Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

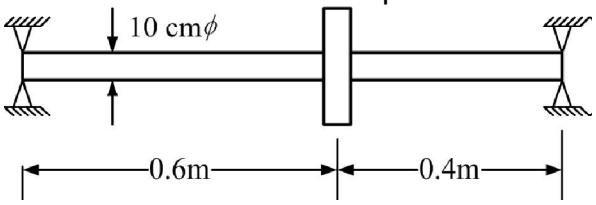
P2MYCC02

2nd Semester Regular Examination 2016-17
Dynamics of Rotors.
BRANCH: DESIGN AND DYNAMICS, MECH. SYSTEMS DESIGN & DYNAMICS
Time: 3 Hours
Max Marks: 100
Q.CODE:Z483
Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

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

a) Explain about Unbalance force model
b) A 4 kg mass of a overhung rotor (cantilever) caused the deflection at the free end of 0.8 cm. What would be the stiffness and the natural frequency of the system?
c) Describe about Jeffcott Rotor Model
d) What do you mean by Steady-state response?
e) Define critical speed of a rotor.
f) What do you mean by synchronous whirl?
g) Explain about Parametric excitation.
h) How instability occurred due to hysteresis?
i) What are support nonlinearities?
j) Why condition monitoring is required?

Q2 Find the bending natural frequency of a rotor system shown in Figure below The disc is rigid and has mass of 10 kg with negligible diametral mass moment of inertia. Consider the shaft as massless and flexible with E = 2.1x 10^2 N/m^2. Take one plane motion only. **(20)**

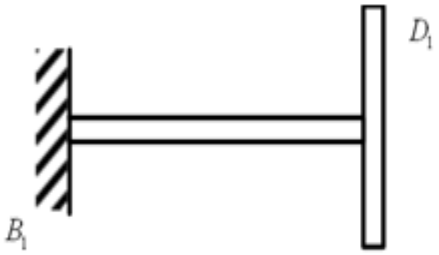


Q3 A disc of mass 13.6 kg and the polar mass moment of inertia 0.02 kg-m^2, is mounted at the mid-span of a shaft with a span length of 0.4064 m. Assume the shaft to be simply supported at bearings. **(20)**
The rotor is known to have an unbalance of 0.2879 kg-cm. Determine forces exerted on bearings at the spin speed of 6000 rpm. The diameter of the steel shaft is 2.54 cm with E = 200 GNm^{-2}.

Q4 Neatly describe the steps to be followed in finding the frequencies of a rotor system using FEM method. **(20)**

Q5 **a)** Obtain the transverse critical speed for the synchronous motion of a cantilever rotor. **(10)**

b) Obtain the torsional natural frequency of a cantilever rotor system as shown in Figure below The end B_1 of the shaft has fixed end conditions. The shaft diameter is 10 mm and the length of the span is 0.2 m. The disc D_1 is thin, and has mass of 10 kg and the polar mass moment of inertia equal to 0.02 kg-m^2. Neglect the mass of the shaft. Compare the torsional natural frequency so obtained with the transverse natural frequency of the same rotor system. **(10)**



Q6 **a)** How the analysis of rotors mounted on hydrodynamic bearings is different from rigid support ? explain. **(10)**

b) Explain how gyroscopic action affecting unbalance response? **(10)**

Q7 **a)** Explain how boundary condition effect the mode shapes of rotor disc system. **(10)**

b) Briefly describe about Balancing of rotors. **(10)**