

KADI SARVA VISHWAVIDHYALAYA
B.E MECHANICAL Semester-V

Subject: Thermal Power plant Engineering
Subject Code: ME-506

Date: 22/11/2016
Time: 10:30a.m. – 1:30 p.m.
Total Marks: 70

Instructions:

1. Answer each section in separate Answer sheet.
2. Use of Scientific calculator is permitted.
3. All questions are **Compulsory**.
4. Indicate **clearly**, the options you attempt along with its respective question number.
5. Use the last page of main supplementary for **rough work**.

SECTION-I

- Q:1 (A)** Explain with neat sketch following circuit for power plant. [5]
(1) Air & flue gas circuit (2) Cooling water circuit
- Q:1 (B)** Explain various methods used for the steam temperature control. [5]
- Q:1 (C)** Explain with Lamont boiler with neat sketch. [5]

OR

- Q:1 (C)** Classify air Preheaters & Explain any one type of air Preheater with neat sketch. [5]
- Q:2 (A)** Explain Evaporative condenser with neat sketch. [5]
- Q:2 (B)** Compare mechanical draught cooling tower with natural draught cooling tower. [5]

OR

- Q:2 (A)** What are the various sources of Air leakage in condenser? And Explain its effect on the performance of condenser. [5]
- Q:2 (B)** Exhaust steam having a quality of 0.9 enter a surface condenser at an absolute pressure of 0.13 bar and comes out as a water at 45°C . The circulating water enters at 30°C and leaves at 40°C . Estimate quantity of cooling water and condenser efficiency.
[from steam table, at 0.13 bar saturation pressure, $T_s = 51^{\circ}\text{C}$, $h_f = 213.7 \text{ kJ/kg}$, $h_{fg} = 2380.2 \text{ kJ/kg}$, & at 45°C saturation temperature, $h_f = 188.4 \text{ kJ/kg}$]
- Q:3 (A)** What is draught? Explain what you understand by forced draught. [5]
- Q:3 (B)** Write short note on Deaerator. [5]

OR

Q:3 (A) Write short note on hot soda lime treatment for feed water. [5]

Q:3 (B) Give the classification of draught and explain Steam Jet Draught with neat sketch. [5]

SECTION-II

Q:4 (A) Explain with neat sketch 'overfeed' and 'Underfeed coal firing'. [5]

Q:4 (B) Write short note on Electrostatic Precipitator with neat sketch. [5]

Q:4 (C) What are the main features of high Pressure boilers? [5]

OR

Q:4 (C) What do you understand by the term Tariff? Explain anyone method of tariff imposed on customer? [5]

Q:5 (A) Write short note on a Nuclear Reactor with its main components with help of neat sketch. [5]

Q:5 (B) Explain with help of a neat sketch the working of a Thermo-state cooling system. [5]

OR

Q:5 (A) Enlist & Explain factors affecting site selection for Nuclear power plant. [5]

Q:5 (B) Explain Splash Lubrication with neat sketch. [5]

Q:6 (A) The annual Peak load on a 30 MW power station is 25 MW. The power station supplies load having maximum demand of 10 kW, 8.5 kW, 5kW, 4.5 kW. The annual load factor is 0.45. Find (1)Average load (2) Energy supplied per year (3) Diversity factor (4) Demand factor [5]

Q:6 (B) Enlist various pollutants from Thermal Power plant & its effect on human body and vegetation. [5]

OR

Q:6 (A) What is acid rain, Explain? What are main causes of acid rain? [5]

Q:6 (B) Define the following: (1) Connected load (2) Demand (3) Average load (4) Plant capacity factor (5) Plant use factor. [5]

Best of Luck

Kadi Sarva Vishwavidyalaya

B.E. Sem V (Mechanical Engineering) Examination November 2015

Subject: Thermal Power Plant Engineering. (ME 506)

Date: 30th November, 2015

Max. Marks: 70

Time: 3 Hrs.

Instruction: (1) Use of Scientific calculator is permitted.

(2) Assume suitable data if necessary.

(3) Use of Steam Table and Mollier diagram is permitted.

