DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

End Semester Examination: Supplementary – 2022-23

Branch: Mechanical Engg. (Third Year B.Tech.) **Sem.:- V**
Subject with Subject Code:- Theory of Machines -II **(BTMEC504)**
Marks: 60
Date:- January 2023 **Time:- 3 Hrs.**

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Instructions:-

1. Figures to the right indicate full marks.
2. Clearly mention the main question number along with the sub questions.
3. Assume suitable data, if necessary.
4. All questions are compulsory.

Q.No.	Question	Marks	CO
1	Solve **Any Two**:		
	a) A belt drive transmits 8 kW of power from a shaft rotating at 240 rpm to another shaft rotating at 160 rpm. The belt is 8 mm thick. The diameter of smaller pulley is 600 mm & the two shafts are 5 m apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 N/mm^2, find the width of the belt for i. An open belt drive, and ii. A crossed belt drive	**06**	**CO1**
	b) What are the different types of pulleys? Explain briefly.	**06**	**CO1**
	c) Derive the relation for ratio of belt tensions in a flat belt drive	**06**	**CO1**
2	Solve **Any Two**:		
	a) State & derive law of gearing with neat sketch.	**06**	**CO2**
	b) Make a comparison of Cycloidal & Involute tooth forms.	**06**	**CO2**
	c) A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is 4 mm. Calculate (i) the centre distance; (ii) the pitch circle diameters of the pinion and the gear; (iii) the addendum and dedendum; (iv) the tooth thickness; (v) the gear ratio.	**06**	**CO2**
3	Solve **Any Two**:		
	a) What is a gear train? What are its main types (with sketches)?	**06**	**CO2**
	b) Sketch a automotive differential gear box & explain its working.	**06**	**CO2**
	c) An epicyclic gear train is shown in Fig.1. The number of teeth on A & B are 80 & 200. Determine the speed of the arm *a.* (i) If A rotates 100 rpm clockwise & B at 50 rpm counter-clockwise. (ii) If A rotates 100 rpm clockwise & B is stationary.	**06**	**CO2**

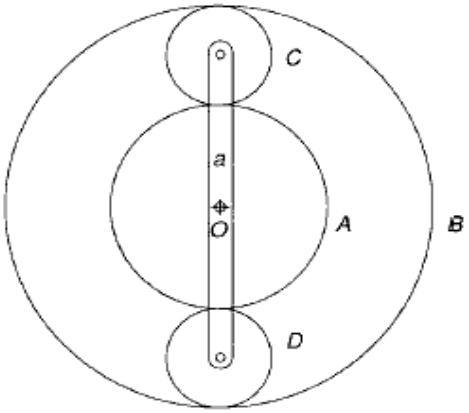

Fig.1

4 Solve **Any Two**:

a) The turning moment diagram of a multi-cylinder engine is drawn with a scale of (1 mm = 1°) on the abscissa and (1 mm = 250 N-m) on the ordinate. The intercepted areas between the torque developed by the engine and the mean resisting torque of the machine, taken in order from one end are – 350, + 800, – 600, + 900, – 550, + 450 and –650 mm^2. The engine is running at a mean speed of 750 rpm and the coefficient of speed fluctuations is limited to 0.02. A rimmed flywheel made of grey cast iron FG 200 (ρ = 7100 kg/m3) is provided. The spokes, hub and shaft are assumed to contribute 10% of the required moment of inertia. The rim has rectangular cross-section and the ratio of width to thickness is 1.5.Determine the dimensions of the rim. **06** **CO4**

b) Explain the terms sensitiveness, hunting, stability, isochronisms & effort of governor relating to the governors. **06** **CO3**

c) Sketch a Hartnell governor. Describe its function & deduce a relation to find the stiffness of the spring. **06** **CO3**

5 Solve **Any Two**:

a) A ship is propelled by turbine rotor having a mass of 6 tonnes & a speed of 2400 rpm. The direction of rotation of the rotor is clockwise when viewed from stern. The radius of gyration of the rotor is 450 mm. Determine the gyroscopic couple & its effect when **06** **CO5**

i. The ship steers to the left in a curve of 60 m radius at a speed of 18 knots (1 knot = 1860 m/h)

ii. The ship pitches 7.5 degrees above & 7.5 degrees below the normal position & the bow is descending with its maximum velocity; the pitching motion is simple harmonic with a periodic time of 18 seconds.

