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C14–M–504

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2018

DME—FIFTH SEMESTER EXAMINATION

HEAT POWER ENGINEERING—II

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Define wet steam, dry steam and super-heated steam. 1+1+1

2. List out the names of any six vapour processes. ½×6

3. What are the factors that influence boiler efficiency? ½×6

4. Compare water tube boilers with fire tube boilers. 1+1+1

5. What is a steam nozzle? List out different types of steam nozzles. 1+2

6. State the effects of super-saturated flow of steam in a nozzle. 1+1+1

7. List out various compounding methods of steam turbine. 1+1+1

8. Write the working principle of a reaction turbine. 3

9. Draw a line diagram of evaporative steam condenser and label the parts. 2+1

10. What is the function of an air pump in steam condenser? 3

PART—B 10×5=50

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

(4) Use of steam tables in permitted.

11. 2 kg of steam initially at a pressure of 12 bar and a temperature 250 °C expands polytropically to 1·2 bar. Find—

(a) the final condition of steam;

(b) work done;

(c) heat transfer;

(d) change in entropy.

Assume the index of expansion as 1·25. 3+2+2+3

12. Describe the working of La Mont boiler with a neat sketch and label its parts. 4+4+2

13. A boiler generates 18000 kg/hr of steam at 12 bar with 95% quality. Feed water temperature is 110 °C. Rate of coal firing is 2000 kg/hr. If HCV of coal is 27500 kJ/kg, find—

(a) the factor of equivalent evaporation;

(b) the equivalent evaporation;

(c) the thermal efficiency of generation. 4+3+3

14. Steam at a pressure of 9 bar absolute and dryness fraction of 0·9 enters a convergent divergent nozzle and leaves it at a pressure of 2 bar absolute. Find for the maximum discharge, the ratio of the cross-sectional area at throat to that of the outlet of the nozzle. Assume 10% loss of total heat drop in the divergent part of the nozzle. 10

15. *(a)* Describe with a neat sketch the working of a steam injector. 5

(b) Draw the layout of a steam condensing plant by labelling important elements. 5

16. *(a)* Discuss with the help of simple sketches about reheating and bleeding with respect to a steam turbine. 4

(b) Describe about nozzle control governing of a steam turbine. 6

17. A De-Laval steam turbine is supplied with 1 kg steam per second from a set of nozzles whose pressure range is 10 bar to 0·2 bar. The nozzle angle is 22° and blade exit angle is 30°. The mean blade speed is 250 m/s. If the nozzle efficiency is 80%, find *(a)* power developed, *(b)* the blade angle at inlet and *(c)* the blade efficiency. 7+1+2

18. Following observations were made during a trial on a steam condenser :

Barometric pressure	760 mm of Hg
Vacuum reading	690 mm of Hg
Rate of cooling water	16 kg/sec
Inlet temperature of cooling water	20 °C
Outlet temperature of cooling water	30 °C
Quantity of steam condensed	20 kg/minute
Hot-well temperature	32 °C
Mean temperature of condensate	35 °C

Determine : 2+2+3+1+2

(a) Vacuum efficiency

(b) Condenser efficiency

(c) Dryness fraction of exhaust steam

(d) Sub-cooling of condensate

(e) Amount of air leakage per kg of steam condensed

Assume R for air = 0·287 kJ/kg/ K and specific heat of water = 4·182 kJ/kg K

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