Section - I

Q.1 **Each carries equal marks**

- [A] Explain the constructional difference between Low pressure and High pressure boiler [5]
[B] Draw a neat layout of thermal power plant and make a list of site selection criteria for the same. [5]
[C] Why super heat temperature needs to be controlled? Explain attemperation method. [5]

OR

- [C] Derive an expression for chimney height in order to obtain a draught of 'h' mm of water column if the boiler used 'm' kg of air / kg of fuel. Assume, surrounding air temperature as ' T_a ' and flue gas temperature as ' T_g ' in degree absolute. Also derive an expression for the condition of maximum discharge of flue gases through a chimney. [5]

Q.2

- [A] Classify different types of cooling tower used in power plant. Explain Natural draft cooling tower also explain the reason of its hyperbolic shape [5]
[B] Classify the steam condensers and describe the methods of obtaining maximum vacuum in condenser. [5]

OR

Q.2

- [A] Write short note on: Reverse osmosis and its application on sea water treatment. [5]
[B] With neat sketch explain construction and working of Fluidized bed combustion boiler and list its advantages and limitations. [5]

Q.3

- [A] Discuss requirements of oil burners? With neat sketch explain long flame, turbulent burners and tangential burners. [5]
[B] Classify various Ash handling system. Explain Pneumatic and steam jet ash handling system [5]

OR

Q.3

- [A] Explain with neat sketch construction and working of Benson Boiler [5]
[B] The following observations were made during a test on surface condenser.
Barometer reading = 760 mm of Hg, condenser vacuum = 705 mm of Hg,
Mean temperature of condensate = 35 °C, Condensate collected= 2000 kg/h,
Quantity of cooling water circulated = 60,000 kg/h, Rise in temperature of cooling water = 16 °C, Hot well temperature = 28 °C.
Determine;
(i) Vacuum efficiency (ii) Condenser efficiency (iii) Quality of steam entering the condenser and (iv) Mass of air present per m³ of condenser volume.
Assume inlet temperature of water as 20 °C.

Section - II

Q.4 **Each carries equal marks**

- [A] Define the following terms:
Average demand, Load factor, Diversity factor, utilization factor, Plant capacity factor. [5]
[B] Daily load of power generation plant is given in following table. [5]

Time	12 AM to 6 AM	6 AM to 8 AM	8 AM to 12PM	12 PM to 2 PM
Load (MW)	1270	1850	3800	2000
Time	2 PM to 4 PM	4 PM to 6 PM	6 PM to 8 PM	8 PM to 12 PM
Load (MW)	3200	3900	3200	2800

Solve the following:

- (1) Draw load curve.
- (2) Calculate average load and load factor for maximum demand of 5000 MW.

[C] Sketch layout of diesel power plant and explain any two circuits? [5]

OR

[C] Explain the followings : [5]

- (i) Binding energy
- (ii) Moderators
- (iii) Isotopes
- (iv) Nuclear fission
- (v) Nuclear fusion

Q.5

[A] Explain the effects of impurities in boiler feed water [5]

[B] Write short notes on : [5]

- (i) Fast breeder reactor
- (ii) Problems in disposal of nuclear waste.

OR

Q.5

[A] A diesel power plant consists of two units of 500 kW capacity of each and one unit of 200 kW capacity. The fuel has a calorific value of 40,000 kJ/kg and fuel consumption is 0.25 kg/kW hr. Determine the quantity of fuel required a month of 30 days and its cost if the fuel cost is Rs 4000 per ton, also find overall efficiency of the plant. [5]

[B] Explain with neat sketch boiling water reactor. [5]

Q.6

[A] Name major pollutants of thermal power plants and their effects on environment and mankind. [5]

[B] State the functions of engine cooling system. Explain with a neat schematic the working of a thermostat cooling system. [5]

OR

Q.6

[A] Describe PWR power plant with a schematic. Explain the functions of a pressuriser. [5]

[B] Write short note on: Reverse osmosis and its application on sea water treatment. [5]

*****END OF PAPER*****

Kadi Sarva Vishwavidyalaya

B.E. Sem V (Mechanical Engineering) Examination November 2014

Subject: Thermal Power Plant Engineering. (ME 506)

Date: 24th November, 2014

Max. Marks: 70

Time: 3 Hrs.

