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Question Paper Code	12974
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B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fourth Semester

Mechanical Engineering

20MEPC404 - THERMAL ENGINEERING

Regulations - 2020

(Use of Steam Table and Refrigeration table is permitted)

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

- | | <i>Marks</i> | <i>K-
Level</i> | <i>CO</i> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|-----------|
| 1. In an ideal otto cycle, the thermal efficiency is primarily a function of:
(a) the heat capacity of the working fluid (b) the compression ratio
(c) the type of fuel used (d) the speed of the engine | 1 | K2 | CO1 |
| 2. What is the purpose of the cut-off ratio in the diesel cycle?
(a) to define the amount of fuel injected
(b) to determine the efficiency of the cycle
(c) to specify the volume at which heat addition occurs
(d) to indicate the maximum temperature reached | 1 | K2 | CO1 |
| 3. What is the primary characteristic of the brayton cycle?
(a) constant volume heat addition (b) constant pressure heat addition
(c) isothermal expansion (d) isentropic compression | 1 | K1 | CO1 |
| 4. A nozzle is said to be a convergent nozzle
(a) when the cross-section of the nozzle increases continuously from the entrance to exit
(b) when the cross-section of the nozzle decreases continuously from the entrance to exit
(c) when the cross-section of the nozzle first decreases from the entrance to the throat and then increases from its throat to exit
(d) none of these | 1 | K1 | CO2 |
| 5. The critical pressure ratio for initially superheated steam is _____ as compared to initially dry saturated steam.
(a) more (b) less (c) same (d) all of these | 1 | K1 | CO2 |
| 6. A nozzle is said to be a divergent nozzle
(a) when the cross-section of the nozzle increases continuously from entrance to exit
(b) when the cross-section of the nozzle decreases continuously from entrance to exit
(c) when the cross-section of the nozzle first decreases from entrance to throat and then increases from its throat to exit
(d) none of the given | 1 | K1 | CO2 |
| 7. The impulse reaction turbine has its driving force
(a) as an impulsive force (b) as a reaction force
(c) partly as an impulsive force and partly as a reaction force (d) none of the mentioned | 1 | K2 | CO3 |
| 8. Steam turbines are used for
(a) large marine propulsion (b) electric power generation
(c) direct drive of fans, compressors, pumps (d) all of these | 1 | K1 | CO3 |
| 9. The following are the method for compounding except
(a) velocity compounding (b) pressure compounding
(c) volume compounding (d) reaction turbine | 1 | K2 | CO3 |
| 10. The compressed air may be used
(a) in gas turbine plants (b) for operating pneumatic drills
(c) in starting and supercharging of I.C. engines (d) all of the above | 1 | K1 | CO4 |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-----|
| 11. The ratio of the discharge pressure to the inlet pressure of air is called
(a) compression ratio (b) expansion ratio
(c) compressor efficiency (d) volumetric efficiency | 1 | K2 | CO4 |
| 12. Compressor capacity is having the unit
(a) cubic meter per kg (b) cubic meter per minute
(c) kg per cubic meter (d) meter square per second | 1 | K1 | CO4 |
| 13. Which one is a link between piston and crank?
(a) Connecting rod (b) Piston pin (c) Push rod (d) Crankshaft | 1 | K1 | CO5 |
| 14. The component that takes care of fluctuation of the cyclic variation in speed is known as
(a) governor (b) flywheel (c) camshaft (d) fuel pump | 1 | K1 | CO5 |
| 15. The compression ratio for an S.I engine usually lies in the range of
(a) 6:1 to 10:1 (b) 11:1 to 20:1 (c) 12:1 to 15:1 (d) 10:1 to 12:1 | 1 | K2 | CO5 |
| 16. In a two-stroke engine, ports are operated by movement of
(a) crank (b) piston (c) connecting rod (d) piston pin | 1 | K1 | CO5 |
| 17. The coefficient of performance is the ratio of
(a) refrigerant effect to the heat of compression
(b) refrigerant effect to the work done by the compressor
(c) refrigerant effect to the enthalpy
(d) none of the above | 1 | K1 | CO6 |
| 18. The higher temperature in the vapour compression cycle occurs at
(a) expansion valve outlet (b) condenser discharge
(c) compressor discharge (d) evaporator outlet | 1 | K2 | CO6 |
| 19. In the vapour absorption refrigeration system, heat is rejected in
(a) condenser only (b) generator only
(c) absorber only (d) condenser and absorber | 1 | K2 | CO6 |
| 20. The COP of a vapour compression plant in comparison to vapour absorption plant is
(a) more (b) less (c) same (d) depends on the size of the plant | 1 | K2 | CO6 |

