A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54704

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Mechanical Engineering

15UME404 - THERMAL ENGINEERING

(Regulation 2015)

(Steam Table and Refrigeration tables are permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The compression ratio of an IC engine is the ratio of CO1- R

   (a) Swept volume to clearance volume

   (b) Total cylinder volume to clearance volume

   (c) Total cylinder volume to swept volume

   (d) Pressure after compression to that before compression

2. For same compression ratio CO1- R

   (a) η otto > η diesel (b) η otto < η diesel (c) η otto = η diesel (d) Un predictable

3. Spark plug is used in CO2- R

   (a) Petrol engine (b) Gas engine (c) Marine engine (d) Diesel engine

4. In engines heat energy converted into CO2- R

   (a) Chemical energy (b) Mechanical energy

   (c) Electrical energy (d) Heat energy

5. For dry steam, polytrophic index value (n) is CO3- R

   (a) 1.335 (b) 1.435 (c) 1.135 (d) 1.113

6. The process of maintaining the speed of the turbine constant for various load conditions, is known as CO3- R

   (a) Bleeding (b) Reheating (c) Governing (d) Superheating

7. In a reciprocating compressor one should aim at compressing the air CO4- R

(a) Adaibatically (b) Isentropically (c) Isothermally (d) Polytropically

8. In compressors, compression and expansion takes CO4- R

(a) Constant volume process (b) Constant pressure process

(c) Constant temperature process (d) Polytropic process

9. Refrigeration is the process of maintaining the temperature CO5- R

(a) Below the surrounding (b) Above the surrounding

(c) Equal to surrounding (d) Above the atmosphere

10. In a window air conditioner the expansion device used is CO5- R

(a) Capillary tube (b) Float valve

(c) Thermostatic expansion device (d) Automatic expansion valve

PART – B (5 x 2= 10Marks)

11. What is the effect of cutoff ratio on the efficiency of diesel cycle when the compression ratiois kept constant? CO1- R

12. Classify IC engines according to cycle of operation. CO2- R

13. What is meant by compounding of steam turbine? CO3- R

14. Why clearance is necessary and what is its effect on the performance of reciprocating compressor? CO4- R

15. What is the function of the throttling valve in vapour compression refrigeration system? CO5- R

PART – C (5 x 16= 80Marks)

16. (a) In an air standard diesel cycle the pressure and temperature of air at the beginning of the cycle are 1 bar and 40°c. The temperature before and after the heat supplied are 400°c and 1500°c. Find the air sandard efficiency and mean effective pressure of the cycle. What is the power output if it makes 100 cycles/min. CO1- App (16)

Or

(b) An ideal dual cycle engine works with a stroke volume of 10 liters of air with a compression ratio of 16. The pressure and temperature of air before isentropic compression is 1 bar and 300K respectively. If the heat is added at a constant pressure of 70 bar and for 5 % of the stroke, determine
(i) Pressure ratio
(ii) Cut-off ratio
(iii) Mass of air contained in the cylinder
(iv) Heat added per cycle
(v) Heat rejected per cycle
(vi) work done per cycle
(vii) Thermal efficiency of the cycle
(viii) Mean effective pressure.
CO1- App (16)

17. (a) Explain with neat sketch two stroke petrol engine and four stroke diesel engine. CO2- U (16)

Or

(b) Explain the working of Battery Ignition system with neat sketch CO2- U (16)

18. (a) Derive the expression for mass flow rate takes place in steam nozzle. CO3-U (16)

Or

(b) With a neat diagram explain impulse and reaction turbine and compare. CO3-U (16)

19. (a) A single acting two-stage air compressor deals with $4m^3$/min of air at 1.013 bar 15^0C with a speed of 250 rpm. The delivery pressure is 80 bar. Assuming complete inter cooling. Find the minimum power required by the compressor and the bore and stroke of the compressor. Assume a piston speed of 3 m/s, mechanical efficiency of 75% and volumetric efficiency of 80% per stage. Assume the polytrophic index of compression in both the stages to be n = 1.25 and neglect clearance. CO4- App (16)

Or

(b) A single acting air compressor has a bore and stroke of both 100 mm and runs at 350 rpm. The clearance volume is 75c.c. and the index of compression and expansion is 1.23. The suction pressure is 0.95 X 10^5 N/m^2 and the delivery is 7X10^5 N/m^2. Calculate the volume of free air at 10^5 N/m^2 and 20^0C dealt with per minute and temperature at end of compression if the temperature at the start of compression is 30^0C. CO4- App (16)

20. (a) Explain the construction and working of the vapour absorption refrigeration system with neat sketch. CO5- U (16)

Or

(b) An air conditioning plant is to be designed for a small office for winter conditions: CO5- App (16)

Out-door conditions = 10^0C DBT and 8^0C WBT

Required indoor conditions = 20^0C DBT and 60% RH

Amount of air circulation = 0.3 m^3/min./person

Seating capacity of the office = 50 persons

The required conditions is achieved first by heating and then by adiabatic humidifying. Find:

Heating capacity of the coil in KW and capacity of the humidifier.