



**B.E DEGREE EXAMINATIONS: NOV/DEC 2022**

(Regulation 2018)

Fifth Semester

**MECHANICAL ENGINEERING**

U18MEI5201: Thermal Engineering

**COURSE OUTCOMES**

- CO1: Explain the working principle and combustion characteristics of IC Engines.  
 CO2: Calculate the performance parameters of Gas power cycles, IC Engines and estimate the fuel properties  
 CO3: Explain the performance characteristics of steam nozzles.  
 CO4: Discuss the importance of velocity diagrams and compounding in Turbines  
 CO5: Calculate the various efficiencies of the air compressors.  
 CO6: Explain the working principle of VCR & VAR systems.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

- |   |     |                   |
|---|-----|-------------------|
| 1. Which BS norms are implemented in India at present?              | CO2 | [K <sub>2</sub> ] |
| 2. Compare 4S and 2S engines  | CO1 | [K <sub>2</sub> ] |
| 3. Draw the actual and theoretical p-v diagram for 4S petrol engine | CO2 | [K <sub>2</sub> ] |
| 4. Differentiate between Octane number and Cetane number            | CO1 | [K <sub>2</sub> ] |
| 5. List the types of steam nozzles                                  | CO3 | [K <sub>1</sub> ] |
| 6. Why compounding is needed in steam turbines?                     | CO4 | [K <sub>2</sub> ] |
| 7. Write down the advantages of multi stage compression             | CO5 | [K <sub>1</sub> ] |
| 8. Compare axial and centrifugal compressors                        | CO5 | [K <sub>2</sub> ] |
| 9. List out the functions of air conditioning system.               | CO6 | [K <sub>1</sub> ] |
| 10. Write about specific humidity                                   | CO6 | [K <sub>1</sub> ] |

**Answer any FIVE Questions:-**

**PART B (5 x 16 = 80 Marks)**

**(Answer not more than 400 words)**

- |  |    |     |                   |
|--|----|-----|-------------------|
| 11. Assess the effects of lubrication and coolant temperature on the combustion characteristics of a four-stroke diesel engine | 16 | CO1 | [K <sub>3</sub> ] |
| 12. Derive dual cycle efficiency with all the p-v and T-s diagrams   | 16 | CO2 | [K <sub>3</sub> ] |

13. Air at a pressure of 20 bar and at a temperature of 18° C is supplied to a convergent divergent nozzle having a throat diameter of 1.25 cm and discharging to the atmosphere. Find the mass of air discharged per minute. Take  $n=1.4$  and  $R=0.287 \text{ kJ/Kg-K}$  16 CO3 [K<sub>3</sub>]
14. In a Pelton wheel, the steam velocity from the nozzle is 850 m/s. The nozzle angle is 20°. Mean blade velocity is 350 m/s. The blades are symmetrical. The mass flow rate is 1000 kg/min. Friction factor is 0.8. Determine a) blade angles b) axial thrust on end bearing c) power developed in kW d) blade efficiency e) stage efficiency if nozzle efficiency is 93% 16 CO4 [K<sub>3</sub>]
15. a) Classify Air compressors and explain the principle of operation of reciprocating air compressor 8 CO5 [K<sub>2</sub>]
- b) In a single stage single acting compressor the index of compression and expansion may be taken as 1.2. The clearance volume may be assumed as 1/19th of the swept volume. A compressor of this type is required capable of compressing 7.6 cubic meter of free air per minute from 100kPa to 900kPa. It runs at 240 rpm with a mean piston speed of 220m/min. Find the bore and stroke of the cylinder and the work done per revolution 8 CO5 [K<sub>3</sub>]
16. Discuss about vapour compression refrigeration system with neat sketch 16 CO6 [K<sub>2</sub>]

\*\*\*\*\*