Register No.:

303

October 2017

Time – Three hours
(Maximum Marks: 75)

[N.B: (1) Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory. Answer any FOUR questions from the remaining in each PART - A and PART - B.

(2) Answer division (a) or division (b) of each question in PART-C.

(3) Each question carries 2 marks in PART – A, 3 marks in Part – B and 10 marks in PART – C.

(4) Use of steam tables and Mollier chart are permitted.]

PART – A

1. State any two examples of open system and isolated system.
2. Define (i) Octane number and (ii) Cetane number.
3. How the efficiency and power output of a gas turbine plant can be increased?
4. Mention the various stages in the formation of steam from water.
5. What do you mean by heat of superheat and degree of superheat?
6. What are the effects of impurities present in the boiler feed water?
7. What are the common external treatments given to the boiler feed water?
8. State the Clausius statements of second law of thermodynamics.

PART – B

9. State and explain steady flow energy equation.
10. A gas in a cylinder is at a pressure of 700kN/m². It is expanded at constant pressure from a volume of 0.28m³ to a volume of 1.68 m³. Determine the work done.
11. The compression ratio and cut-off ratio of a diesel cycle is 14 and 2.2 respectively. Determine the air-standard efficiency of the cycle.
12. Compare detonation with diesel knock.
13. State the applications of rockets.
14. Distinguish between wet steam and dry steam.
15. Distinguish between boiler mountings and accessories.

[Turn over.....

16. The specific volume of steam at 10 bar is recorded as 0.1749m³/kg. Determine the quality of steam, enthalpy and its entropy.

PART – C

17. (a) 0.25kg of air at a pressure of 1 bar occupies a volume of 0.3m³. If this air expands isothermally to a volume of 0.9m³, determine (i) the initial temperature (ii) the final temperature (iii) external work done (iv) change in internal energy (v) heat absorbed by the air and (vi)change in entropy. Assume R=0.29kJ/kgK.

(Or)

(b) A quantity of air occupies a volume of 30 litres at a temperature of 38°C and a pressure of 104kN/m². The temperature of the air is raised by adiabatic compression until the volume becomes 6 litres. Find (i) the final temperature (ii) the external work done (iii) the change in internal energy (iv) the heat transferred (v) the change in enthalpy and (vi) the change in entropy. Take R=0.29kJ/kgK and γ=1.4.

18. (a) Find the power output of a diesel engine working on a standard diesel cycle with a compression ratio of 16 and an air flow rate of 0.25kg/s. The initial condition of air is at 1 bar pressure absolute and 27°C temperature. Heat added per cycle is 2500kJ/kg. Assume C_p=1.0kJ/kgK and C_v=0.714kJ/kgK.

(Or)

(b) Explain in detail the various stages of combustion in diesel engines.

19. (a) A single stage single acting air compressor has a bore of 200mm and a stroke of 300mm. It receives air at 1 bar and 20°C and delivers it at 5.5 bar. If the compression follows the law $PV^{1.3}$=C and the clearance volume is 5% of the stroke volume, determine the power required to drive the compressor. The speed of compressor is 500 rpm.

(Or)

(b) Explain the working of a liquid propellant rocket engine with a neat sketch.

20. (a) 1 kg of steam at a pressure of 1 bar absolute and 0.85 dry is compressed according to the law $PV^{1.25}$=C. The final pressure is 2 bar. Find the final condition of steam and heat which passes through the cylinder walls.

(Or)

(b) Explain the method of finding dryness fraction of steam using separating and throttling colorimeter with a neat sketch.

21. (a) During the test of an oil fired water tube boiler, the following data were obtained.

Steam pressure	=16 bar absolute
Quality of steam	=99% dry
Water evaporated per minute	=282.85kg
Feed water temperature	=76°C
Fuel oil burnt per minute	=22.45kg
Calorific value of fuel oil	=44,966kJ/kg

Calculate (i) the actual evaporation (ii) factor of evaporation (iii) the equivalent evaporation from and at 100°C (iv) boiler efficiency and (v) boiler power.

(Or)

(b) The following results were obtained in a boiler trail.

Feed water per hour = 1520kg at 30°C
Steam produced = 0.95 dry at 9 bar
Coal per hour 200kg of calorific value =27500 kJ/kg
Ash and unburnt coal collected from beneath fire bars 16kg per hour of calorific value =2720kJ/kg
Mass of dry flue gases per kg of coal burnt =17.3kg
Flue gas temperature = 330°C
Air temperature = 17°C
Specific heat of flue gas = 1.00kJ/kgK
Loss due to incomplete combustion is 1% of the coal.

Draw up a heat balance sheet per kg of coal and also determine the equivalent evaporation from and at 100°C per kg of coal.
