

**DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO.**

TR / TES / M-II / DIP/ 16

Test Booklet Series

**TEST BOOKLET**  
**MECHANICAL ENGINEERING PAPER – II**  
**(DIPLOMA)**

**D**

\_\_\_\_\_  
(Signature of the Candidate)

\_\_\_\_\_  
(Invigilator's Signature)

**Time Allowed–3 hours (Three hours)**

**Maximum Marks–200**

**I N S T R U C T I O N S**

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY TEST BOOKLET OF SAME SERIES.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.
3. This Test Booklet is divided into three section, i.e Sections - A, Section - B & Section - C.  
(A) Section - A (MCQ pattern) contains 40 items (questions). Each question, carrying 2 (two) marks only, has four responses (answers). You will select the response which you want to mark on the OMR Sheet. In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose ONLY ONE response for each item. There shall be no negative marking for wrong / multiple answer.  
(B) Questions under Section - B (Conventional Method) & Section - C (Conventional Method) are to be answered in separate answer book.
4. You have to mark all your responses of Section - A by Black Ball Point Pen only on the separate OMR Answer Sheet provided. See directions in the Answer Sheet.
5. Before you proceed to answer the responses to various items in the Test Booklet, you have fill in some particulars both in the Answer sheet for Section-A and in the Answer Book for Section-B and Section - C
6. On the completion of the Examination, you should hand over the OMR Answer Sheet for Section - A & Answer Book for Section - B & C to the Invigilator only. You are permitted to take the Test Booklet with you.
7. Sheets for rough work are appended on the Test Booklet at the end.

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All symbols have their usual meanings

The figure in the margin indicate full marks for the questions.

Candidates are requested to give their answers in their own words as far as practicable.

### SECION -A

Answer *all* questions. Each question carries 2 marks.

40×2=80

Each question is having four options. Select correct option and mark on OMR Answer Sheet

Example : The refrigerant number R-40 means

(A) Carbon dioxide

(C) Sulphur dioxide

(B) Ammonia

● Methyl chloride

- If air fuel ratio of the mixture in petrol engine is more than 15 : 1
  - NO<sub>x</sub> is reduced
  - CO<sub>2</sub> is reduced
  - HC is reduced
  - CO is reduced
- The proper output from a spark ignition engine is varied by
  - changing the ignition timing
  - regulating the amount of air-fuel inducted
  - regulating the amount of air-fuel mixture
  - regulating the amount of air.
- The normal range of compression ratio for diesel cycle is
  - 4 to 6
  - 6 to 8
  - 15 to 20
  - > 25
- For the same compression ratio and heat rejection
  - $\eta_{\text{otto}} > \eta_{\text{dual}} > \eta_{\text{diesel}}$
  - $\eta_{\text{diesel}} > \eta_{\text{dual}} > \eta_{\text{otto}}$
  - $\eta_{\text{dual}} > \eta_{\text{diesel}} > \eta_{\text{otto}}$
  - $\eta_{\text{dual}} > \eta_{\text{otto}} > \eta_{\text{diesel}}$
- The volumetric efficiency is affected by
  - the exhaust gas in the clearance volume
  - the design of intake and exhaust valve
  - valve timing
  - all of the above
- Bio-diesel is
  - obtained from fermentation of sugars
  - obtained from pyrolysis process
  - exudates of plants
  - an upgraded vegetable oil

