

R18

Code No: 154CD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, September/October - 2023

THERMAL ENGINEERING – I
(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What is the need of providing lubrication to the IC engine? [2]
- b) Draw the P-V and T-S Diagram of Otto Cycle and Diesel Cycle. [3]
- c) What is meant by delay period? [2]
- d) Write the stages of Abnormal Combustion in CI Engine. [3]
- e) What is heat balance sheet? [2]
- f) Write the applications of air compressor. [3]
- g) What are the effects of clearance on the performance of reciprocating compressors? [2]
- h) What do you mean by pressure coefficient in dynamic compressors? [3]
- i) Explain the merits and demerits of closed and semi-closed cycle gas turbines. [2]
- j) Draw the line diagram of gas turbine plant with regeneration, inter cooling and reheating system? [3]

PART – B

(50 Marks)

- 2.a) With the help of a neat sketches, explain the Thermo-syphon cooling system.
- b) Discuss with the help of a suitable sketch the Wet sump lubrication system? [5+5]

OR

- 3.a) What is exhaust blow down loss? Discuss the optimum opening position of exhaust valve to reduce this loss.
- b) Describe a battery ignition system with the help of a sketch. [5+5]

- 4.a) What is ignition lag? Explain the factors effecting ignition lag.
- b) Explain the effect of various engine variables on SI engine knock. [5+5]

OR

- 5.a) Explain normal and abnormal combustions in SI engine.
- b) Explain with figures the various types of combustion chambers used in CI engines. [5+5]

- QA QA QA QA QA QA QA QA QA
- 6.a) What are the various methods of measuring indicated power? Briefly compare their relative accuracy?
b) How will you classify the compressors? Differentiate between the working principles of positive displacement and dynamic compressors. [5+5]

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7. **OR**
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? [10]

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- 8.a) Explain the working of Root's blower with a neat sketch, and derive the expression for its efficiency.
b) Derive the expression for slip factor and pressure coefficient in case of centrifugal compressor. [5+5]

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9. **OR**
Free air of 20 m³/min is compressed from 1 bar to 2.2 bar. Find (a) the I.P required if the compression carried out in roots bower, (b) if the compression is carried out in Vane blower. Assume that there is 25% reduction in volume before the back flow occurs and (c) the isentropic efficiency in each case? [10]

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10. In a open cycle gas turbine plant, air enters at 1 bar, 20⁰C and compressed to 5 bar. Taking the maximum temperature of the cycle as 680⁰C, compressor, turbine and combustion efficiencies as 85%, 80% and 85% respectively, pressure loss in the combustion chamber as 0.1 bar, specific heat (Cp) as 1.02 kJ/kg.K and $\gamma = 1.4$ for air and gas. Find the
a) Air circulation if power developed by the plant is 1065 kW;
b) Thermal efficiency of the cycle. Neglect the mass of the fuel? [10]

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- 11.a) **OR**
Explain about the open cycle and closed cycle turbines with neat sketches and also draw P-V & T-S diagrams?
b) Discuss the effect of Compressor inlet temperature and Turbine isentropic efficiency on the specific output and thermal efficiency of the open cycle gas turbine at different pressure ratios? [5+5]

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