

**B.Tech. - VIEP - MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

June, 2019

BIMEE-008 : MECHANICAL VIBRATION

Time : 3 hours

Maximum Marks : 70

Note : (i) Answer any five questions.

(ii) All questions carry equal marks.

(iii) Use of scientific calculator is permitted.

(iv) Assume missing data suitably.

1. Define following terms : 4x3½=14
- Free Vibration
 - Natural Frequency
 - Forced Vibration
 - Periodic Motion

2. Figure 1 shows a flywheel of mass 750 kg mounted on a vertical shaft of diameter 50 mm. The both ends of the shaft are fixed. The length L_1 of the shaft is 1350 mm whereas the length L_2 of 900 mm. If $E = 200 \text{ GN/m}^2$, then find the natural frequencies of longitudinal and transverse vibrations. Neglect the weight of the shaft. 14

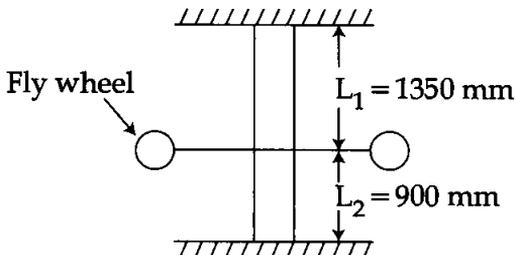


Figure 1

3. (a) Derive a differential equation for a spring - mass system under undamped free vibration. 7
- (b) Find the frequency of transverse vibrations of a shaft which is simply supported at the ends and is of 40 mm in diameter. The length of the shaft is 5 m. The shaft carries three point loads of masses 15 kg, 35 kg and 22.5 kg at 1 m, 2 m and 3.4 m respectively from the left support. The Young's modulus for the material of the shaft is 200 GN/m². Neglect the weight of the shaft. 7
4. A shaft carries a motor at one end and a gear wheel on the other end. The diameter of this shaft is 54 mm and length is L meter. There is another shaft of length 400 mm and of diameter 45 mm. This shaft carries a pinion at one end and a centrifugal pump on the other end. The gear wheel and pinion are meshing together so that the centrifugal pump is driven by the motor. The mass moment of inertia of motor and of centrifugal pump are 0.375 kgm² and 0.59 kgm² respectively. Neglecting the inertia effect of the gears, find the value of L, if the gears are to be at nodes for the torsional vibrations of the system. The speed of the centrifugal pump is four times the speed of the motor. Find also the frequency of torsional vibrations. Take the value of modulus of rigidity for shaft material as equal to 84 kN/mm². 14

5. A harmonic exciting force of 25 kN is acting on a machine part, which is having a mass of 2 kg and is vibrating in a viscous medium. Their exciting force causes a resonant amplitude of 12.5 mm with a period of 0.20 seconds. Determine the damping coefficient. If the system is excited by a harmonic force of frequency 4 Hz, find the increase in amplitude of forced vibration when damper is removed. 14
6. Write short notes on **any four** of the following :
- (a) Vibration measuring instruments $4 \times 3^{1/2} = 14$
 - (b) Vibration absorbers
 - (c) Reciprocal theorem
 - (d) Rayleigh - Ritz method
 - (e) Secondary critical speed
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