

[4]

Determine:

- (a) Volumetric efficiency on the air basis alone
- (b) Air-fuel ratio
- (c) The brake mean effective pressure
- (d) The relative efficiency on the brake thermal efficiency

- |     |      |  |   |
|-----|------|--|---|
| Q.5 | i.   | Explain different types of brakes.                             | 4 |
|     | ii.  | Explain the condition of self energizing condition for brakes. | 6 |
| OR  | iii. | Describe the design steps for internal expanding brakes.       | 6 |
|     |      |  |   |
| Q.6 |      | Attempt any two:   |   |
|     | i.   | Describe the design steps for friction clutch.                 | 5 |
|     | ii.  | Explain the function of cone and centrifugal clutch.           | 5 |
|     | iii. | Describe the torque transmitting capacity of clutch.           | 5 |

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Total No. of Questions: 6

Total No. of Printed Pages:4

Enrollment No.....



Faculty of Engineering  
End Sem (Odd) Examination Dec-2022  
AU3CO13 / ME3CO12 Machine Design -II  
Programme: B.Tech. Branch/Specialisation: AU/ME

Duration: 3 Hrs.

Maximum Marks: 60

Note: (a) 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.

(b) Use of design data book is permitted & assume suitable data if required with reason.

- |     |      |   |   |
|-----|------|---|---|
| Q.1 | i.   | The journal bearings are generally used in _____.   | 1 |
|     |      | (a) Belts (b) Columns (c) Beams (d) Supports  |   |
|     | ii.  | Which of the following is true for the bearing's body?  | 1 |
|     |      | (a) Total moment of various forces acting on the body is the vector sum of all moments in 3D  |   |
|     |      | (b) Total moment of various forces acting on the body is the algebraic sum of all moments in 3D   |   |
|     |      | (c) Total moment of various forces acting on the body is always zero in any dimension   |   |
|     |      | (d) Total moment of various forces acting on the body is the vector sum of all moments which is perpendicular to each other forces whatever be the dimensions                             |   |
|     | iii. | The shortest distance measured along the normal to the helix between corresponding points on the adjacent teeth is called _____.  | 1 |
|     |      | (a) Gear pitch (b) Helical pitch  |   |
|     |      | (c) Circular pitch (d) Normal circular pitch  |   |
|     | iv.  | The angle at which the teeth of the gear are inclined to the axis of a gear is called as _____.   | 1 |
|     |      | (a) Pitch angle (b) Normal angle  |   |
|     |      | (c) Helix angle (d) Gear angle  |   |
|     | v.   | A four-stroke diesel engine operating at 1200 rpm uses 0.1 kg of fuel in 5 minutes and has the brake specific fuel consumption equals to 0.1910 kg\BHP\h. Calculate the torque developed. | 1 |
|     |      | (a) 6.5 kg-m (b) 8 kg-m (c) 7.5 kg-m (d) 5 kg-m   |   |

P.T.O.

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- vi. Rapid explosion of air-fuel mixture within the cylinder, when ignited by a spark is known as \_\_\_\_\_. **1**  
 (a) Constant heat combustion  
 (b) Constant pressure combustion  
 (c) Constant volume combustion  
 (d) Cut off ratio
- vii. The energy absorb by brake is always \_\_\_\_\_. **1**  
 (a) Potential (b) Kinetic  
 (c) Either potential or kinetic (d) None of these
- viii. A solid cast iron disk of mass 1000kg is rotating at 350rpm. Diameter of the disk is 1m and time taken to come to stop the disk by brake is 1.6 sec. Square of radius of gyration is 0.2. Calculate the angle through which disk rotated during braking period. **1**  
 (a) 27.5 rad. (b) 24.6 rad. (c) 29.3 rad. (d) 32.4 rad.
- ix. Clutch and coupling perform the same action. **1**  
 (a) Both being permanent joints  
 (b) No they are different type of joints  
 (c) Both being temporary joints  
 (d) None of these
- x. A plate clutch consists of 1 pair of contacting surfaces. The inner and outer diameter of the friction disk is 100mm and 200mm respectively. The coefficient of friction is 0.2 and permissible intensity of pressure is 1.5N/mm<sup>2</sup>. Assuming uniform wear theory, calculate the operating force in the clutch. **1**  
 (a) 15546 N (b) 12344 N (c) 23562 N (d) 24543 N
- Q.2 i. Explain different type of lubricants. **2**  
 ii. Describe the hydrodynamic theory. **3**  
 iii. Explain different type of roller bearing and describe the bearing life. **5**
- OR iv. Describe the selection parameter of ball and roller bearings. **5**
- Q.3 i. Explain the Lewis equation. **2**  
 ii. Describe the design steps for straight tooth spur and helical gears. **8**
- OR iii. A gear drive consists of two gears, A and B, and has a velocity ratio of 1.50. Gear A, the smaller of the two gears, revolves at 126 rpm in the clockwise direction, and has 28 teeth. If the gears have a module of 2 mm, determine the following: **8**

