Code No: R2022033 **R20** **SET - 1**

II B. Tech II Semester Regular Examinations, June/July - 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 Derive the air standard .efficiency of Dual Cycle. [14M]

Or

2 a) How the Actual cycles differ from the air standard cycles? [7M]

b) Discuss about the time loss factor occurred in IC engine with a neat sketch. [7M]

UNIT-II

3 a) Explain the working of splash lubricating system with neat sketch. [7M]

b) Mention the reasons why the water cooling system is superior to air cooling system. [7M]

Or

4 a) Explain the working of the fuel injector with a neat sketch. [7M]

b) What is the importance of spark plug in SI engine? Explain the working of spark plug with a neat diagram. [7M]

UNIT-III

5 a) Explain the phenomenon of knocking in SI engine. State the adverse effects caused due to knocking. [7M]

b) List out the functions of nozzles in CI Engines. Explain why the nozzles are so important in compression ignition engines. [7M]

Or

6 a) Discuss why the preignition is more dangerous in multi cylinder engines than in single cylinder engine. [7M]

b) Discuss the advantages and disadvantages of F-head combustion chambers over the normal combustion chamber. [7M]

UNIT-IV

7 A four stroke engine having a cylinder of 250 mm diameter and stroke 450 mm has a volumetric efficiency of 80%, ratio of air to gas is 8 to 1, calorific value of gas is 20 MJ/m^3 at NTP. Find the heat supplied to the engine per working cycle. If the compression ratio is 5, what is the heating value of the mixture per working stroke per m^3 of total cylinder volume? [14M]

Or

8 The air flow to a four cylinder four stroke gasoline engine was measured by means of a 8 cm diameter sharp edged orifice with C_d =0.65.During a test the following data were recorded. [14M]

Bore=10cm, Stroke=15 cm, Engine speed=2500 rpm, Brake power=36 kW, Fuel consumption=10kg/hr, Calorific value of fuel=42 MJ/kg, Pressure drop across the orifice=4 cm of water. Atmospheric temperature and pressure are 17^0C and 1 bar respectively. Calculate (i) Brake thermal efficiency (ii) Brake mean effective pressure (iii) Volumetric efficiency based on free air condition.
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UNIT-V

9 a) State the fundamental differences between the jet propulsion and rocket propulsion. [7M]

b) Explain inter cooling method with neat sketch applied to gas turbine to improve the thermal efficiency of gas turbine. [7M]

Or

10 a) Explain with a neat sketch the working of a open cycle gas turbine with the P-v and T-s diagrams. [7M]

b) Explain the working of turbo jet engine with a neat sketch. [7M]

Code No: R2022033 **R20** **SET - 2**

II B. Tech II Semester Regular Examinations, June/July - 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 In an air standard Diesel cycle, the compression ratio is 16,and at the beginning of isentropic compression, the temperature is 15^0 C and the pressure is 0.1 Mpa. Heat is added until the temperature at the end of the constant pressure process is 1480^0C.Calculate (a) the cut-off ratio (b) the heat supplied per kg of air (c) the cycle efficiency (d) the m.e.p [14M]

Or

2 a) Mention the methods to improve the volumetric efficiency of IC engine. [7M]

b) Discuss the exhaust blow down loss of internal combustion engine with a neat sketch. [7M]

UNIT-II

3 a) Explain the working of Magneto ignition system with a neat sketch. [7M]

b) Explain the essential properties of good lubricating oil. [7M]

Or

4 a) Explain how the turbo charged engine differ from the actual IC engines. [7M]

b) Differentiate the working of Four stoke CI engine and SI engine. [7M]

UNIT-III

5 a) Explain the basic requirements of good SI engine combustion chamber. [7M]

b) What is ignition lag? Discuss the effect of engine variables on ignition lag. [7M]

Or

6 a) Mention the differences between the 'air swirl 'in CI engines with 'turbulence' in SI engines. [7M]

b) Explain the methods to control the knock in CI engine. [7M]

UNIT-IV

7 A six cylinder petrol engine has a volume compression ratio of 7:1.The clearance volume of each cylinder is 0.000116 m^3.The engine consumes 10 kg of fuel per hour whose calorific value is 42000kJ/kg. The engine runs at 3200 rpm and the efficiency ratio is 0.8. Calculate the average indicated mean effective pressure developed. [14M]

Or
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8 a) What are the methods available for improving the performance of an engine? [7M]

b) Explain the measurement of Break power. [7M]

UNIT-V

9 a) Explain the working of solid rocket with a neat sketch. [7M]

b) Derive the expression for the thermal efficiency of gas turbine with regeneration using P-v and T-s diagram. [7M]

Or

10 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 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) Thermal efficiency of the plant when the combustion efficiency is 93% and calorific value of the fuel is 45000 kJ/kg (v) Propulsive power (vi) Propulsive efficiency (vii) overall efficiency. [14M]

Code No: R2022033 **R20** **SET - 3**

II B. Tech II Semester Regular Examinations, June/July - 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 Derive an expression for efficiency of Brayton cycle by representing the processes on P-v and T-s diagrams. [14M]