Instruction: (1) Use of Scientific calculator is permitted.
(2) Assume suitable data if necessary.

Section – I

Q.1 Each carries equal marks

- [A] Give the layout of modern thermal power station including major circuit/path of flow of condensate. [5]
[B] Explain the constructional difference between Low pressure and High pressure boiler. [5]
[C] Explain any one method of controlling the superheat temperature of steam. [5]

OR

- [C] The following reading were taken during a test on a surface condenser Mean condenser temperature =35 °C , Hot well temperature=30 °C, condenser vacuum=69cm Hg, barometer reading = 76 cm Hg, condensate collected = 16kg/min. Cooling water enters at 20 °C and leaves at 32.5 °C, flow rate being 37500 kg/hr calculate
i. Mass of air present per cubic meter of condensate
ii. Quality of steam at condenser inlet
iii. Vacuum efficiency
iv. Condenser efficiency

Q.2

- [A] Classify the steam condensers and describe the methods of obtaining maximum vacuum in condenser. [5]
[B] Explain cyclone burner with a schematic. State its merits and demerits. [5]

OR

Q.2

- [A] What is meant by “overfeed” and “underfeed” principle of coal firing. Give the advantages and disadvantages of each. [5]
[B] Compare Jet condenser with surface condenser. [5]

Q.3

- [A] Prove with usual notations that the draught produced in mm of water head by a chimney is given by, $h_w = 353H \left[\frac{1}{T_a} - \frac{1}{T_g} \left(\frac{m_a + 1}{m_a} \right) \right]$ [5]
[B] State the function of cooling tower in a modern steam power plant. Describe with neat sketch the working of a mechanical type cooling tower. [5]

OR

Q.3

- [A] Explain with neat construction and working of sketch La Mont Boiler. [5]
[B] A chimney 30 m high deals with flue gases at 288 °C when the outside air temperature is 21 °C. Air supplied for combustion is 18 kg per kg of coal burnt. Calculate: (1) the velocity of flue gases in the chimney, if 50 % of the draught is lost in friction at the grate and passage, and (2) the temperature of flue gases under the condition of maximum discharge. [5]

Section – II

Q.4 Each carries equal marks

- [A] Define: load factor, use factor, capacity factor, demand factor, diversity factor. [5]
[B] The loads on a power plant with respect to time for 24 hours are given as follows:

Time (hours)	0-6	6-12	12-14	14-18	18-24
Load (kW)	30000	90000	60000	100000	50000

- a. Draw the load curve
b. Draw the load duration curve

c. Select suitable generating units to supply the load

d. Calculate the load factor

e. Calculate the capacity of the plant and plant capacity factor.

- [C] List different impurities found in feed water and their effects on performance of thermal power plant. [5]

OR

- [C] Compare PWR and BWR. [5]

Q.5

- [A] Explain the terms "Priming and Foaming" in feed water? What are its effects on boiler? [5]
Explain the effects of dissolved gases on boiler.

- [B] Explain with neat sketch arrangement of a Diesel power plant explain in brief function of each system [5]

OR

Q.5

- [A] List and explain various type of fuel injection systems of a Diesel power plant and give [5]
the essential functions of a fuel injection system.

- [B] Give the functions and materials used for following components of nuclear reactor: [5]
(1) moderator (2) control rod (3) biological shield.

Q.6

- [A] What are the different methods used to control NO_x in the flue gases? Explain any one. [5]

- [B] A diesel power plant consists of two units of 500 kW capacity of each and one unit of 200 kW capacity. The fuel has a calorific value of 40,000 k J/kg and fuel consumption is 0.25 kg/kW hr. Determine the quantity of fuel required a month of 30 days and its cost if the fuel cost is Rs 4000 per ton, also find overall efficiency of the plant. [5]

OR

Q.6

- [A] Explain with neat sketch construction and working of CANDU type reactor. [5]

- [B] Discuss the various methods of reducing sulphur oxides in emissions. What is thermal Pollution. [5]

*****END OF PAPER*****

II Semester

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Kadi Sarva Vishwavidyalaya

B.E. Sem V (Mechanical Engineering) Examination April 2015

Subject: Thermal Power Plant Engineering. (ME 506)

Date: 25th April, 2015

Max. Marks: 70

Time: 3 Hrs.

