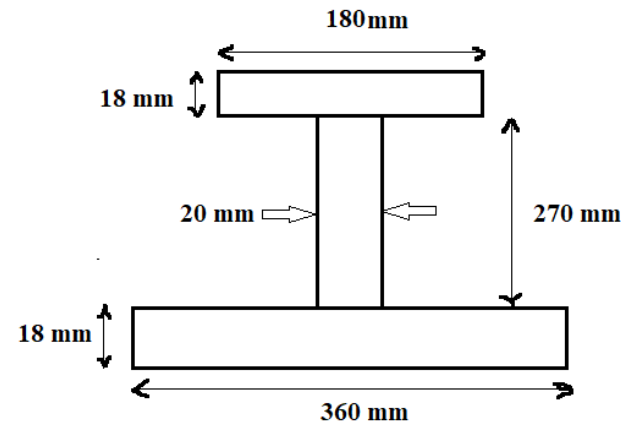OR iii. Calculate the moment of inertia of given I-section about an axis passing through centroid and parallel to its base.

7 2 1 5

180mm
18 mm
20 mm
270 mm
18 mm
360 mm

******

Enrollment No..

Faculty of Engineering / Science
End Sem Examination Dec 2024

EN3ES18 / BC3ES06 Basic Mechanical Engineering

Programme: B.Tech. / B.Sc.   Branch/Specialisation: All

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	A material fails in cyclic loading is associated with- (a) Hardness (b) Fatigue (c) Toughness (d) Resilience	1	2	1	1	
	ii.	Which one of the mechanical property is represented using area under stress strain diagram? (a) Strength (b) Ductility (c) Malleability (d) Toughness	1	2	1	1	
	iii.	The device used for maintaining the temperature of the space or body greater than that of its surroundings is called- (a) PMM-I (b) Heat engine (c) Heat pump (d) All of these	1	2	1	2	
	iv.	Temperature measurement principal based on (a) Zeroth law of thermodynamics (b) First law of thermodynamic (c) Second law of thermodynamics (d) None of these	1	2	1	2	
	v.	In the two-stroke engine, the process of replacing the exhaust gas in a cylinder with the fresh air/fuel mixture is known as- (a) Scavenging (b) Suction (c) Expansion (d) Exhaust	1	1	1	3	

P.T.O.

vi. The volume occupied by piston between TDC and BDC is known as- **1** 1 1 3
    (a) Dead volume
    (b) Compression ratio
    (c) Clearance volume
    (d) Swept volume

vii. Which one of the following is not a mounting in boiler **1** 1 1 4
    (a) Fusible plug
    (b) Spark plug
    (c) Feed check valve
    (d) Blow off valve

viii. Steam generating capacity of Lancashire boiler is _____ kg/hr. **1** 1 2 4
    (a) 1000 - 2000
    (b) 3000 - 4000
    (c) 5000 -7000
    (d) 8000 - 10000

ix. CG of a plane lamina is not at its geometrical centre, if it is a- **1** 2 1 5
    (a) Circle
    (b) Square
    (c) Rectangle
    (d) Right angle triangle

x. Centre of gravity of rigid body lies- **1** 2 1 5
    (a) Inside a body
    (b) Outside a body
    (c) Either inside or outside
    (d) None of these

Q.2 i. Explain the stress strain diagram of mild steel. **4** 2 1 1
    ii. Explain important mechanical properties and application of white cast iron. **6** 2 1 1
OR iii. Define hardness. Explain any one hardness test with suitable diagram. **6** 2 1 1

Q.3 i. Define intensive and extensive properties with examples. **3** 2 1 2

ii. Explain the second law of thermodynamics in details also enlist limitations of first law. **7** 2 1 2
OR iii. A stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 MPa to a final state of 0.15 m^3 and 0.105 MPa, the pressure remaining constant during the process. There is transfer of 37.6 kJ of heat from the gas during the process. How much does the internal energy of gas change? **7** 4 2 2

Q.4 i. Write important differences between SI and CI engine. **3** 2 1 3
    ii. An engine is working with Otto cycle is supplied with air at 0.1 MPa, 35 ^{0}C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the cycle efficiency, temperature at the end of compression and maximum temperature of the cycle. **7** 4 2 3
OR iii. Derive an expression for efficiency of diesel cycle with suitable P-V diagram. **7** 2 1 3

Q.5 i. Define dryness fraction of steam. Also explain the function of three important boiler accessories. **4** 2 1 4
    ii. Explain any two important boiler performance parameters with formula. **6** 2 1 4
OR iii. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250 ^{0}C. The mass of liquid present is 9 kg. Find the total mass of mixture and enthalpy. Take v_f = 0.0012512 m^3/kg, v_g = 0.05013 m^3/kg, h_f = 1085.36 kJ/kg, h_{fg} = 1716.2 kJ/kg. **6** 4 2 4

Q.6 i. Explain the concept of centre of gravity with example. **3** 2 1 5
    ii. State parallel axis theorem and derive an expression for the theorem. **7** 4 1 5

Marking Scheme
EN3ES18 (T) Basic Mechanical Engineering (T)

Q.1   i)   b) Fatigue   **1**

ii)   d) Toughness   **1**

iii)   c) Heat pump   **1**

iv)   a) Zeroth law of thermodynamics   **1**

v)   a) Scavenging   **1**

vi)   d) Swept volume   **1**

vii)   b) Spark plug   **1**

viii)   d) 8000 - 10000   **1**

ix)   d) Right angle triangle   **1**

x)   c) Either inside or outside   **1**

Q.2   i.   Explanation   **3**
Stress strain diagram   **1**

ii.   Mechanical properties (3 properties)   **3**
Application of white cast iron. (3 Application)   **3**

OR   iii.   Define hardness   **2**
Explanation of one hardness test   **3**
Diagram.   **1**

Q.3   i.   Define intensive properties with examples. **1.5M**   **3**
Extensive properties with examples. **1.5M**

ii.   Explain the second law of thermodynamics.   **5**
(2.5 for each statement)   **2**
Enlist limitations of first law. 2M

OR   iii.   Formula of first law of thermodynamics 1M   **7**
Find change in internal energy= -21.85 Kj 6M

Q.4   i.   1 Mark for each difference   **3**

ii.   Calculate the cycle efficiency. (56.5 %) 3M   **7**
Temperature at the end of compression. (708.4 K) 2M
Maximum temperature of the cycle. (3633 K) 2M

OR   iii.   P-v diagram. 1M   **7**
Expression for efficiency of Diesel cycle. 6M

Q.5   i.   Dryness fraction of steam. 1M   **4**
Function of three important boiler accessories. 3M

ii.   One performance parameter with formula carry 3 marks   **6**

OR   iii.   Total mass of mixture. (9.575 kg) 3M   **3**
Enthalpy. (1188.32 kJ) 3M   **3**

Q.6

i.   Concept of centre of gravity. 2M   **3**
Example. 1M

ii.   Statement of parallel axis theorem 3M   **7**
Expression for the theorem. 4M

OR   iii.   Calculate CG 3M   **7**
Calculate MOI 4M

$A_1 = 3240$ mm^2
$A_2 = 5400$ mm^2
$A_3 = 6480$ mm^2

$\overline{Y}_1 = 279$ mm
$\overline{Y}_2 = 135$ mm
$\overline{Y}_3 = 9$ mm

$\overline{Y} = 111.86$ mm
$I_x = 195 \times 10^6$ mm^4

*****

[2]

[3]