

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fourth Semester

MECHANICAL ENGINEERING

U07ME403: Thermal Engineering

(Use of Approved Data Book and Tables are Permitted)

Time: Three Hours

Maximum Marks: 100

Answer All Questions:-

PARTA (10 x 1 = 10 Marks)

1. In a Diesel cycle the compression ratio is
 - a) Greater than expansion ratio
 - b) Less than expansion ratio
 - c) Equal to expansion ratio
 - d) equal to zero
2. Air standard efficiency of an Otto cycle is given by
 - a) $\eta = 1 - 1/(r)^{\gamma+1}$
 - b) $\eta = 1 - 1/(r)^{\gamma-1}$
 - c) $\eta = 1 - 1/(r)^{\gamma+1}$
 - d) $\eta = 2 - 1/(r)^{\gamma-1}$
3. The volume of the cylinder when the piston is at TDC is known as
 - a) Clearance volume
 - b) Swept volume
 - c) Total volume
 - d) Cylinder Volume
4. Function of a choke is to
 - a) Increase fuel supply
 - b) reduce fuel supply
 - c) stop the fuel supply
 - d) Maintain constant fuel supply
5. The effect of considering friction losses in steam nozzle for the same pressure ratio leads to
 - a) Increase in exit velocity
 - b) decrease in exit velocity
 - c) no change in exit velocity
 - d) increase or decrease depending upon exit quality of steam
6. Steam turbines are governed by the following method
 - a) Throttle governing
 - b) Nozzle control governing
 - c) By-pass governing
 - d) all the above
7. Volumetric efficiency of an air compressor is lowered by
 - a) Very high speed
 - b) Inertia effect of air in suction pipe
 - c) Too large clearance volume
 - d) All the above
8. In centrifugal air compressor the pressure developed depends on
 - a) Impeller tip velocity
 - b) inlet temperature
 - c) compression index
 - d) all the above
9. C.O.P for a Carnot refrigerator is
 - a) less than that of Carnot heat pump
 - b) More than that of Carnot heat pump
 - c) Equal to Carnot heat pump
 - d) zero
10. The pressure and temperature conditions of air at the suction of compressor are
 - a) Less than atmospheric
 - b) more than atmospheric
 - c) equal to atmospheric
 - d) may be less or more than atmospheric

PART B (10 x 2 = 20 Marks)

11. Write the assumption made for air standard cycle analysis.
12. Name the various gas power cycles.
13. State any four functions of carburetor.
14. Why compression ratio of petrol engine is low compare to diesel engines?
15. What is compounding of turbine?
16. Define nozzle efficiency.
17. Define volumetric efficiency in an air compressor
18. Give two merits of rotary compressors over reciprocating compressors.
19. Name any four commonly used refrigerants
20. How are air-conditioning systems classified?

PART C (5 x 14 = 70 Marks)

21. a) A certain quantity of air at a pressure of 1 bar and temperature of 70°C is compressed adiabatically until the pressure is 7 bar in Otto cycle engine. 465 kJ of heat per kg of air is now added at constant volume. Determine

- (i) Compression ratio of the engine
- (ii) Temperature at the end of compression
- (iii) Temperature at the end of heat addition

Take the air $c_p=1.0$ KJ/kgK, $c_v= 0.706$ KJ/kg K, show each operation on p-V and T-s diagram.

(OR)

- b) A diesel engine has a compression ratio of 15 and heat addition at constant pressure takes place at 6% of stroke. Find the air standard efficiency of the engine. Take γ for the air as 1.4

22. a) Explain in detail the thermo- syphon and thermostat cooling system in an I.C engine

(OR)

- b) With a neat diagram explain the working of a battery ignition system.

23. a) Dry saturated steam at a pressure of 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine

- (i) Exit velocity of the steam
- (ii) Ratio of cross section at exit and that at throat

Assume the index of the adiabatic expansion to be 1.135

(OR)

b) What do you understand by compounding of steam turbines? What are the types? Explain any one with a neat diagram.'

24. a) A four cylinder double acting compressor is required to compress $30\text{m}^3/\text{min}$ of air at 1 bar and 27°C to a pressure of 16 bar. Determine the power of the motor required and cylinder dimensions if the following data is given

- (i) Speed of the compressor= 320 rpm
- (ii) Clearance Volume= 4%
- (iii) Stroke to bore ratio= 1.2
- (iv) Mechanical efficiency= 82%
- (v) Value of index= 1.32

Assume no pressure change in suction valves and air gets heated by 12°C during suction stroke.

(OR)

b) A single stage double acting air compressor is required to deliver 14m^3 of air per minute measured at 1.013 bar and 15°C . The delivery pressure is 7 bar and speed 300 rpm. Take the clearance volume as 5% of the swept volume with the compression and expansion index of $n=1.3$. Calculate

- (i) Swept volume of the cylinder.
- (ii) Delivery Temperature.
- (iii) Indicated Power.

25. a) With a neat sketch explain the working of a simple vapour absorption refrigeration system

(OR)

b) An office is to be air conditioned for 50 staff when the out door conditions are 30°C DBT and 75% RH if the quantity of air supplied is $0.4\text{m}^3/\text{min}/\text{person}$, Find the following

- (i) Capacity of cooling coil in tones of refrigeration
- (ii) Capacity of heating coil in kW
- (iii) Amount of water vapour removed per hour

Assume that required air inlet conditions are 20°C DBT and 60% RH. Air is conditioned first by cooling and dehumidifying and then by heating. If the heating coil surface temperature is 20°C find the bypass factor of the heating coil.
