

II B. Tech II Semester Supplementary Examinations, December - 2022
THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks

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**UNIT-I**

- 1 a) Compare air standard and actual cycles. [7M]  
b) Explain the working of Otto cycle. Derive the expression for its thermal efficiency. [7M]

**Or**

- 2 a) Define volumetric efficiency. Discuss the factors affecting the volumetric efficiency. [7M]  
b) Discuss the following [7M]  
i) Heat loss factor ii) Time loss factor.

**UNIT – II**

- 3 a) What is the necessity of cooling and lubrication in IC engines? Explain the properties of ideal cooling and lubrication system. [7M]  
b) With a neat sketch explain the working of Wankle engine. [7M]

**Or**

- 4 a) What is Valve timing diagram? Explain the valve timing diagram of a four stroke CI engine. Why do actual valve timing diagram differ from ideal valve timing diagram? [7M]  
b) Explain the working principle of super charging. Discuss its advantages and applications. [7M]

**UNIT – III**

- 5 a) Explain Normal Combustion and abnormal combustion. [5]  
b) Write a note on antiknock additives. [4]  
c) What is octane number? Explain SI engine fuel rating process. [5]

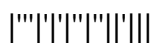
**Or**

- 6 a) Discuss the process of combustion in CI engines and explain various stages of combustion. [9]  
b) Discuss the requirements of CI engine fuel. [5]

**UNIT – IV**

- 7 a) What is frictional power? Discuss the process of evaluating frictional power by Willan's line method. State the limitations of this method. [7M]  
b) A four-stroke, four-cylinder gasoline engine has a bore of 60 mm and a stroke of 100 mm. On test it develops a torque of 66.5 Nm when running at 3000 rpm. If the clearance volume in each cylinder is 60 cc the relative efficiency with respect to brake thermal efficiency is 0.5 and the calorific value of the fuel is 42 MJ/kg, determine the fuel consumption in kg/h and the brake mean effective pressure. [7M]

**Or**



- 8 a) Explain how engine performance curves are used in evaluating the performance of an IC engine. [5M]
- b) A single-cylinder 4-stroke diesel engine gave the following results while running on full load : [9M]  
Area of indicator card =  $300 \text{ mm}^2$ , Length of diagram = 40 mm, Spring constant = 1 bar/mm, Speed of the engine = 400 r.p.m., Load on the brake = 370 N, Spring balance reading = 50 N, Diameter of brake drum = 1.2 m, Fuel consumption = 2.8 kg/h, Calorific value of fuel = 41800 kJ/kg, Diameter of the cylinder = 160 mm, Stroke of the piston = 200 mm. Calculate : (i) Indicated mean effective pressure (ii) Brake power and brake mean effective pressure (iii) Brake specific fuel consumption, brake thermal and indicated thermal efficiencies.

**UNIT – V**

- 9 a) Explain the working of closed cycle gas turbine plant. Derive the expression for its thermal efficiency. [7M]
- b) A gas turbine unit receives air at 100 kPa and 300 Kelvin and compresses it adiabatically to 620 kPa with efficiency of the compressor 88%. The fuel has a heating value of 44180 kJ/kg and the fuel/air ratio is 0.017. The turbine internal efficiency is 90%. Calculate the compressor work, turbine work and thermal efficiency. [7M]

**Or**

- 10 a) A turbo-jet engine flying at a speed of 960 km/h consumes air at the rate of 54.5 kg/s. Calculate: i) Exit velocity of the jet when the enthalpy change for the nozzle is 200 KJ/kg and velocity coefficient is 0.97 ii) fuel flow rate in kg/s when air fuel ratio is 75:1 iii) Thrust specific fuel consumption iv) propulsive power v) propulsive efficiency. [7M]
- b) Discuss about solid propulsion and liquid propulsion. Write their advantages and disadvantages. [7M]

