

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VI Examination-Nov/Dec-2011

Subject code: 161806**Date: 02/12/2011****Subject Name: Mechanics of Machines-I****Time: 10.30 am -1.00 pm****Total marks: 70****Instructions:**

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

Q.1 (a) State the different types of governors. What is the difference between centrifugal and inertia type governors? **07**

(b) Construct the profile of a cam to suit the following specifications : **07**

Cam shaft diameter = 40 mm; Least radius of cam = 25 mm; Diameter of roller = 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm; Number of pauses are two of equal interval between motions.

During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

Q.2 (a) What is train value in gear trains? Derive an expression for train value in simple and compound gear trains. **07**

(b) All the arms of a Porter governor are 178 mm long and are hinged at a distance of 38 mm from the axis of rotation. The mass of each ball is 1.15 kg and mass of the sleeve is 20 kg. The governor sleeve begins to rise at 280 rpm when the links are at an angle of 30° to the vertical. Assuming the friction force to be constant, determine the minimum and maximum speed of rotation when the inclination of the arms to the vertical is 45° . **07**

OR

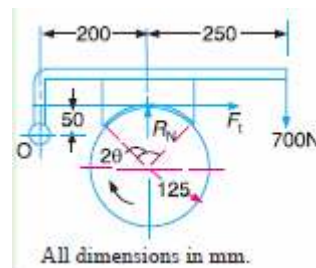
(b) The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; crank angle, 1 mm = 1° . The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm². The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 rpm. **07**

Q.3 (a) Derive an expression for the length of the arc of contact in a pair of meshed spur gears. **07**

(b) Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with, (1) a wheel to give a gear ratio of 3 to 1; and (2) an equal wheel. The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed. **07**

OR

- Q.3 (a)** Explain and draw acceleration diagram for slider crank mechanism. **07**
- (b)** What is the difference between piston effort, crank effort and crank-pin effort? **07**
- Q.4 (a)** For a flat belt, prove that $T_1/T_2 = e^{\mu\theta}$ **07**
 where
 T_1 = Tension in the tight side of the belt,
 T_2 = Tension in the slack side of the belt,
 μ = Coefficient of friction between the belt and the pulley, and
 θ = Angle of contact between the belt and the pulley
- (b)** A single block brake is shown below. The diameter of the drum is **07**
 250 mm and the angle of contact is 90° . If the operating force of
 700 N is applied at the end of a lever and the coefficient of friction
 between the drum and the lining is 0.35, determine the torque that
 may be transmitted by the block brake.



OR

- Q.4 (a)** What is the function of a flywheel? Define the terms ‘coefficient of **07**
 fluctuation of energy’ and ‘coefficient of fluctuation of speed’, in
 the case of flywheel.
- Q.4 (b)** What is stability of a governor? Sketch the controlling force versus **07**
 radius diagrams for a stable, unstable and isochronous governor.
 Derive the conditions for stability.
- Q.5 (a)** Classify different types of cams and followers. **07**
- (b)** An open belt running over two pulleys 240 mm and 600 mm **07**
 diameter connects two parallel shafts 3 meters apart and transmits 4
 kW from the smaller pulley that rotates at 300 rpm. Coefficient of
 friction between the belt and the pulley is 0.3 and the safe working
 tension is 10N per mm width. Determine: 1. minimum width of the
 belt, 2. initial belt tension, and 3. length of the belt required.

OR

- Q.5 (a)** Derive the expressions for displacement, velocity and acceleration **07**
 for a circular arc cam operating a flat-faced follower when the
 contact is on the circular flank.
- (b)** Explain properties of instantaneous centre and types of **07**
 instantaneous centers.
