

7457

BOARD DIPLOMA EXAMINATION, (C-20)
NOVEMBER/DECEMBER—2022
DME – FOURTH SEMESTER EXAMINATION
HEAT POWER ENGINEERING-1

Time : 3 hours]

[Total Marks : 80

PART—A

- Instructions :** (1) Answer **all** questions.
 (2) Each question carries **three** marks.
 (3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. What is ultimate analysis of a fuel? State its purpose. 2+1=3
2. List out any 6 desired characteristics of a fuel. 3
3. Define the following :
(i) IC engine *(ii)* EC engine and give one example to each. 3
- * 4. Identify any 3 advantages and 3 disadvantages of 2-stroke engine over 4-stroke engine.
5. Define the following terms with respect to performance of IC engines.
i) Brake Thermal efficiency *(ii)* Indicated Thermal efficiency and *(iii)* Volumetric efficiency. 1+1+1=3
6. Draw the following model performance curves of CI engine : 1+1+1=3
(i) RPM vs BMEP *(ii)* RPM vs BP *(iii)* RPM vs BSFC

7. Draw P-V diagram of a single-stage reciprocating air compressor subjected to cyclic process having no clearance with the following methods of compression (i) Isothermal (ii) Polytropic and (iii) Adiabatic.
8. List out any 6 advantages of multi-stage compression over single-stage compression.
9. List out any 3 advantages and 3 disadvantages of closed cycle gas turbine over open cycle gas turbine.
10. Classify jet propulsion units.

PART—B

- Instructions :**
- (1) Answer **all** questions.
 - (2) Each question carries **eight** marks.
 - (3) Answers should be comprehensive and the criteria for valuation are the content but not the length of the answer.

11. The gravimetric analysis of a sample of coal is given an 88% C, 8% H₂ and 4% ash. Calculate the stoichiometric air and analysis of the products by volume. 8

(OR)

The gravimetric analysis of a solid fuel is as follows :

Carbon= 85%, Hydrogen =12% and Sulphur=3%. 25% excess air is supplied. Estimate the mass of air required for complete combustion of (i) Carbon (ii) Sulphur (iii) Hydrogen and (iv) Total mass of air supplied.

(2+2+2+2=8)

12. State any five differences between spark ignition engines and compression ignition engines. 5+3 =8
What happens when petrol is poured in a diesel engine?

(OR)

Describe Magneto Ignition System used in SI engines with a legible sketch and state any 2 advantages of it. 3+3+2=8.

/7457

2

[Contd...

*

- 13.** List out any 3 objectives of testing of an IC engine. 3+4+1=8

A single cylinder 4–stroke oil engine, 165 mm bore and 190 mm stroke works on diesel cycle. The details of indicator card are as follows :

Area of indicator card	= 300 mm ²
Length of the diagram	= 40 mm
Spring constant	= 0.1 N/mm ² per mm
Speed of the engine	= 400 RPM

Calculate IP and BP if mechanical efficiency is 70%

(OR)

Define the following terms with respect to IC engines :
Specific fuel consumption and Economical Speed.

A 6 cylinder, 4–stroke diesel engine has the following specifications :

Bore = 140 mm, Stroke = 200 mm, Speed = 1000 RPM

Weight on brake drum = 1175 N

Spring balance reading = 65 N

Mean diameter of brake wheel = 1500 mm. Calculate Brake mean effective pressure. 1+1+6 = 8

- 14.** The specifications of Single Stage Air compressor are as follows : 2+3+5=8

* Effective Swept Volume = 5 m³/s

Pressure at delivery = 6.5 bar

Temperature at suction = 35°C

Pressure at suction = 1.01 bar

Assume compression index $n = 1.3$ and Characteristic gas constant = 0.287/kJ/kg K

Calculate : *

- (i) The mass of air compressed per minute
- (ii) The temperature at the end of compression
- (c) The power required to run the compressor

(OR)

The specifications of double acting single cylinder Air Compressor are as follows :

IP = 7.5 kW, Suction pressure = 0.9 bar, Delivery pressure = 6 bar, Average piston speed = 120 m/min, Law of compression $PV^{1.3} = \text{constant}$.

Stroke to diameter ratio = 1.25

Neglect clearance volume.

Calculate dimensions of the cylinder.

15. Explain working of open cycle Constant pressure Gas Turbine with a legible sketch and draw PV diagram of the cycle used in it. 3+3+2=8

(OR)

Describe ramjet engine with a legible sketch and mention any 2 advantages of it. 3+3+2=8

PART—C

10×1=10

- Instructions :** (1) Answer the following question.
* (2) The question carries **ten** marks.
(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. The following data was obtained while conducting full load on an oil engine :

IP = 30 kW, BP=24 kW, Fuel consumption = 0.128 kg/min

Mass of water circulating around cylinder per min = 5.98 kg

Temperature rise of cooling water = 50.2°C

Temperature of exhaust gases = 378.7°C

Temperature of engine room = 18.5°C

Air fuel ratio = 20

Calorific value of exhaust gas = 45300 kJ/kg

Specific heat of exhaust gas = 1.004 kJ/kg°C

Specific heat of water = 4.186 kJ/kg°C

Determine the mechanical efficiency and indicated thermal efficiency and draw up an energy balance sheet on the basis of kJ/s and in percentage.

★ ★ ★

*

*