Or

2 a) Derive the air standard efficiency of Diesel cycle. [7M]

b) Explain the rubbing loss of engine with a neat sketch. [7M]

UNIT-II

3 a) Classify the Internal combustion engines. [7M]

b) Explain the working of thermo-syphon cooling system with neat sketch. [7M]

Or

4 a) Differentiate the Four stoke and Two stroke IC engines. [7M]

b) Explain the working of Battery Ignition system with neat sketch. [7M]

UNIT-III

5 a) Explain how the diesel knock is differ from the detonation in SI engines. [7M]

b) List out the advantages and disadvantage of induction swirl. [7M]

Or

6 Explain how the engine variables affects the Delay period in IC engines. [14M]

UNIT-IV

7 During a test on a diesel engine the following observations were made: [14M]
The power developed by the engine is used for driving a D.C. generator. The output of the generator was 220 A at 220V; the efficiency of generator being 80%.The quantity of fuel supplied to the engine was 12 kg/h; calorific value of fuel being 42000kJ/kg. The air-fuel ratio was 20:1.
The exhaust gases were passed through a exhaust gas calorimeter for which the observations were as follows: Water circulated through exhaust gas calorimeter =550 liters/hr. Temperature rise of water through calorimeter= 40^0.Temperature of exhaust gases at exit from calorimeter = 98^0C. Ambient temperature=20^0C.
Heat lost to jacket cooling water is 32% of the total heat supplied.
If the specific heat of exhaust gases be 1.05kJ/kg K. Draw up the heat balance sheet on minute basis.

Or
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8 a) Explain the working of rope brake dynamometer with a neat sketch. [7M]

b) Explain the air box method for the measurement of air consumption in internal combustion engine. [7M]

UNIT-V

9 Find the required air-fuel ratio in a gas turbine whose turbine and compressor efficiencies are 75% and 82% respectively. Maximum cycle temperature is 865^0C.The working fluid can be taken as air (C_p = 1. kJ/kgK, γ =1.4) which enters the compressor at 1 bar and 29^0C. The pressure ratio is 5.The fuel used has calorific value of 41500 kJ/kg. There is a loss of 10% of calorific value in the combustion chamber. [14M]

Or

10 a) Explain the working of liquid propellant rocket engine with a neat sketch. [7M]

b) List out the functions of components of gas turbines. State the difference between the open cycle and closed cycle gas turbines. [7M]

Code No: R2022033 **R20** **SET - 4**

II B. Tech II Semester Regular Examinations, June/July - 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 Derive an expression for efficiency of an Otto cycle by representing the processes on P-v and T-s diagram. [14M]

Or

2 a) Compare between OttO and Diesel Cycles. [7M]

b) Explain the loss occurred due to gas exchange process with a suitable example. [7M]

UNIT-II

3 a) Explain the importance of valve timing diagram and also quote the differences of actual and theoretical valve timing diagrams. [7M]

b) Explain the working of Wankel engine with a neat sketch. [7M]

Or

4 a) Explain the working of four stroke CI engine with a neat sketch. [7M]

b) Explain how the super charging engine is differ from the actual engine. [7M]

UNIT-III

5 a) Discuss the different methods to suppress the abnormal compulsion in engines. [7M]

b) Explain the procedure to rate the fuels used in the IC engines. [7M]

Or

6 Briefly explain the stages of combustion in SI engines elaborating the flame front propagation. [14M]

UNIT-IV

7 A six cylinder, 4 stroke SI engine having a piston displacement of 750cm^3 per cylinder developed 80kW at 3500r.p.m. and consumed 27 kg of petrol per hour. The calorific value of petrol is 42 MJ/kg. Estimate: [14M]
(i)The volumetric efficiency of the engine if the air-fuel ratio is 10 and intake air is at 0.9 bar, 32^{0}C (ii) The brake thermal efficiency (iii) The brake torque
For air, R=0.287kJ/kg K

Or
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8 In a trail of a single cylinder oil engine working on dual cycle, the following observations were made: [14M]
Compression ratio=15, Oil consumption=11 kg/hr, Calorific value of fuel=44000 kJ/kg, Air consumption=4 kg/min. Speed=2000 r.p.m, Torque on the brake drum =190 N-m, Quantity of cooling water used=15 kg/min, Temperature rise=40^0C, Exhaust gas temperature=410^0C, Room temperature=20^0C, Cp for exhaust gases =1.17 kJ/kg K
Calculate: (i) Brake power, (ii) Brake specific fuel consumption (iii) Brake thermal efficiency. Draw heat balance sheet on minute basis

9 Derive the expression for the thermal efficiency of reheating gas turbine with the P-v and T-s diagram. [14M]

Or

10 A compressor of a turbojet engine operates in standard sea level. Air with a pressure ratio of 5 and an consumption of 35 kg/s at an isentropic efficiency of 86%.calculate the work per kg of air, the power required to drive the air compressor, and the total head temperature at the compressor discharge. [14M]