

B.E. Power Engineering 3rd Year, 2nd Semester (Old) - 2017**Steam Generator**

Time : 3 Hours

Full Marks: 100

Answer any five questions

- 1.a) Write down the differences between tower type boiler layout and Π type boiler layout. 6
- b) Which coal firing method is most commonly used in modern power station steam generators and why? 6
- c) With neat sketches show the unit system and central system of pulverized coal firing and discuss the advantages and disadvantages of each type. 8
2. a) Explain the differences in structure and functioning between straight flow type pulverized coal burners and vortex type pulverized coal burners. Also state the firing arrangements for each of the two types of burners. 10
- b) What are the different methods of controlling NO_x formation in the furnace of a coal fired steam generator. Explain the method which is commonly employed in wall fired steam generator. 10
- 3.a) Why is atomization required for fuel oil combustion in steam generator? 4
- b) What is the use of air preheater in steam generator? With a neat sketch explain the functioning of a regenerative air-preheater. What are the limitations of this type of air preheater and how can they be overcome? 2+8+6
- 4.a) In a finned economizer, on which side of the tube wall would you recommend to put the fins and why? Discuss with sketches the various types of fin arrangements on the wall of an economizer tube bank. 4+6
- b) Which type of water walls are commonly used in modern steam generators and why? 5
- c) What is circulation in a steam generator? How does circulation take place in a natural circulation boiler? 5
5. a) Feedwater enters the economizer inlet header of a steam generator at 130 bar and 220°C at a rate of 540 kg/s and leaves as saturated liquid at the same pressure. It is heated by flue gas flowing over the economizer at 1200 kg/s and entering at 800°C . The gas velocity is restricted at 10 m/s and the water velocity leaving the economizer coil is 1.0 m/s. The tubes are of 50 mm internal diameter and 5 mm thick and the overall heat transfer coefficient is $60\text{ W/m}^2\text{ K}$. Determine the number of coils in the economizer tube bank and the length of each coil. Take C_p (flue gas) = 1.12 kJ/kg K . 12

- b) Draw the pool boiling curve and show the critical heat flux point in it. Explain the significance of critical heat flux with respect to the operation of a steam generator? 4+4
- 6.a) What are the functions of steam drum in a steam generator? What is blow down and why is it done? 4+4
- b) How would you classify superheaters based on structural arrangement and flow arrangement? Discuss the advantages and limitations of each type. 8
- c) Why is spray attemperator required in steam generator? 4
7. Write short notes on (any four):
- (i) Boiler losses
 - (ii) Supercritical boiler
 - (iii) Flue gas recirculation in steam generator
 - (iv) Downshot firing of pulverized coal
 - (v) Dry out of evaporator tubes
- 4×5