7. Liquefaction of biomass is carried out  
 (A) high temperature and low pressure  
 (B) relatively low temperature and high pressure  
 (C) relatively low temperature and normal pressure  
 (D) room temperature and high pressure
8. The percentage of the incoming radiation reflected back to space by the earth is  
 (A) 10%  
 (B) 20%  
 (C) 30%  
 (D) 40%
9. A solar cell is basically  
 (A) a voltage source, controlled by flux of radiation  
 (B) a current source, controlled by flux of radiation  
 (C) an uncontrolled current source  
 (D) an uncontrolled voltage source
10. The efficiency of a commercial solar cell lies in the range  
 (A) 0 - 10%  
 (B) 10 - 20%  
 (C) 20 - 30%  
 (D) 50 - 60%
11. A solar thermal collector  
 (A) collects the solar energy and reflects it back  
 (B) absorbs the solar radiation and dissipates it to the ambient  
 (C) collects and converts the solar energy into electrical energy  
 (D) collects and converts the solar energy into thermal energy and delivers it to the next stage of the system
12. The energy associated with a photon is  
 (A) directly proportional to the wavelength  
 (B) inversely proportional to the frequency  
 (C) directly proportional to the intensity of radiation  
 (D) inversely proportional to the wavelength
13. The range of wind speed suitable for wind power generation is  
 (A) 0 to 5 m/s  
 (B) 5 to 25 m/s  
 (C) 25 to 50 m/s  
 (D) 50 to 75 m/s
14. Stalled flow occurs when the value of the incident angle is  
 (A)  $0^\circ$   
 (B)  $180^\circ$   
 (C) in the range from 0 to  $16^\circ$   
 (D) beyond  $16^\circ$

23. The vapour compression refrigeration cycle is an inherently irreversible cycle, because
- (A) the compressor is non-ideal
  - (B) the evaporator is not frictionless
  - (C) the condensation process is not isothermal
  - (D) of the use of expansion valve instead of an expansion engine
24. In a vapour compression cycle, a good refrigerant should have a
- (A) large latent heat of vaporization at constant pressure
  - (B) large latent heat of evaporator pressure
  - (C) condenser pressure close to critical pressure
  - (D) low critical pressure
25. Environment friendly refrigerant R134 is used in the new generation domestic refrigerators. Its chemical formula is
- (A)  $\text{CHClF}_2$
  - (B)  $\text{C}_2\text{Cl}_2\text{F}_3$
  - (C)  $\text{C}_2\text{Cl}_2\text{F}_4$
  - (D)  $\text{C}_2\text{H}_2\text{F}_4$
26. Morse test is applicable only to
- (A) single cylinder SI engine
  - (B) single cylinder CI engine
  - (C) multicylinder CI engine
  - (D) single and multicylinder SI and CI engine
27. Flame ionization detection is used for measuring
- (A) CO
  - (B) HC
  - (C)  $\text{NO}_x$
  - (D)  $\text{CO}_2$
28. Octane number of iso-octane is
- (A) 0
  - (B) 30
  - (C) 60
  - (D) 100
29. Thermostat is used in radiators to
- (A) control the velocity of water
  - (B) control the distribution of water to various cylinders
  - (C) control the water temperature
  - (D) control the pressure of water
30. Pump used in the forced cooling system is normally
- (A) Piston pump
  - (B) Gear pump
  - (C) Vane pump
  - (D) Centrifugal pump
31. Lean air mixture is required during
- (A) idling
  - (B) starting
  - (C) accelerating
  - (D) cruising

32. Decrease in air-fuel ratio in SI engine results in  
 (A) increase of  $\text{NO}_x$   
 (B) decrease of CO and UBHC  
 (C) increase of CO and UBHC  
 (D) None of the above
33. Fuel injector is used for  
 (A) Gas engines  
 (B) CI engines  
 (C) SI engines  
 (D) None of the above
34. Mechanical efficiency is the ratio of  
 (A) Brake power to heat input  
 (B) Indicated power to heat input  
 (C) Brake power to indicated power  
 (D) Friction loss to heat input
35. Friction that occurs between the layers of oil film is called  
 (A) Viscous friction  
 (B) Greasy friction  
 (C) Dry friction  
 (D) Boundary friction
36. Blue smoke in diesel engines indicate  
 (A)  $\text{NO}_x$   
 (B) HC  
 (C) CO  
 (D) Unburnt oil
37. Supercharging increases the power output of engine by  
 (A) increasing the charge temperature  
 (B) increasing the charge pressure  
 (C) increasing the speed of the engine  
 (D) quantity of fuel admitted
38. Stoichiometric air-fuel ratio of petrol engine is roughly  
 (A) 50 : 1  
 (B) 25 : 1  
 (C) 15 : 1  
 (D) 1 : 1
39. For peak lead operation, the spark advance  
 (A) must be decreased  
 (B) must be increased  
 (C) need not be altered  
 (D) None of the above
40. In CI engines the delay period is affected by  
 (A) compression ratio  
 (B) engine speed  
 (C) output  
 (D) All of the above.