Instruction:

(1) Use of Scientific calculator is permitted.

(2) Assume suitable data if necessary.

(3) Use of Steam Table and Mollier diagram is permitted.

Section - I

Q.1

Each carries equal marks

- [A] Explain with neat sketch construction and working of Benson Boiler. [5]
[B] Give the layout of modern thermal power station including major circuit/path of flow of condensate. [5]
[C] With neat sketch explain different types of super heaters. [5]

OR

- [C] Derive an expression for chimney height in order to obtain a draught of 'h' mm of water column if the boiler used 'm' kg of air / kg of fuel. Assume, surrounding air temperature as ' T_a ' and flue gas temperature as ' T_g ' in degree absolute. Also derive an expression for the condition of maximum discharge of flue gases through a chimney. [5]

Q.2

- [A] Explain following terms pertaining to cooling tower: Drift, Fill, Approach, Range and Cooling efficiency of cooling tower. [5]
[B] Explain Ball and Race mill with a schematic. State its merits and demerits. [5]

OR

Q.2

- [A] Describe working of hot sodium zeolite process with neat sketch and chemical reactions. [5]
List advantages and disadvantages over ion exchange system.
[B] Classify the steam condensers and describe the methods of obtaining maximum vacuum in condenser. [5]

Q.3

- [A] Discuss requirements of oil burners? With neat sketch explain long flame, turbulent burners and tangential burners. [5]
[B] Explain the working of electrostatic precipitator with neat sketch. [5]

OR

Q.3

- [A] Classify Different types of Fan. Explain why are centrifugal backward-curved blading normally used for Forced Draft Fan. [5]
[B] Dry steam is condensed at a rate of 7000 kg/h and the air leakage amounts to 14 kg/h. The air pump suction is screened off. The exhaust steam temperature is 32°C. The condensate temperature is 30°C and the temperature at the air pump suction is 25°C. Determine (i) the volume of air handled by the pump, (ii) the mass of steam condensed in the air cooler section per hour, and (iii) the mass of water vapour carried away by air. [5]

Section - II

Q.4

Each carries equal marks

- [A] How is the total annual cost of electricity estimated? How does the fuel cost relate to the load and cost of power generation? [5]
[B] Calculate the cost of generation per kWh for a power station having following data: Installed capacity of plant =200MW; Capital cost=Rs 400; crores Rate of interest and depreciation =12% Annual cost of fuel, salaries and taxation=Rs 5 crores; Load factor=50%. Also estimate the saving in cost per kWh if annual factor is raised to 60% [5]
[C] Compare the following:
a) Nuclear power plant and thermal power plant
b) Diesel power plant and thermal power plant [5]

OR

- [C] Explain with neat sketch arrangement of a Diesel power plant explain in brief function of [5] each system.

Q.5

- [A] List different impurities found in feed water and their effects on performance of [5] thermal power plant.
[B] What are fission fragment and fission product? Explain Fission Reaction with an [5] example.

OR

Q.5

- [A] A diesel power plant consists of two units of 500 kW capacity of each and one unit of 200 [5] kW capacity. The fuel has a calorific value of 40,000K J/kg and fuel consumption is 0.25 kg/kW hr. Determine the quantity of fuel required a month of 30 days and its cost if the fuel cost is Rs 4000 per ton, also find overall efficiency of the plant.
[B] Write short notes on : [5]
(i) Fast breeder reactor
(ii) Problems in disposal of nuclear waste.

Q.6

- [A] What are the different pollutant emitted from power plant and discuss its defects. [5]
[B] State objectives of a lubrication system. Explain working with a schematic of a dry sump [5] lubrication system. Differentiate between wet sump and dry sump lubrication system.

OR

Q.6

- [A] Explain with neat sketch Pressurizes water Reactor(PWR) Explain function of pressurizer [5] in PWR.
[B] Write short note on: Reverse osmosis and its application on sea water treatment. [5]

*****END OF PAPER*****