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- (a) The number of teeth on Gear B  
 (b) The pitch (reference) diameters for the two gears  
 (c) The addendum  
 (d) The dedendum  
 (e) The circular pitch  
 (f) The tooth thickness  
 (g) The speed of Gear B  
 The theoretical centre distance of the two gears
- Q.4 i. Write short note on any three design considerations in I. C. Engine **3**  
 ii. A trial carried out in a four-stroke single cylinder gas engine gave the following results. Cylinder diameter =300 mm, Engine stroke =500 mm, Clearance volume =6750 cc, Explosions per minute =100,  $P_{max}$  (kN/m<sup>2</sup>) = 765, Net work load on the brake =190 kg, Brake diameter =1.5 m Rope diameter =25mm, Speed of the engine =240rpm, Gas used =30 m<sup>3</sup>/kghr, Calorific value of gas =2.515 kJ/m<sup>3</sup>. Determine Compression ratio, Mechanical efficiency, Indicated thermal efficiency, Air standard efficiency, Relative efficiency, assume  $r = 1.4$  **7**  
 Design of Piston  
 Design a cast iron piston for a single acting four stroke diesel engine with the following data:  
 Cylinder bore = 300 mm  
 Length of stroke = 450 mm  
 Speed = 300 rpm  
 Indicated mean effective pressure = 0.85 Mpa  
 Maximum gas pressure = 5 Mpa  
 Fuel consumption = 0.3 kg per BP per h  
 Higher calorific value of fuel = 44000 kJ/kg  
 Assume suitable data, if necessary.
- OR iii. The following observations are recorded during a test on a four-stroke petrol engine, F.C = 3000 of fuel in 12sec, speed of the engine is 2500 rpm, B.P = 20 kW, Air intake orifice diameter = 35 mm, Pressure across the orifice = 140 mm of water coefficient of discharge of orifice = 0.6, piston diameter = 150 mm, stroke length = 100 mm, Density of the fuel = 0.85 gm/cc,  $r = 6.5$ ,  $C_v$  of fuel = 42000 kJ/kg, Barometric pressure = 760mm of Hg, Room temperature = 24 °C. **7**

P.T.O.

## Marking Scheme

### AU3CO13 / ME3CO12 Machine Design -II

Q.1	i.	(d) Supports	1 Mark	<b>1</b>
	ii.	(c) Total moment of various forces acting on the body is always zero in any dimension	1 Mark	<b>1</b>
	iii.	(d) Normal circular pitch	1 Mark	<b>1</b>
	iv.	(c) Helix angle	1 Mark	<b>1</b>
	v.	(c) 7.5 kg-m	1 Mark	<b>1</b>
	vi.	(c) Constant volume combustion	1 Mark	<b>1</b>
	vii.	(c) Either potential or kinetic	1 Mark	<b>1</b>
	viii.	(c) 29.3 rad.	1 Mark	<b>1</b>
	ix.	(b) No they are different type of joints	1 Mark	<b>1</b>
	x.	(a) 15546 N	1 Mark	<b>1</b>
Q.2	i.	Different type of lubricants	2 Marks	<b>2</b>
	ii.	Explanation with diagram	3 Marks	<b>3</b>
	iii.	Type of roller bearing	2.5 Marks	<b>5</b>
		Bearing life.	2.5 Marks	
OR	iv.	Selection parameter of ball bearings	2.5 Marks	<b>5</b>
		Selection parameter of roller bearings	2.5 Marks	
Q.3	i.	Lewis equation with notation	2 Marks	<b>2</b>
	ii.	Design Steps of spur gears	4 Marks	<b>8</b>
		Design steps of helical gears.	4 Marks	
OR	iii.	The number of teeth on Gear B	1 Mark	<b>8</b>
		The pitch (reference) diameters for the two gears	1 Mark	
		The addendum	1 Mark	
		The dedendum	1 Mark	
		The circular pitch	1 Mark	
		The tooth thickness	1 Mark	
		The speed of Gear B	1 Mark	
		The theoretical centre distance of the two gears	1 Mark	
Q.4	i.	Three design considerations in I. C. Engine	1 Mark each (1 Mark*3)	<b>3</b>
	ii.	Design formula	1 Mark	<b>7</b>
		Various important dimension	4 Marks	
		Pin dimension	2 Marks	
OR	iii.	(a) Volumetric efficiency on the air basis alone	2 Marks	<b>7</b>

		(b) Air-fuel ratio	1 Mark	
		(c) The brake mean effective pressure	2 Marks	
		(d) The relative efficiency on the brake thermal efficiency	2 Marks	
Q.5	i.	Any four types of brakes with explanation	1 Mark each (1 Mark*4)	<b>4</b>
	ii.	Self energizing brakes	2 Marks	<b>6</b>
		Related diagram	2 Marks	
		Moment equation	2 Marks	
OR	iii.	Related diagram	1 Mark	<b>6</b>
		Design procedure	3 Marks	
		Related formula	2 Marks	
Q.6		Attempt any two:		
	i.	Design Steps	3 Marks	<b>5</b>
		Related formula	2 Marks	
	ii.	Function & related diagram for cone clutch	2.5 Marks	<b>5</b>
		Function & related diagram for centrifugal clutch	2.5 Marks	
	iii.	Torque transmitting capacity	2.5 Marks	<b>5</b>
		Various equation of torque	2.5 Marks	