] When a run of river plant operates as a peak load station with a weekly load factor of 20%, all its capacity is firm capacity. What must be the minimum flow in the river so that the station may serve as the base load station? Data given as: Rated Capacity: 10,000 kW with operating head-15 m, efficiency of a plant is 80%. Estimate the daily load factor of the plant if the stream flow is 15 cumsec.

(b) [CO1] The load curve of an electrical system at different times of the day is given below:

Time	12 a.m.	5a.m.	9 a.m.	6p.m.	8p.m.	10 p.m	12 a.m.
Load(MW)	50	50	100	100	150	80	50

Find the energy required per day and the load factor of the electrical system.

Q23. (a) [CO5] Draw the neat diagram of indirect with intermediate cycle nuclear reactor and also explain the working.

(b) [CO2] A 400 V, three phase delta connected induction motor draws a current of 25 A at 0.8 lagging power factor under full load condition. It is desired to install a bank of capacitors to raise the full load overall power factor to 0.9 lag. Find the kVAR rating of the delta connected and the value of each capacitor.

OR

Q24. [CO4] Draw the schematic diagram of indirect cycle reactor of the nuclear power plant. A proposed hydro-electric station has an available head of 120 meters, a catchment area of 200 sq. km, the rainfall of which is 120 cm per annum. If 0.62 of the total rainfall can be collected then calculate the power that could be generated. Suggest suitable rating of generator.