MASTER OF TECHNOLOGYIN ENERGY SCIENCE & TECHNOLOGY EXAMINATION, 2024

(1stSemester)

POWER PLANT ENGINEERING

Time: Three hours Full Marks: 100

Part – I (Marks - 60)

Answer **Q. No. 1** and ***any two*** from the following questions.

1. (a) What are the limitations of Carnot Cycle?

   (b) What do you understand by mean temperature of heat addition?

   (c) What are riser and down comer in a power boiler?

   (d) What is water hammer in a hydro power plant?

   (e) Explain the function of draft tube?

   (f) What is the function of steam traps?

   (g) What is cavitation?

   (h) How much coal is required for a 250MW power plant?

   (i) What are the limitations of nuclear power plant?

   (i) What are the functions of de-aerator?

   (j) Explain the function of surge tank?

   10X2=20

2. (a) Explain the effects of pressure and temperature of the supply steam and condenser pressure on Rankine cycle efficiency.

   6

   (b) Explain Reheat and Regenerative cycle for steam based thermal power plant.

   6

   (c) Draw a layout of a coal based thermal power plant and explain its different circuits.

   8

3. (a) What do you understand by boiler mountings and boiler accessories? Explain different boiler mountings with their working principles.

10

(b) A coal based thermal power plant operates between 35 bar and 0.05 bar. The condition of the steam supplied to the turbine is 0.95 dry. Calculate Cycle efficiency and steam consumption per kWhr considering (i) pump work and (ii) neglecting pump work. Assume isentropic expansion.

10

4. (a) What do you understand by Impulse turbine and Reaction turbine? 4

(b) Deduce the expression for critical pressure ratio and the optimum mass flow rate for a nozzle. 10

(b) What do you understand by Nozzle efficiency and velocity ratio? What are different factors on which nozzle efficiency depends?

6

5. (a) The run-off data of two rivers is tabulated below for 12 months. The run-off is given in millions of cu. m. per month.

Month	J	F	M	A	M	J	J	A	S	O	N	D
River A	15	20	20	40	70	80	90	90	80	30	20	25
River B	15	15	10	10	20	90	110	110	120	60	40	20

Using above data, draw hydrograph and flow duration curve and find,

(v) The ratio of run-off of river A and B if the constant run-off is required for 70% time of the year.

(vi) Which river is more suitable for run-off river plant if the constant run-off is required for 60% time of the year and why?

(vii) Which river is more suitable for storage type plant and why?

(viii) What is the percentage time when the run-off rate of the both rivers is same? (Consider same head for both the River)

16

(b) Explain the different parameters on which the output of hydro-electric power plant depends.

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Ref. No.: Ex/PG/EST/T/116A/2024

MASTER OF TECHNOLOGY IN ENERGY SCIENCE & TECHNOLOGY

EXAMINATION - 2024

(First Year, First Semester)

POWER PLANT ENGINEERING

Time: Three hours Full Marks: 100

Part – II (40 Marks)

Answer ***any two*** from the following questions.

1. (a) What is meant by uranium enrichment? Describe some methods of uranium enrichment.

2+10=12

(b) What is the CANDU nuclear reactor? Also explain the major components and advantages of CANDU reactors compared to other types of nuclear reactors.

8

2. (a) What factors should be considered when determining the most appropriate type of hydraulic turbine used for a Hydel plants application?

4

(b) A Pelton wheel has to be designed for the following specifications.

Power to be developed = 6000 kW. Net head available = 300 m. Speed = 550 rpm. Ratio of jet diameter to wheel diameter 1/10. Hydraulic efficiency = 0.85. Assuming the velocity coefficient (C_v) = 0.98 and speed ratio(f) = 0.46, find (a) the number of jets (b) diameter of each jet (c) diameter of the wheel and (d) the quantity of water required. [g = 9.81 m/s^2]

4+4+4+4=16

3. Answers any **four** of the following question 4×5=20

(a) What is Controlled Nuclear Fission and Spontaneous Nuclear Fission?

(b) What is Fissile Material and Fertile Material?

(c) What is the Radioactive Waste? Explain the different type of nuclear power plant waste.

(d) write short note on Control Roads, Moderator and Coolant.

(e) How to manage Radioactive Wastes of nuclear power plant in India?