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SF-7169

B. E. - III (Sem. VI) Examination

May / June - 2011

Tribology & Machine Dynamics

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :
☛ B. E. - 3 (SEM. 6)

Name of the Subject :
☛ TRIBOLOGY & MACHINE DYNAMICS

☛ Subject Code No. : 7 1 6 9 ☛ Section No. (1, 2,.....) : NIL

Seat No. :

Student's Signature

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

1 (a) Answer the following questions : **10**
(i) Discuss the effect of pressure on viscosity.
(ii) Define "friction" and "wear".
(iii) What is surface roughness ?
(iv) Define viscosity and viscosity index.
(v) Explain hydrostatic lubrication.

(b) What is tribology ? Discuss the significance of tribology. **5**

(c) Explain ten point irregularity method related to surface texture. **5**

2 Attempt any two : **16**
(i) A steel disc having 200 mm dia and 10 mm width is required to roll freely on a rigid plane. Find the force required to pull the disc if the density of steel = 8000 kg/m^3, pressure ratio = 0.3, E=2.1 x 10^{11} N/m^2, E=hysteresis loss 25%.
(ii) Which information are essentially required for indicating surface texture on a drawing ?
(iii) Show that the volume of wear due to adhesion and abrasion is $V\omega = K\omega \frac{W_x}{H}$, where $K\omega$ = west constant.

3 Attempt any two : **14**

(i) Derive the equation for the coefficient of friction due to the free rolling. Write your assumptions.

(ii) In a pin on disc experiment the disc specimen constant is made of steel and pin specimen is made of brass, the disc is rotating at const. speed of 700 r.p.m. at the radius of contact of pin at 50 mm from centre. The pin is under constant load of 60 N. If the co-efficient of friction is 0.2 then determine the power required to drive the disc. Also find out the average asperity angle of disc surface.

(iii) Define wear and explain in detail the adhesive wear.

4 (a) Answer the following (any five) **10**

(i) Explain in brief energy method to find out natural frequency of vibration for a single degree of freedom free vibration.

(ii) Represent the following complex numbers in exponential form -5 + j(4)

(iii) Write down main causes of vibration.

(iv) Define Transmissibility.

(v) Explain briefly degree of freedom.

(vi) Beats phenomenon.

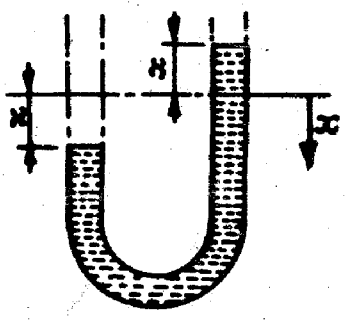
(vii) Define :

(a) damping coefficient

(b) logarithmic decrement

(b) Answer the following : **10**

(i) A simple U tube manometer filled with liquid is shown in figure 1. Calculate the frequency of resulting motion if the minimum length of manometer tube is 0.15 m. **5**



(ii) A spring mass system has spring constant of K kg/cm and the weight of mass W kg. It has natural frequency of vibration as 12 c.p.s. An extra 2 kg weight is coupled to W and natural frequency reduces by 2 c.p.s. Find K and W. **5**

5 Attempt any two : **16**

(i) The disc of a torsional pendulum has a moment of inertia of 600 kg-cm^2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed, amplitudes on the same side of rest position for successive cycles are 9^o, 6^o and 4^o. Determine

(a) Logarithmic decrement

(b) Dumping torque at unit velocity

(c) The periodic time of vibration

Assume for the brass shaft G = 4.4 x 10^{10} N/m^2.

(ii) An electric motor is supported on a spring and a dashpot. The spring has the stiffness 6400 N/m, and the dashpot offer resistance of 500 N at 4.0 m/sec. The unbalanced mass 0.5 kg rotates at 5 cm radius and the total mass of vibratory system is 20 kg. The motor runs at 400 r.p.m. Determine

(a) Damping factor

(b) Amplitude of vibration and phase angle

(c) Resonant speed and resonant amplitude

(iii) A shaft 1.5 cm dia and 1 m long is held in long bearings. The weight of the disc at the centre of the shaft is 15 kg. The eccentricity of the centre of gravity of the disc from centre of rotor is 0.03 cm. The modulus of elasticity of the material of shaft is 2 x 10^6 kg/cm^2. The permissible stress in the shaft material is 700 kg/cm^2.

Find the critical speed of the shaft considering position of the shaft horizontal. Neglect the weight of the shaft.

6 Attempt any two : **14**

(i) Explain with neat sketches vibration measuring instruments.

(ii) Derive the equation for displacement, velocity, acceleration and jerk for the 3-4-5 polynomial D-R-D cam.

(iii) Write a short note on different types of damping methods.
