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C09–M–405

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BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2016

DME—FOURTH SEMESTER EXAMINATION

THERMAL 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. State the function of a governor in IC engine.

2. Write the limitations of air-cooling system used in IC engine.

3. Write any three main differences between centrifugal compressor and axial-flow compressor.

4. Mention any three limitations of gas turbines.

5. Define tractive effort.

6. Write the importance of *(a)* economizer and *(b)* superheater in a boiler and where they will be placed in the boiler.

7. How do you classify draught?

8. Mention the assumptions made in analyzing the flow of steam through a nozzle.

9. Write various energy losses in steam turbines.

10. Write the working principle of reaction turbine.

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.

11. In a trial of a single-cylinder oil engine working on dual cycle, the following observations were made :

Compression ratio	=	15
Oil consumption	=	10·2 kg/h
Calorific value of the fuel	=	43890 kJ/kg
Air consumption	=	3·8 kg/min
Speed	=	1900 r.p.m.
Torque on the brake drum	=	186 Nm
Quantity of cooling water used	=	15·5 kg/min
Temperature rise	=	36 °C
Exhaust gas temperature	=	410 °C
Room temperature	=	20 °C
C_p for exhaust gases	=	1·17 kJ/kg-K

(a) Calculate brake power.

(b) Calculate brake specific fuel consumption.

(c) Calculate brake thermal efficiency.

(d) Draw heat balance sheet on minute basis.

12. *(a)* Sketch the hypothetical valve timing diagrams for *(i)* four-stroke diesel engine, *(ii)* two-stroke petrol engine and mention approximate valve timing values. 7

(b) Write the difference between the blades of impulse turbine and reaction turbine. 3

13. *(a)* Describe the working of a axial-flow type compressor with a neat sketch.

(b) Explain briefly why isothermal compression is the usual standard of compression for reciprocating compressors. Sketch suitable temperature-entropy diagram to demonstrate it.

14. *(a)* Explain with a neat sketch, the working of a rocket engine.

(b) Enumerate various applications of rocket.

15. Describe the working of friction clutch with a neat sketch.

16. A boiler plant supplies 5600 kg of steam per hour at 9-bar and 0·95 dry from feedwater at 42 °C when used 700 kg of coal per hour having a calorific value of 32000 kJ/kg.

Determine—

(a) the thermal efficiency of boiler;

(b) the equivalent evaporation;

(c) the percentage saving in coal if feedwater temperature is raised to 100 °C by using an economizer.

Assume 5% increase in boiler efficiency, other conditions being same.

17. Dry saturated steam at a pressure of 8-bar enters a convergent-divergent nozzle and leaves its at a pressure of 1 bar. If the flow is isentropic, and the corresponding expansion index is 1·135, find the ratio of cross-sectional area at exit and throat for maximum discharge. Take R 0 287 kJ/kg-K and C_p 1 005 kJ/kg-K.

18. In a reaction turbine, the mean blade ring diameter is 1 m and the turbine runs at a speed of 50 RPS. The blades are designed for 50% reaction with exit angles 30° and inlet angles 50°. The turbine is supplied with steam at the rate of 160 kg/sec and the stage efficiency is 85%. Determine—

(a) power output of the stage;

(b) percentage increase in relative velocity.

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