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

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|--------------------------------------------------------------------------|---|----|-----|
| 21. Compare Otto and Diesel Cycle. | 2 | K2 | CO1 |
| 22. Define back work ratio. | 2 | K1 | CO1 |
| 23. What are the advantages of convergent divergent nozzle? | 2 | K1 | CO2 |
| 24. What is metastable flow? | 2 | K1 | CO2 |
| 25. State the principle of impulse turbine. | 2 | K1 | CO3 |
| 26. What is meant by Pressure Compounding? | 2 | K1 | CO3 |
| 27. What do you mean by perfect intercooling? | 2 | K1 | CO4 |
| 28. Differentiate centrifugal compressor and rotary blower. | 2 | K2 | CO4 |
| 29. What do you understand by knocking? | 2 | K2 | CO5 |
| 30. Name the various components used in simple vapour absorption system. | 2 | K1 | CO6 |

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

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| 31. a) Find the air standard efficiencies for the Otto and Diesel cycles on the basis of equal compression ratio of 10 and equal heat rejection of 840 kJ/kg. The suction conditions are 1 bar and 328 K. | 10 | K2 | CO1 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|

OR

- | | | | |
|----------------------------------------------------------|----|----|-----|
| b) Derive the Air Standard efficiency for Brayton Cycle. | 10 | K2 | CO1 |
|----------------------------------------------------------|----|----|-----|

32. a) Dry saturated steam enters a frictionless adiabatic nozzle with negligible velocity at a temperature of 300°C . It is expanded to pressure of 550 KPa. The mass flow rate is 0.9 kg/s. Calculate the exit velocity of the steam. 10 K2 CO2
- OR**
- b) Derive the expression of maximum mass flow rate when steam pass through steam nozzle. 10 K2 CO2
33. a) What is meant by compounding of steam turbine? Explain the velocity and pressure compounding in detail. 10 K2 CO3
- OR**
- b) In De-lavel turbine, the steam enters the wheel through a nozzle with a velocity of 500 m/s and at an angle of 20° to the direction of the motion of the blade. The Blade speed is 200 m/s and the exit angle of the moving blood is 25° . Find the inlet angle of the moving blood exit velocity of steam and its direction and work done per kg of steam. 10 K3 CO3
34. a) Drive an expression for the work done by single stage single acting reciprocating air compressor. 10 K2 CO4
- OR**
- b) A single stage single acting reciprocating air compressor has a bore of 200mm stroke of 250 mm and run at 300 rpm it receives air at 1.1bar and 280°C and delivers it at 9 bar the law of compression is $p v^{1.35} = C$. determine the power supplied to compressor and mass of air delivered per minute. Assume $\eta_{\text{vol}} = 80\%$ $\eta_{\text{mech}} = 85\%$. 10 K3 CO4
35. a) What is the purpose of cooling an I.C. Engine? Explain IC engine cooling systems. 10 K2 CO5
- OR**
- b) Describe with a suitable sketch two stroke cycle spark ignition engine and how its indicator diagram differs from that of four stroke cycle spark ignition engine. 10 K2 CO5
36. a) Explain the construction and working of vapour compression refrigeration system. 10 K2 CO6
- OR**
- b) Describe the working principle of a centralized air conditioning system and enumerate the need for it. 10 K2 CO6