## SECTION – B

Answer *all* the questions.

Each question carries 6 (*six*) marks.

15×6=90

1. (a) What is the function of pyrometer ? 4+2=6  
(b) What is solar time ?
2. (a) What are the advantages of solar energy ? 4+2=6  
(b) What are the indirect forms of solar energy ?
3. (a) Explain the major applications of wind power.  
(b) What range of wind speed is considered favourable for wind-power generation ? 4+2=6
4. (a) What is the origin of biomass energy ?  
(b) Explain the process of production of biogas from biomass 2+4=6
5. Explain with neat sketch the vapour absorption refrigeration system. 6
6. (a) Why the dry bulb and wet bulb temperatures are important in refrigeration and air conditioning system ?  
(b) How the compressor work can be minimised in the refrigeration system ? 4+2=6
7. (a) How does the throttle valve work ?  
(b) Write four types of refrigerant. 4+2=6
8. (a) How solar energy can be used in refrigeration system ?  
(b) Define C.O.P. 4+2=6
9. What are the basic types of carburettor ? Explain 6

10. (a) What is the purpose of using a governor in CI engines ?  
 (b) What are catalytic convertors ? 4+2=6
11. (a) Why fins and baffles are required in an air cooled engine ? Explain.  
 (b) What are the major emissions that come out of engine exhaust ? 4+2=6
12. Briefly discuss the important qualities of gasoline. 6
13. (a) List three principal factors that influence engine performance ?  
 (b) What is meant by the optimum spark advance ? 4+2=6
14. (a) Draw the otto cycle on P-V and T-S diagram and mark the various process.  
 (b) What is Brayton cycle ? 4+2=6
15. Derive the expressions for the efficiency and mean effective pressure of a dual cycle. 6

### SECTION - C

Answer *all* the questions

Each question carries 6(six) marks.

5×6=30

1. A sample of moist air at a total pressure of 85 kPa has a dry bulb temperature of 30°C (saturation vapour pressure of water = 4.24 kPa). If the air sample has a relative humidity of 65%, calculate the absolute humidity (in grams) to water vapour per Kg of dry air.
2. A heat engine having an efficiency of 70% is used to drive a refrigerator having a coefficient of performance of 5. Calculate the energy absorbed from low temperature reservoir by the refrigerator for each kJ of energy absorbed from high temperature source by the engine.

3. A gas engine working on the otto cycle has a cylinder of diameter 200 mm and stroke 250 mm, the clearance volume is 1570 cc. Find the air standard efficiency. Assume  $C_p = 1.004 \text{ kJ/kg K}$  and  $C_v = 0.717 \text{ kJ/kg K}$  for air.
4. A single cylinder engine running at 1800 rpm develops a torque of 8 N.m, the indicated power of the engine is 1.8 kW. Find the loss due to friction power as the percentage of brake power.
5. An air standard dual cycle has a compression ratio of 10. The pressure and the temperature at the beginning of compression are 1 bar and  $27^\circ\text{C}$ . The maximum pressure reached is 42 bar and the maximum temperature is  $1500^\circ\text{C}$ . Determine the cut-off ratio. Assume  $C_p = 1.004 \text{ kJ/kg K}$  and  $C_v = 0.717 \text{ kJ/kg K}$  for air.