1269

Code : 15ME52T

Register Number | | | | | | | | | | |

V Semester Diploma Examination, Nov./Dec. 2018

APPLIED THERMAL ENGINEERING

Time : 3 Hours] **[Max. Marks : 100**

Note : (i) Answer any **six** from Part – A and any **seven** from Part – B.
(ii) Use of steam tables and Miller charts permitted.
(iii) Assume any missing data suitably.

PART – A

1. Define the following terms : **5**
   (i) Wet steam
   (ii) Dry saturated steam
   (iii) Superheated steam
   (iv) Dryness fraction of the steam
   (v) Specific volume of steam

2. Explain separating type steam calorimeter with a neat sketch. **5**

3. Give the classification of steam boilers. **5**

4. List the functions of cooling tower in a modern condensing plant and its applications. **5**

5. Define steam nozzle. State the applications of steam nozzles. **5**

6. Explain briefly the velocity compounding of steam turbine with a diagram. **5**

7. State the differences between impulse turbine and reaction turbine. **5**

8. Sketch and explain the working of axial flow air compressor. **5**

9. Explain summer air conditioning system with a neat sketch. **5**

PART – B

10. (a) Calculate the internal energy of 1 kg of steam at a pressure of 10 bar when the steam is

    (i) 0.9 dry

    (ii) Dry saturated

    (b) Using Mollier's chart find the enthalpy drop and condition of the steam when it is expanded isentropically from an initial pressure of 30 bar and 350 °C to a pressure of 1 bar.

11. A sample of 1 kg of steam at a pressure of 15 bar exists in the following two conditions :

    (i) Wet steam with dryness fraction 0.8

    (ii) Superheated steam with a temperature of 215 °C

    Determine the following properties in each case :

    (a) Enthalpy

    (b) Specific volume

    (c) Entropy

    (d) External work

    (e) Internal energy

12. (a) Compare high pressure boiler and low pressure boiler.

    (b) State the location and function of the following :

    (i) Fusible plug

    (ii) Economizer

    (iii) Blow-off cock

    (iv) Safety valve

    (v) Superheater

13. Sketch and explain the construction and working of a La-mont boiler.

14. Explain barometric jet condenser with a neat sketch.

5. A convergent divergent nozzle is required to discharge 350 kg of steam per hour. The nozzle is supplied with steam at 8.5 bar and 90% dry and discharges against a back pressure of 4 bar. Neglecting the effect of friction, find the throat and exit diameters.

10

16. Steam issues from the nozzle of a simple impulse turbine with a velocity of 900 m/sec. The nozzle angle is 20°, the mean diameter of the blades is 25 cms. and the speed of rotation is 20000 rpm. The mass flow through the turbine nozzles and blading is 0.18 kg of steam per second. Draw the velocity diagram and calculate the following :

(a) Tangential force on blades

(b) Axial force on blades

(c) Power developed by the turbine wheel

(d) Efficiency of the blading and

(e) Inlet angles of the blades

10

17. An impulse turbine with a single row wheel is to develop 99.3 kW, the blade speed being 150 m/sec. A mass of 2 kg of steam per second is to flow from the nozzles at a speed of 350 m/sec. The velocity coefficient of the blades may be assumed to be 0.8 while the steam is to flow axially after passing through the blades ring. Determine the nozzle angle, and the blade angles at inlet and exit assuming no shock. Estimate also the diagram efficiency of the blading.

10

18. A single stage single acting reciprocating air compressor has a bore of 200 mm and stroke of 300 mm. 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 clearance volume is 5% of stroke volume.

Determine :

(i) Mean effective pressure

(ii) The power required

to drive the compressor, if it runs at 500 rpm.

10

19. (a) Define :

(i) Dry bulb temperature

(ii) Wet bulb temperature

(iii) Dew point temperature

(iv) Tonne of refrigeration

(v) COP

(b) Explain vapour absorption refrigeration system with flow diagram.
