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Total Number of Pages : 02

B.Tech
PME7G001

7th Semester Regular Examination 2019-20
MACHINE DYNAMICS AND DESIGN

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : HR365

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- a) Define notch sensitivity.
- b) What is a welded joint? Compare welded joint with riveted joint
- c) What are the stresses acting on screwed fasteners?
- d) Why square thread is used in Screw jack?
- e) Difference between cotter and knuckle joints.
- f) Difference between shaft and axle.
- g) What is self locking screw?
- h) What is compound gear drive?
- i) What is the function of a flywheel?
- j) Explain the term 'fluctuation of energy' as applied to flywheels.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

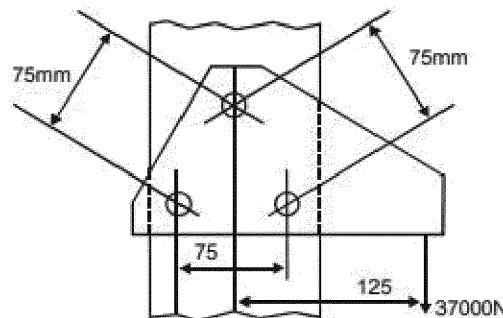
- a) A two dimensional state of stress at a point is given by $\sigma_x = 60\text{MPa}$, $\sigma_y = 20\text{MPa}$ and τ_{xy}
 - i. What is the maximum permissible magnitude of the shear stress, τ_{xy} , if the larger principal stress is not exceeding 75 MPa.
 - ii. What is the magnitude of the other principal stress and maximum shear stress.
- b) A rod of circular cross section is subjected to an alternating tensile force, varying from 50kN to 90kN. Determine the diameter of the rod, according to Gerber, Goodman and Soderberg method. Take $\sigma_{ut} = 900\text{MPa}$, $\sigma_{yt} = 550\text{MPa}$
- c) Define Gruebler's Criterion of mechanism. How it is differ from Kutzbach's criterion?
- d) How do you determine the instantaneous centre of a link AB having velocities of V_A and V_B ?
- e) In a screw jack , the diameter of threaded screw is 40 mm and the pitch 8mm. The load is 20KN and it does not rotate with the screw but it carried on a swivel head having a bearing diameter of 70 mm. The coefficient of friction between the swivel head and the spindle is 0.08 and between the screw and nut is 0.1. Determine the total torque required to raise the load and the efficiency.
- f) Inner diameter of a boiler is 1500 mm and the steam pressure is 2 N/mm². Use a proper joint along the length and design it completely. Use following permissible values of stress. $\sigma_t = 150\text{ MPa}$ $\tau_s = 75\text{ MPa}$, $\sigma_c = 90\text{ MPa}$,
- g) A steel plate strip of 150 mm width and 10 mm thickness is welded by a compound fillet weld to another plate. The strip is required to carry an axial load P such that P is equal to tensile load capacity of the strip with a factor of safety of 2.5 on ultimate tensile strength of strip. Calculate the length of the fillet weld and show on diagram. Ultimate tensile strength of strip material is 380 MPa. Find fillet length.
- h) A conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm² . The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure.

- i) Describe about centrifugal clutch.
- j) In a four bar mechanism ABCD, points A and C are fixed points 30 cm apart and AB, CD are bars 60 cm and 70 cm long respectively, which are connected by a rod BD which is 50 cm long. If AB rotates with uniform speed of 60 r.p.m, determine i) velocity of D when AB is perpendicular to AC and also when it makes 10° on either side of the perpendicular, and ii) the instantaneous centre of the bar BD and its angular velocities in the three positions.
- k) The centre distance between the two shafts, which are connected by two left-handed helical gears is 37 cm. The shaft angle is 60° and normal module is 6 mm. If the gear ratio is 2 and larger gear is having 70 teeth, then find the helix angle of two gears.
- l) Write about Belt Transmission Dynamometer with figure.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** A machine shaft, supported on bearings having their centres 750 mm apart, transmitted 185 kW at 600 rpm. A gear of 200 mm and 20° tooth profile is located 250 mm to the right of left hand bearing and a 450 mm diameter pulley is mounted at 200 mm to the right of right-hand bearing. The gear is driven by a pinion with a downward tangential force while a pulley drives a horizontal belt having 180° angle of contact. The pulley weighs 1000N and coefficient of friction is 0.3. Find the diameter of shaft if the allowable shear stress is 63 MPa. (16)
- Q4** A plate riveted on to a vertical column with three rivets placed at three corners of an equilateral triangle of size 75 mm. A load of 37 kN acts on the plate at a distance of 125 mm from vertical line through a rivet. If the permissible stress in rivet is 60 N/mm² calculate the diameter of the rivet. (16)



- Q5** The torque exerted on the crank-shaft of a two stroke engine is given by the equation: $T \text{ (N-m)} = 14000 + 2200 \sin 2\theta - 1900 \cos 2\theta$, where θ is the crank angle displacement from inner dead centre. Assuming the resisting torque to be constant, determine i) the power developed when the speed is 150 r.p.m ii) the moment of inertia of the flywheel if the total fluctuation of speed is not to exceed 1% of the mean speed. iii) the angular acceleration of flywheel when the crank has turned through 30° from the inner dead centre. (16)
- Q6** In a Hartnell governor the radius of rotation is 7 cm when speed is 500 rpm. At this speed, ball arm is normal and sleeve is at mid position. The sleeve movement is 2 cm with $\pm 5\%$ of change in speed. The mass of sleeve is 6 kg and friction is equivalent to 25 N at the sleeve. The mass of the ball is 2 kg. If ball arm and sleeve arms are equal, find, (a) Spring rate, (b) Initial compression in the spring, and (c) Governor effort and power for 1% change in the speed if there is no friction. (16)