

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- V (New) EXAMINATION – WINTER 2019

Subject Code: 2151902
Date: 06/12/2019
Subject Name: Theory of Machines
Time: 10:30 AM TO 01:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

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|-----|-----|---|----|
| Q.1 | (a) | With a neat sketch, explain construction and list application of a centrifugal clutch. | 03 |
| | (b) | Enlist the factors on which capacity of a brake depends. | 04 |
| | (c) | Differentiate transmission type dynamometer and absorption type dynamometer? Explain any one type of absorption dynamometer. | 07 |
| | | | |
| Q.2 | (a) | Suggest the characteristics of good friction material for clutch. | 03 |
| | (b) | What are the leading and trailing shoes of an internal expanding shoe brake? | 04 |
| | (c) | The simple band brake, as shown in Fig. 1, is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find :
1. the torque applied due to a hand load of 100 N,
2. the number of turns of the wheel before it is brought to rest, and 3. the time required to bring it to rest, from the moment of the application of the brake. | 07 |
| OR | | | |
| | (c) | A single dry plate clutch transmits 7.5 kW at 900 r.p.m. The axial pressure is limited to 0.07 N/mm ² . If the coefficient of friction is 0.25, find 1. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and 2. Outer and inner radii of the clutch plate. | 07 |
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| Q.3 | (a) | State and explain parallel axis theorem. | 03 |
| | (b) | Explain impulse and momentum. | 04 |
| | (c) | What do you mean by free body diagrams? How are they useful in finding various forces acting on the various members of the mechanism? | 07 |
| OR | | | |
| Q.3 | (a) | Explain D'Alembert's Principle | 03 |
| | (b) | State Lami's theorem and give suitable example. | 04 |
| | (c) | The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm ² . The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate : 1. pressure on slide bars, 2. thrust in the connecting rod. | 07 |
| | | | |
| Q.4 | (a) | Explain the roll, pitch and yaw motions. | 03 |
| | (b) | Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn. | 04 |
| | (c) | Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve. | 07 |

- Q.4** (a) What do you understand by gyroscopic couple ? Derive a formula for its magnitude. **03**
- (b) Explain in brief the application of gyroscopic principles to aircrafts. **04**
- (c) The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60 m. Its speed is 2000 r.p.m. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Determine the following: 1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the ship during pitching, and 3. The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the rear. **07**

- Q.5** (a) What information can be availed from turning moment diagrams **03**
- (b) What is stability of a governor ? Sketch the controlling force versus radius diagrams for a stable, unstable and isochronous governor. **04**
- (c) The turning moment diagram for a multicylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows : + 52, - 124, + 92, - 140, + 85, - 72 and + 107 mm², when the engine is running at a speed of 600 r. p.m. If the total fluctuation of speed is not to exceed $\pm 1.5\%$ of the mean, find the necessary mass of the flywheel of radius 0.5 m. **07**

OR

- Q.5** (a) Explain the term 'turning moment diagram', 'Coefficient of fluctuation of speed' and 'Coefficient of fluctuation of energy'. **03**
- (b) Define and explain the following terms relating to governors : **04**
1. Stability, 2. Sensitiveness, 3. Isochronism, and 4. Hunting
- (c) A punching press is required to punch 40 mm diameter holes in a plate of 15 mm thickness at the rate of 30 holes per minute. It requires 6 N-mm of energy per mm of sheared area. If the punching takes 1/10 of a second and the r.p.m. of the flywheel varies from 160 to 140, determine the mass of the flywheel having radius of gyration of 1 metre. **07**

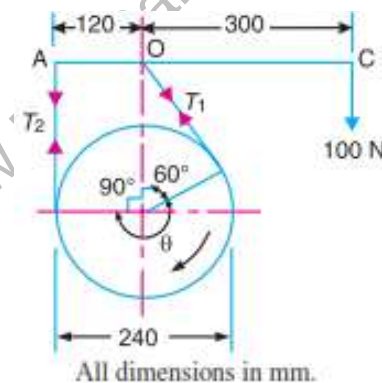


Figure 1
