



**B.E DEGREE EXAMINATIONS: NOV/DEC 2024**

(Regulation 2018)

Fifth Semester

**MECHANICAL ENGINEERING**

U18MEI5201: Thermal Engineering

(Use of Approved steam tables and Psychrometric chart is permitted)

**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)**

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|---|-----|-------------------|
| 1. Compare Spark Ignition (S.I) and Compression Ignition (C.I) engines.   | CO1 | [K <sub>2</sub> ] |
| 2. Outline the different types of lubrication system used in I.C engines. | CO1 | [K <sub>2</sub> ] |
| 3. Sketch the P-V and T-S diagram of Diesel cycle.                        | CO2 | [K <sub>2</sub> ] |
| 4. Define Compression ratio.  | CO2 | [K <sub>2</sub> ] |
| 5. Outline the effect of friction in steam nozzle.                        | CO3 | [K <sub>2</sub> ] |
| 6. Differentiate between impulse and reaction turbines.                   | CO4 | [K <sub>2</sub> ] |
| 7. Classify the different types of air compressor.                        | CO5 | [K <sub>2</sub> ] |
| 8. Define volumetric efficiency of compressor.                            | CO5 | [K <sub>2</sub> ] |
| 9. Outline the effect of super heating and sub cooling in VCR.            | CO6 | [K <sub>2</sub> ] |
| 10. Classify the different types of air conditioning system.              | CO6 | [K <sub>2</sub> ] |

**Answer any FIVE Questions: -**

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

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

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|---|---|-----|-------------------|
| 11. a) Explain the three stages of combustion in S.I engine with the help of P- $\theta$ diagram. | 8 | CO1 | [K <sub>2</sub> ] |
| b) Discuss the types of lubrication system used in I.C engines.                                   | 8 | CO1 | [K <sub>2</sub> ] |

12. a) Derive an expression for air standard efficiency of Diesel cycle with the help of P-V diagram. 8 CO2 [K<sub>3</sub>]
- b) An engine of bore 250 mm and 375 mm stroke works on Otto cycle, the clearance volume is 0.00263 m<sup>3</sup>. The initial pressure and temperature is 1 bar, 50°C. If the maximum pressure is 25 bar. Calculate the air standard efficiency. 8 CO2 [K<sub>2</sub>]
13. a) Dry saturated steam at 10 bar is expanded isentropically in a nozzle to 0.1 bar. Using steam tables only, find the dryness fraction of the steam at exit. Also find the velocity of steam leaving the nozzle when 1. initial velocity is negligible, and 2. Initial velocity of the steam is 135 m/s. 8 CO3 [K<sub>3</sub>]
- b) Discuss the compounding of steam turbines in detail. 8 CO4 [K<sub>2</sub>]
14. a) Derive an expression for work done by single stage reciprocating air compressor with clearance volume. 8 CO5 [K<sub>3</sub>]
- b) Discuss the working principle of centrifugal air compressor and its applications. 8 CO5 [K<sub>2</sub>]
15. a) Explain the working principle of Lithium bromide- water absorption system in detail. 8 CO6 [K<sub>2</sub>]
- b) Discuss the working principle of centralized air conditioning system. 8 CO6 [K<sub>2</sub>]
16. a) Compare Otto and diesel cycle. 8 CO2 [K<sub>2</sub>]
- b) An engine operates on the air standard diesel cycle. The inlet temperature and pressure are 27°C and 100KPa respectively. The compression ratio is 12:1 and the heat addition is 1800KJ/kg. Calculate the maximum temperature and pressure of the cycle. 8 CO2 [K<sub>3</sub>]

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