

- N.B. : (1) Question No. 1 is compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) Assume suitable data if necessary but justify the same.
 (4) Figures to the right indicate full marks.

Q1. Attempt any four

(20)

- A. How does a clutch differ from that of a brake?
 B. Explain the controlling force diagram for a spring controlled governor.
 C. Derive the equation for the gyroscopic couple on a naval ship during pitching.
 D. What do you mean by gear train? List down all the types of gear train and give one application of each.
 E. Determine the minimum value for the radius ratio R_2 / R_1 of a single plate clutch at which the capacity of clutch will decrease by not more than 10 % during the initial wear period.

Q2 A. A plate clutch has three discs on the driving shaft and two discs on the driven shaft. The inside and the outside diameters of the friction surfaces are 125 mm and 250 mm respectively. Assuming uniform pressure and coefficient of friction equal to 0.3, find the total spring load pressing the plates together to transmit 30 kW at 1500 rpm. (7)

B. A simple band brake is applied to a shaft carrying a flywheel of mass 250 kg and radius of gyration 300 mm. The shaft speed is 200 rpm. The drum diameter is 200 mm and the coefficient of friction is 0.25. The free end of band is attached at 100 mm from the fulcrum and effort of 120 N is applied on lever at 280 mm on the other side of the fulcrum. The angle embraced by belt is 225° . Determine for counter clockwise rotation of drum i) Braking torque ii) The number of turns of flywheel before it comes to rest. (7)

C. What do you mean by a dynamometer? Classify the same. How does a dynamometer differ from a brake? (6)

Q3 A. For a spring controlled Hartnell type governor, following data is provided:- (7)

Mass of the governor ball = 1.80 kg

Length of the vertical arm of the bell crank lever = 8.75 cm

Length of the other arm of bell crank lever = 10 cm

The speeds corresponding to radii of rotations of 12 cm and 13 cm are 296 and 304 rpm respectively. Determine the stiffness of the spring.

B. A solid circular steel disc 250 mm diameter and 50 mm thick is mounted with its polar axis on the line OX, of the three Cartesian axes OX, OY and OZ. If at a particular instant the disc is spinning about OX at 12 rad/sec in anticlockwise direction when viewed from right hand side and the frame is rotated at 5 rad/sec about OY in anticlockwise direction when viewed from top, determine the magnitude and sense of the gyroscopic couple. Density of the steel may be taken as 7.8 gm/cc. (7)

C. With the help of neat sketch explain the following terms with respect to gyroscope i) Spin plane ii) Precession axis iii) Gyroscopic plane (6)

TURN OVER