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**UNIVERSITY OF PUNE****[4364]-441****B. E. (Mechanical Engineering) Examination - 2013***Power Plant Engineering (2008 Course)***[Time: 3 Hours]****[Max. Marks: 100]****Instructions:**

- 1 *Answers 3 Que. From section I and 3 Que. From section II*
- 2 *Black figures to the right indicate full marks.*
- 3 *Neat diagrams must be drawn wherever necessary.*
- 4 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5 *Assume suitable data, if necessary.*

**SECTION –I****Unit I**

- Q.1      A      Write short notes on any two 10
1. Load Shedding
  2. Role of NTPC
  3. Carbon credits and its implications clean technology.
- B      Find the generation cost of a 20MW power station from 06  
the following data.
- Capital cost-Rs.  $60 \times 10^6$   
                 Annual cost of fuel- Rs.  $6 \times 10^6$   
                 Annual wages and taxes- Rs.  $8 \times 10^6$   
                 Interest and depreciation- 18%  
                 Annual load factor- 50%

**OR**

- Q.2      A      Compare the steam, hydro, gas and diesel power plant on 04  
the basis of site, cost, reliability, life cycle.
- B      Explain the Hopkinson and Doherty rates of tariff. 04
- C      A power plant of 300MW capacity has the following 08  
particulars:  
                 Capital cost=Rs 30,000/KW installed.

Interest and depreciation=15%

Annual load factor=60% Annual capacity factor=54%

Annual running charges Rs.  $500 \times 10^6$ .

Energy consumed by power plant auxiliaries=5%.

Calculate the reserve capacity and cost of generation per KWh.

### Unit II

- Q. 3      A      Discuss the working of multi-retort underfeed stoker with the help of a neat sketch. Bring out clearly its merits. 05
- B      What are the various types of ash handling systems used? Discuss the working of any one of them. 05
- C      Following data were recorded during the testing of a condenser: 06  
                  Vacuum=71cm; Barometer reading=75.5cm of Hg.  
                  Condensate temperature=25°C. Determine the partial pressure of air and steam in the condenser and the mass of air per kg of steam. Also determine the vacuum efficiency.

### OR

- Q. 4      A      Explain the working of cyclone dust collector 05
- B      State various types of impurities association with water and their effect on steam power plants. 05
- C      In a co-generation steam power plant, the boiler generates steam at 50bar, 400°C. Which is supplied to turbine for expansion, steam at 5 bar is extracted from turbine for process heating and reminder continues to expand up to condenser pressure of 0.05 bar. The man flow rate of steam from boiler is 15kg/s. if the amount of steam extracted for process heating is 5kg/s which is condensed at 5bar from process heater. Find. 06
1. Power output of turbine in KW
  2. Process heat energy utilized in KW
  3. Effectiveness of co-generation.

### Unit III

- Q. 5      A      Explain in details the various plants used based on the availability of quality of water. 06
- B      Derive an expression for maximum work in Brayton cycle and prove that. 06

$$W_{\max} = C_P(\sqrt{T_{\max}} - \sqrt{T_{\min}})^2$$

- C Define specific speed and state its significance. State the range of specific speeds for various types of water turbine. 06

**OR**

- Q. 6 A Discuss various types dams with neat figure. Bring out clearly their applications. 06
- B Why combined cycles are used? Represent a combined gas and steam cycles are on T-S diagram. If the efficiency of individual cycles are  $\eta_1$  and  $\eta_2$  what is the efficiency of combined cycle? 06
- C In a gas turbine plant the compressor takes in air at a temperature of 15°C and compresses it to 4 times of its initial pressure with an isentropic efficiency of 85%. The air is then passed through a regenerator heated by turbine exhaust gases before reading to combustion chamber. The effectiveness of regenerator is 0.8. The maximum temperature of cycle is 600°C and gases expand to their initial pressure in turbine with isentropic efficiency of 85%. Find the thermal efficiency of the plant and net power output if mass flow of air is 20kg/s.  $C_p = 1.05 \text{ KJ/kgK}$ ,  $\gamma = 1.4$  Neglect the effect of mass of fuel. 06

## SECTION II

### Unit IV

- Q. 7 A What do you understand by breeding? Name any such nuclear power plant. Describe in brief giving neat sketch, working of Fast breeder reactor. 08
- B Draw a typical layout of a diesel power station and explain. 08

**OR**

- Q. 8 A Explain with neat sketch BWR. What are the merits of BWR. 04
- B Compare between nuclear and thermal power plants. 04
- C Draw performance characteristic curves of diesel power plants. 04
- D Discuss various losses in I.C. engines. 04

**Unit V**

- Q. 9    A    Discuss the advantages of hydrogen cooling over air cooling in large capacity generators. 04
- B    Write short notes on any two 08
- i.    Circuit breaker
- ii.   Protective relay
- iii.   Switch gear
- C    Explain single basis and double basis tidal power plant with neat diagrams. 06

**OR**

- Q. 10   A    How the electrical distribution systems are classified? Explain by schematic diagrams the primary and secondary A.C. distribution systems. 06
- B    What are high temperature solar thermal power plants? Discuss the working of central receiver tower power plant. 06
- C    Write a short note on 'necessity and methods of cooling of transformers'. 06

**Unit VI**

- Q. 11   A    Discuss the various methods in brief to control pollutants of power plants. 08
- B    Write a note on 'Noise pollution in thermal power plants and its control' 08

**OR**

- Q. 12   A    Write short notes on any three. 12
- a.    Acid rain
- b.    Thermal pollution
- c.    Impact of cooling tower
- d.    Global warming and green house effect.
- B    How SO<sub>2</sub> can be controlled caused by power plants? What is pre and post treatment? 04