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B.TECH
PME4I101

4th Semester Regular / Back Examination 2017-18
MECHANISMS & MACHINES
BRANCH: MECHANICAL
Time: 3 Hours
Max Marks: 100
Q.CODE: C1016

Answer Question No.1 and 2 which is compulsory and any FOUR from the rest.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

Q1 Answer the following questions: ***Short answer type*** **(2 x 10)**

a) The driving and driven shafts connected by a Hooke's joint will have equal speeds, if……..

b) The cam follower extensively used in air-craft engines is……
(*a*) knife edge follower (*b*) flat faced follower
(*c*) spherical faced follower (*d*) roller follower

c) The ratio of the maximum fluctuation of energy to the, ... is called coefficient of fluctuation energy.
(*a*) minimum fluctuation of energy (*b*) work done per cycle.

d) The size of a gear is usually specified by……

e) When the sleeve of a Porter governor moves upwards, the governor speed……..

f) In an automobile, if the vehicle makes a left turn, the gyroscopic torque……
(*a*) increases the forces on the outer wheels (*b*) decreases the forces on the outer wheels (*c*) does not affect the forces on the outer wheels
(*d*) none of the above

g) The balancing of rotating and reciprocating parts of an engine is necessary when it runs at……
(*a*) slow speed (*b*) medium speed (*c*) high speed

h) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them.

i) In order to facilitate the starting of locomotive in any position, the cranks of a locomotive, with two cylinders, are placed at . . . . . to each other.

j) What do you mean by vibration isolation?.

Q2 Answer the following questions: ***Short answer type*** **(2 x 10)**

a) What are the different types of motion with which a follower can move ?

b) What is the function of a flywheel? How does it differ from that of a governor?

c) Why Ackerman steering gear is preferred to the Davis steering gear mechanism?

d) What will be the effect of the gyroscopic couple on a disc fixed at a certain angle to a rotating shaft ?

e) Explain the term height of the governor. What are the limitations of a Watt governor?

f) What do you mean by Hammer blow?

g) Discuss the effect of inertia of a shaft on free torsional vibration.

h) A vibrating system consists of a mass of 200kg, a spring of stiffness 80N/mm and a damper with damping coefficient of 800N/m/s. Determine the frequency of vibration of the system.

i) The mass of flywheel of an engine is 6.5tonnes and the radius of gyration is 1.8m.It is found from the turning moment diagram that the fluctuation of energy is 56KN-m.If the mean speed of the engine is 120rpm,find the maximum and minimum speeds.

j) What is partial balancing of engines?

Q3 **a)** A symmetrical circular cam operating a flat-faced follower has the following particulars :Minimum radius of the cam = 30 mm ; Total lift = 20 mm ; Angle of lift = 75° ; Nose radius= 5 mm ; Speed = 600 r.p.m. Find : **(10)**

1. the principal dimensions of the cam, and **2.** the acceleration of the follower at the beginning of the lift, at the end of contact with the circular flank , at the beginning of contact with nose and at the apex of the nose.

b) Two inclined shafts are connected by means of a universal joints. The speed of the driving shaft is 600rpm.If the speed of the driven shaft must lie between 540 to 660 rpm. What is the maximum possible inclination between two shafts. With this angle what will be the maximum aceleration to which the driven shaft is subjected. **(5)**

Q4 **a)** The crankshaft of a punching machine runs at a speed of 300 r.p.m. During punching of 10 mm diameter holes in mild steel sheets, the torque required by the machine increases uniformly from 1000N-m to 4000 N-m while the shaft turns through 40°, remains constant for the next 100°, decreases uniformly to 1000 N-m for the next 40° and remains constant for the next 180°. This cycle is repeated during each revolution. The power is supplied by a constant torque motor and the fluctuation of speed is to be limited to ± 3% of the mean speed. Find the power of the motor and the moment of inertia of the flywheel fitted to the machine. **(10)**

b) A governor of the Proell type has each arm 250 mm long. The pivots of the upper and lower arms are 25 mm from the axis. The central load acting on the sleeve has a mass of 25 kg and the each rotating ball has a mass of 3.2 kg. When the governor sleeve is in mid-position,the extension link of the lower arm is vertical and the radius of the path of rotation of the masses is175 mm. The vertical height of the governor is 200 mm.If the governor speed is 160 r.p.m. when in mid-position, find : **(5)**

1. length of the extension link; and **2.** tension in the upper arm.

Q5 **a)** A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm.Also find the angle through which the pinion turns while any pairs of teeth are in contact. **(10)**

b) What do you understand by Gyroscopic couple? Derive the formula for its magnitude. **(5)**

Q6 **a)** A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine : **1.** The magnitude of the masses at A and D ; **2.** the distance between planes A and D ; and **3.** the angular position of the mass at D. **(10)**

b) Define the performance parameters of Governors.. **(5)**

Q7 **a)** The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine : **1.** stiffness of the spring, **2.** logarithmic decrement, and **3.** damping factor, i.e. the ratio of the system damping to critical damping. **(10)**

b) Derive the expression for motion in damped vibration. How it behaves in the following conditions ,under damping, critical damping, and over damping. **(5)**

Q8 **a)** State and prove Law of gearing. What do you mean by Interference and undercutting. What are the method of eliminating interference. **(10)**

b) What do you mean by tractive force? Derive the expression for variation of tractive force. **(5)**