



C20-M-404

7457

BOARD DIPLOMA EXAMINATION, (C-20)  
OCTOBER/NOVEMBER—2024  
DME – FOURTH SEMESTER EXAMINATION  
HEAT POWER ENGINEERING—I

Time : 3 Hours ]

[ Total Marks : 80

**PART—A**

3×10=30

- 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. Define combustion of a fuel and write the composition of air (a) by mass and (b) by volume basis. 1+1+1
2. List the names of any three combustible elements of a fuel along with their chemical formulae. 6×½
3. Write any three advantages and three disadvantages of 2 stroke engine over 4 stroke engine. 3
4. Classify IC engines with respect to (a) application and (b) method of ignition. 3
5. Define the following terms with respect to performance of IC engines : 1+1+1
  - (a) Mechanical efficiency
  - (b) Thermal efficiency
  - (c) Relative efficiency
6. Draw the following model performance curves of CI engine : 1+1+1
  - (a) RPM vs BP
  - (b) RPM vs BMEP
  - (c) RPM vs BSFC

7. Draw the P-V diagram of a single stage reciprocating air compressor without clearance with the following methods of compression (a) isothermal and (b) polytropic. 3
8. List three advantages of multistage compression over single stage compression. 3
9. List three advantages of RAM JET engine. 3
10. Classify gas turbines with respect to (a) path of working fluid and (b) the basis of combustion process. 3

**PART—B**

8×5=40

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

11. The Orsat analysis of flue gas is  $\text{CO}_2 = 8.2\%$ ,  $\text{O}_2 = 4.6\%$ ,  $\text{CO} = 2.2\%$ ,  $\text{N}_2 = 85\%$ . Determine mass of dry flue gases if the fuel contains 65% C by mass. 8

**(OR)**

A sample of coal has the following composition by mass: Carbon 80%, Hydrogen 8%, Oxygen 2%, Sulphur 0.5%, the remainder ash. 5+3

- (a) Determine the stoichiometric air required for the complete combustion of 1.5 kg of this fuel.
- (b) If 16 kg of air is supplied, determine the percentage of excess air.

12. Describe the working principle of 2 stroke petrol engine with legible sketches. 4+4

**(OR)**

- (a) Explain the purpose of super charging of IC engines. 3+5
- (b) Discuss any two methods of lubrication of an IC engine with neat sketches.

13. Explain the need of testing of an IC engine. 3

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 : 5

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

Calculate IP, BP if mechanical efficiency is 70%.

**(OR)**

A 6 cylinder, 4- stroke diesel engine has the following specifications : 8

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.

- 14.** Determine the minimum work required to complete 1 kg of air from 1 bar and 15 °C to 9 bar in two stages. The law of compression is  $pV^{1.25} = \text{constant}$  and inter cooling is complete. If the air was compressed in one stage between the same pressure limits, what is the percentage saving in work by compressing it in two stages? Assume  $R = 0.287 \text{ kJ/kg K}$ . 3+3+2

**(OR)**

Compare reciprocating compressor with rotary compressor in any 5 factors. Draw a line diagram of centrifugal compressor and label the parts. 5+3

- 15.** Describe turbo-propeller unit and turbo-jet unit along with legible sketches. 2+2+2+2

(OR)

Describe closed cycle gas turbine with a legible sketch and draw PV diagram of the cycle used in it. 4+2+2

**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.** A 4 cylinder, 4 stroke petrol engine having 70 mm bore and 90 mm stroke is tested at full throttle at constant speed. The fuel supply is fixed at 0.065 kg/min and the plugs of the 4 cylinders are successively short circuited without change of speed. Brake torque being correspondingly adjusted. Following power measurements are made under different conditions : 4+2+4

BP with all cylinders firing	=	0.01192 MW
BP with cylinder No. 1 short circuited	=	8.46 kW
BP with cylinder No. 2 short circuited	=	0.00857 MW
BP with cylinder No. 3 short circuited	=	8.61 kW
BP with cylinder No. 4 short circuited	=	8.5 kW

- (a) Determine the IP of the engine under these conditions.  
(b) Determine indicated thermal efficiency if the CV of fuel is 43780 kJ/kg.  
(c) Relative efficiency based on IP.

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