iii. The ship rolls & at the instant, its angular velocity is 0.035 rad/s counter clockwise when viewed from stern

iv. Also find the maximum angular acceleration during pitching

b) Explain in what way the gyroscopic couple affects the motion an aircraft & naval ship? **06** **CO5**

c) How do the effects of gyroscopic couple & of centrifugal force make the rider of a two wheeler tilt on one side? Derive a relation for angle of heel. **06** **CO5**

6 Solve **Any Two**:

a) Explain the whirling of vertical shaft carrying a single rotor without damping & derive the equation for deflection of the shaft. **06** **CO6**

b) Determine the natural frequency of the system shown in Fig.2. **06** **CO6**

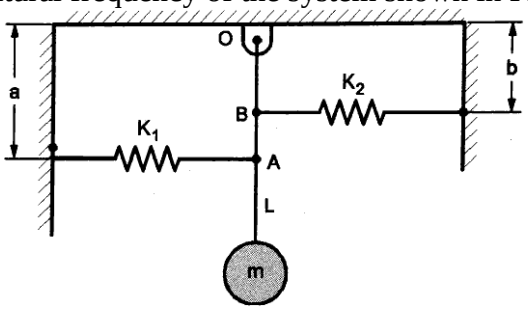

Fig.2.

c) In a forced vibratory system a body having 2 kg mass vibrates in a viscous fluid. The harmonic exciting force of 20 N acting on the mass result in a resonance amplitude of 15 mm with a period of 0.15 sec. Determine the damping coefficient of viscous fluid. **06** **CO6**

If the system is excited by the same harmonic force but at a frequency of 5 cycles /sec. what will be the amplitudes of forced vibration with & without damper?

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD -402 103
Winter Semester Examination – December - 2019

Branch: B. Tech Mechanical **Sem.:- V**
Subject with Code: - Theory of Machine -II (BTMEC504) **Marks: 60**
Date:- 16/12/2019 **Time:- 3 Hr.**

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately
   Assume it and should mention it clearly

(Marks)

Que.1. **(2×6=12)**

A) A pulley is driven by a flat belt, angle of lap being 120^0. The belt is 100 mm wide by 6 mm thick and density 1000 kg/m^3. If coefficient of friction is 0.3 & maximum stress in belt is not exceed 2 MPa. Find greatest power which the belt can transmit & corresponding speed of belt.

B) Explain centrifugal Tension in belt.

Que.2. **(2×6=12)**

A) What do you understand by the term 'Interference' & 'undercutting' as applied to gears

B) A pinion of 20 involutes teeth and 125mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum numbers of teeth in contact at a time.

Que.3. Attempt the following

A) Explain compound gear train with neat sketch. (6)

B) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B. (6)

Que. 4. **(2×6=12)**

A) The turning moment diagram for a petrol engine is drawn to the following scales : Turning moment, 1 mm = 5 N-m Crank angle, 1 mm = 1º. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2 . The rotating parts are equivalent to a mass of 36kg at a radius of gyration of 150mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.

B) Explain the terms. i) Sensitiveness of governor. ii) Stability of governor.

iii) Isochronism. iv) Hunting of governor.

Que. 5. **(2×6=12)**

A) The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.6m Its speed is 2000 r.p.m. The ship pitches 6º above and 6º below the horizontal position. The complete oscillation takes 30 seconds and the motion is simple harmonic. Determine the following. i) Maximum gyroscopic couple. ii) Maximum angular acceleration of the ship during pitching and iii) The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the left.

B) The turbine rotor of ship has a mass of 2000kg and rotates at a speed of 3000r.p.m. clockwise when looking from a stern. The radius of gyration of the rotor is 0.5m. Determine the gyroscopic couple and its effect upon the ship when the ship is steering to the right in curve of 100m radius at a speed of 16.1 knots (1 knot = 1855 m/h) calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12º. Find the maximum acceleration during pitching motion.

Que. 6. Solve the following.

A) Explain Rayleigh's method. **(6)**

B) Explain and derive expression for critical or whirling speed of a shaft. **(6)**

*******End Paper*******