



B.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Fourth Semester

MECHANICAL ENGINEERING

U15METPE12: Power Plant Engineering

COURSE OUTCOMES

- CO1:** Explain the working principle of various power plants and higher pressure boilers.
CO2: Illustrate the various circuits in steam power plant.
CO3: Summarize the various nuclear reactors and waste disposal methods.
CO4: Outline the steps involved in site selection and working principle of hydroelectric power plants.
CO5: Discuss the working of diesel and gas turbine power plants.
CO6: Explain the working of renewable power plants and discuss the economics of power plants.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match List I with List II

CO3 [K₂]

List I	List II
A. Boiling water reactor	i. Heavy water as coolant and moderator
B. CANDU (Canadian –Deuterium – Uranium) reactor	ii. Light water as coolant and moderator
C. Fast breeder reactors	iii. Liquid metals as coolants
D. Pressurized water reactor	iv. water is pressurized by pressuriser

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|----|-----|----|-----|----|
| | A | B | C | D |
| a) | ii | i | iii | iv |
| b) | iii | iv | ii | i |
| c) | ii | iv | iii | i |
| d) | iii | i | ii | iv |

2. Blowing down the boiler is the process to

CO1 [K₂]

- | | |
|-------------------------------|---|
| a) Reduce the boiler pressure | b) Control the solid concentration in the boiler. |
| c) To increase steam pressure | d) To scrap the boiler |

3. Consider the following statements. CO2 [K₂]
1. The force draught fan should rotate at high speeds
 2. The induced draught fan should rotate at low speeds
 3. The force draught fan should rotate at low speeds
 4. The induced draught fan should rotate at high speeds
- Which of these statements are correct?
- a) 1,3 b) 1,4
c) 1,2 d) 2,3
4. The single largest nuclear power plant in India is located in CO3 [K₂]
- a) Kudankulam, Tamil Nadu b) Kalpakkam, Tamil Nadu
c) Tarapur, Maharashtra d) Kota, Rajasthan
5. Assertion (A): Chain grate stoker is a overfeed stoker CO2 [K₂]
Reason (R): Underfeed stoker is used for Anthracite coal
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
6. Coal fired power plant boilers manufactured in India generally use CO1 [K₂]
- a) Pulverised fuel combustion b) Fluidized bed combustion
c) Circulating Fluidized fuel bed combustion d) Moving stoker firing system
7. Consider the following steps to find the load factor of a residential consumer for a day CO6 [K₂]
1. Collect the load data for 24 hours
 2. Calculate the average load
 3. Find the energy consumption during the day
 4. Estimate the maximum demand
- The correct sequence to calculate the load factor is
- a) 2-3-1-4 b) 1-3-2-4
c) 3-4-2-1 d) 4-1-3-2
8. The power output from a hydroelectric power plants depends on which of the three parameters CO4 [K₂]
- a) Head, type of dam and discharge b) Head, discharge and efficiency of the system
c) Efficiency of the system, type of draft tube and type of turbine used. d) Type of dam, discharge and type of catchment area.
9. Assertion (A): Gas turbines for power generation are normally used to supply peak load requirements. CO5 [K₂]
Reason (R): In gas turbines, higher thermal efficiency is obtained in open cycle.
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
10. Francis, Kaplan and propeller turbines fall under the category of CO4 [K_L]
- a) Impulse turbine b) Reaction turbine
c) Impulse and reaction combined d) Axial flow turbine

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

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|--|-----|-------------------|
| 11. Differentiate between subcritical and super critical boilers. | CO1 | [K ₂] |
| 12. List the functions of mechanical stokers in thermal power plant. | CO2 | [K ₂] |
| 13. Enumerate the importance of heavy water in a nuclear power plant. | CO3 | [K ₂] |
| 14. Compare forced draft cooling tower with induced draft cooling tower. | CO2 | [K ₂] |
| 15. List any four differences between two stroke and four stroke diesel engine. | CO5 | [K ₂] |
| 16. Write an expression for the first law of thermodynamics for a system. | CO5 | [K ₂] |
| 17. How hydraulic turbines are classified? | CO4 | [K ₁] |
| 18. What are the desired properties required for good moderator in nuclear reactors? | CO3 | [K ₂] |
| 19. Differentiate between impulse turbine and reaction hydraulic turbine. | CO4 | [K ₂] |
| 20. Compare load factor and capacity factor. | CO6 | [K ₂] |

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

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|--|-----|-----------------------|
| 21. With a neat sketch, explain the combined gas turbine-steam turbine power plant. | CO1 | [K ₂] |
| 22. With neat sketch, explain the construction and working principle of Lamont boiler. | CO1 | [K ₂] |
| 23. A) With a neat sketch, explain Bowl mill. | (7) | CO2 [K ₂] |
| B) Draw the schematic layout of pulverized coal handling plant. | (7) | CO2 [K ₂] |
| 24. A) With a neat sketch, explain the parts of a nuclear reactor. | (7) | CO3 [K ₂] |
| B) Classify the different types of nuclear reactor. | (7) | CO3 [K ₂] |
| 25. A) List the parameters for the selection of a site for hydroelectric power plant | (7) | CO4 [K ₂] |
| B) Draw the schematic layout of a diesel engine power plant. | (7) | CO5 [K ₂] |
| 26. A) Differentiate between open cycle gas turbine and closed cycle gas turbine power plants. | (7) | CO5 [K ₂] |
| B) With a neat sketch, explain the closed ocean thermal energy conversion (OTEC) ammonia system. | (7) | CO6 [K ₂] |

27. A) Determine the generating cost per unit of 8MW power station with the following (7) CO6 [K₃]
data:

Capacity cost = Rs 40×10^5

Annual cost of fuel = Rs 80,000

Annual wages and taxes = Rs 90,000

Interest and depreciation = 10%

Annual load factor = 45%

B) A power station has a maximum demand of 80,000 kW and daily load curve is defined as follows: (7) CO6 [K₃]

Time (hours)	0-6	6-8	8-12	12-14	14-18	18-22	22-24
Load (MW)	40	50	60	50	70	80	40

Plot the load curve and determine the load factor of the power station.
