

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019**

**Course Code: ME204**

**Course Name: THERMAL ENGINEERING**

Max. Marks: 100

Duration: 3 Hours

*Use of Approved data books are permitted*

**PART A**

*Answer any three full questions, each carries 10marks.*

Marks

- |   |   |      |
|---|---|------|
| 1 | Steam at a pressure of 15 bar and 250°C is expanded through a turbine to a pressure of 4 bar. It is then reheated at constant pressure to 250 °C and finally expanded to 0.1 bar. Find out the efficiency of this cycle. What will be the efficiency without reheating? Pump work can be neglected. | (10) |
| 2 | a) Derive the expression for critical pressure for maximum discharge through a nozzle.  | (7)  |
|   | b) Discuss the merits and demerits of water tube boiler over fire tube boiler.  | (3)  |
| 3 | What do you meant by governing of steam turbine? Explain different methods of governing.  | (10) |
| 4 | a) Differentiate between impulse and reaction turbines.   | (4)  |
|   | b) Define i) stage efficiency ii) degree of reaction iii) reheat factor.  | (6)  |

**PART B**

*Answer any three full questions, each carries 10marks.*

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|---|--|------|
| 5 | a) Compare two stroke and four stroke engines.   | (4)  |
|   | b) Prove that efficiency of Ericsson cycle is same as that of Carnot cycle   | (6)  |
| 6 | a) Explain the concept of stratified charge engines and mention its advantages over conventional engines.  | (6)  |
|   | b) What do you meant by turbo charging and supercharging?  | (4)  |
| 7 | A single cylinder 4 stroke engine was tested and following observations were noted. Area of indicator diagram = 3 cm <sup>2</sup> . Length of indicator diagram = 4 cm. Indicator spring constant is 10 bar/cm. Speed of the engine is 400 rpm. Brake drum diameter = 120 cm. Dead weight on brake = 380 N. Spring balance reading is 50 N. Fuel consumption rate is 2.8 kg/hr and calorific value of the fuel is 42000 kJ/kg. Bore is 16 cm and stroke is 20 cm. Find frictional power, | (10) |

mechanical efficiency, specific fuel consumption and brake thermal efficiency.

- 8 a) Write short notes on (i) LPG (ii) CNG (iii) Biogas (6)  
b) Define equivalence ratio and explain its significance. (4)

### PART C

*Answer any four full questions, each carries 10marks.*

- 9 a) How catalytic converter helps to reduce emission of an engine? (6)  
b) Explain about Octane and Cetane rating of fuels. (4)
- 10 With the help of a pressure – crank angle diagram explain different stages of CI engine combustion. (10)
- 11 Explain detonation in SI engine with the help of auto ignition theory. What are the factors effecting detonation? Also mention various effects caused by detonation. (10)
- 12 a) Differentiate between open cycle gas turbine and closed cycle gas turbine. (4)  
b) Derive the expression for optimum pressure ratio for maximum work output. (6)
- 13 Air enters an open cycle gas turbine plant at 1 bar and 30 °C. The pressure ratio of the plant is 5.6. Compression is carried out in two stages with perfect intercooling in between. Maximum temperature of the cycle is limited to 700 °C. Isentropic efficiency of both the compressors are 85% and that of turbine is 90%. Air flow rate is 1.2 kg/S. Determine the power developed and efficiency of the plant.  $C_p = 1.02$  kJ/kgK and  $\gamma = 1.41$  for both air and gas. Mass of fuel can be neglected. (10)
- 14 With the help of T-S diagrams explain how intercooling, reheating and regeneration improve the performance of gas turbine cycle. (10)

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