

Total No. of Questions: 6

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Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2019
EN3ES03 Basic Mechanical Engineering

Programme: B.Tech.

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.

- Q.1
- i. Which of the following material has maximum ductility? 1
(a) Mild Steel (b) Copper (c) Nickel (d) Aluminium
 - ii. Which one of the following property are closely associated with gray cast iron? 1
(a) Self lubrication (b) Highly ductile
(c) Highly malleable (d) Both (b) and (c)
 - iii. The principle of zeroth law of thermodynamics are used for measurement of 1
(a) Entropy (b) Temperature
(c) Enthalpy (d) Internal energy
 - iv. During a refrigeration cycle, heat is rejected by the refrigerant in a 1
(a) Compressor (b) Condenser
(c) Evaporator (d) Expansion valve
 - v. The energy of expanding gas is transferred by piston to connecting rod through 1
(a) Crank pin (b) Gudgeon pin
(c) Bearing (d) Crankcase
 - vi. An engine working on Otto cycle, the ratio of heat rejection to the heat supply is 30%, the efficiency of the engine will be 1
(a) 50 % (b) 40% (c) 70% (d) 60%
 - vii. Moment of inertia of triangular section having base (b) and height (h) about an axis passing through its C.G. and parallel to base (b), is 1
(a) $hb^3/36$ (b) $bh^3/36$ (c) $h^2b^3/36$ (d) $b^2h^3/36$

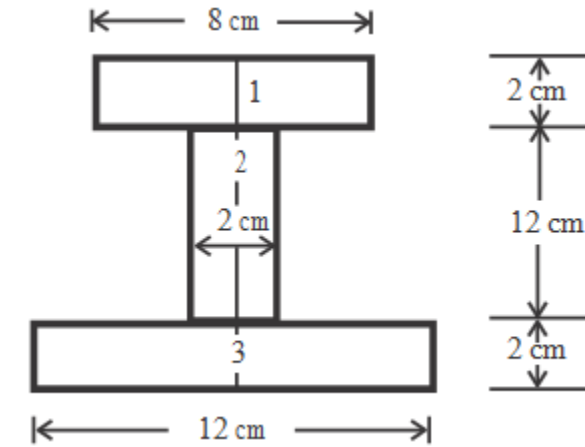
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- viii. The height of the centroid above the base of a semicircle is **1**
 (a) r/π (b) $3r/4\pi$ (c) $4r/3\pi$ (d) None of these
- ix. The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to **1**
 (a) T_c (b) $2T_c$ (c) $3T_c$ (d) $4T_c$
- x. The centrifugal tension in belts **1**
 (a) Increases power transmitted
 (b) Decreases power transmitted
 (c) Have no effect on the power transmitted
 (d) Increases power transmitted up to a certain speed and then decreases
- Q.2 i. Draw and explain the Stress-Strain diagram for mild steel specimen **4**
 ii. A hollow cylinder 1.5 m long has an outside diameter of 55 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 27 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of E for the cylinder material is 105 GPa. **6**
- OR iii. Describe the construction and working of micrometer with neat sketch. **6**
- Q.3 i. Define enthalpy. **2**
 ii. Write the Kelvin-Planck and Clausius statements of second law of thermodynamics. **3**
 iii. Find the enthalpy and entropy of steam when the pressure is 10 bars and specific volume is $0.08 \text{ m}^3/\text{kg}$. **5**
- OR iv. What do you mean by ecofriendly refrigerants? **5**
- Q.4 i. Why mountings are necessary in steam generators? Explain. **2**
 ii. Derive an expression for the efficiency of Otto cycle. **3**
 iii. Explain the working principle of two stroke S.I engine with neat sketch? **5**
- OR iv. In an air standard Diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15°C . Heat is added until the temperature at the end of constant pressure process is 1480°C . Calculate cut-off ratio, heat supplied per kg of air and the cycle efficiency. **5**

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- Q.5 i. State and prove the perpendicular axis theorem. **4**
 ii. Find the moment of inertia of the section (Fig.1) about the horizontal centroidal axis. **6**



- OR iii. Derive an expression for moment of inertia for rectangle having base (b) and depth (d) about Centroidal axes parallel to its base. **6**
- Q.6 i. Explain the different types of belt drives with neat sketch. **4**
 ii. An open flat belt drive connects two parallel shafts 1.2 meters apart. The driving and the driven shafts rotate at 350 r.p.m. and 140 r.p.m. respectively and the driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3 and the maximum permissible tension in the belting is 1.4 MN/m^2 . Determine:
 (a) Diameter of the driving pulley,
 (b) Maximum power that may be transmitted by the belting
 (c) Required initial belt tension. **6**
- iii. Derive an expression for the ratio of tension in an open belt drive. **6**
 Consider following notations:
 T_1 and T_2 are the tension in tight side and slack side respectively. μ is the coefficient of friction and θ is the angle of contact.

Marking Scheme
EN3ES03 Basic Mechanical Engineering

Q.1	i.	Which of the following material has maximum ductility? (a) Mild Steel	1
	ii.	Which one of the following property are closely associated with gray cast iron? (a) Self lubrication	1
	iii.	The principle of zeroth law of thermodynamics are used for measurement of (b) Temperature	1
	iv.	During a refrigeration cycle, heat is rejected by the refrigerant in a (b) Condenser	1
	v.	The energy of expanding gas is transferred by piston to connecting rod through (b) Gudgeon pin	1
	vi.	An engine working on Otto cycle, the ratio of heat rejection to the heat supply is 30%, the efficiency of the engine will be (c) 70%	1
	vii.	Moment of inertia of triangular section having base (b) and height (h) about an axis passing through its C.G. and parallel to base (b), is (b) $bh^3/36$	1
	viii.	The height of the centroid above the base of a semicircle is (c) $4r/3\pi$	1
	ix.	The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to (c) $3T_c$	1
	x.	The centrifugal tension in belts (c) Have no effect on the power transmitted	1

Q.2	i.	Stress-Strain diagram	2 marks	4
		Explanation	2 marks	
	ii.	Finding the stress value	3 marks	6
		Finding deformation value	2 marks	
OR		For formulas	1 mark	6
	iii.	Construction of micrometer	1 mark	
		Diagram	2 marks	
		Working of micrometer	3 marks	

Q.3	i.	Definition of enthalpy.	2
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	ii.	Kelvin-Plank and Clausius statements of second law of thermodynamics	1.5 mark for each statement	(1.5 marks * 2)	5
	iii.	Finding enthalpy	2 marks		
		Finding entropy	2 marks		
		Dryness fraction	1 mark		5
OR	iv.	Definition ecofriendly refrigerants	2 marks		
		Characteristics or properties	3 marks		
Q.4	i.	Mountings are necessary in steam generators			2
	ii.	Derivation for efficiency of Otto cycle. P-V diagram or T-S diagram	1 mark		3
		Derivation	2 marks		5
	iii.	Working principle of two stroke S.I engine			
		Diagram	2 marks		5
		Four process description	3 marks		
OR	iv.	Calculate			5
		cut-off ratio	1 mark		
		heat supplied per kg of air	1 mark		
		Cycle efficiency	1 mark		
		Calculation	2 marks		
Q.5	i.	Perpendicular axis theorem			4
		Statement	2 marks		
		Proof	2 marks		6
	ii.	Find the moment of inertia of the section			
		C.G.	2 marks		6
		M.I.	4 marks		
OR	iii.	Diagram	1 mark		6
		Proof	5 marks		
Q.6	i.	Types of belt drives	2 marks		4
		Diagram	2 marks		
	ii.	(a) Diameter of the driving pulley	2 marks		6
		(b) Maximum power	2 marks		
		(c) Required initial belt tension.	2 marks		6
	iii.	Diagram	2 marks		
		Derivation	4 marks		
