

[Total No. of Questions - 9]  
(2063)

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993

B. Tech 6th Semester Examination

Vehicle Dynamics

Au-6003

Time : 3 Hours

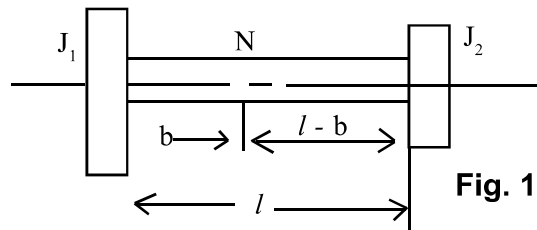
Max. Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.*

**Note :** Attempt five questions in all selecting one question from each of the section A, B, C and D. Section E is compulsory.

**SECTION - A**

1. Two heavy masses with moments of inertia  $J_1$  and  $J_2$  are connected by a shaft of small diameter  $d$ , as show in Fig. 1. Find an expression for the frequency of vibration due to twist of one mass relative to the other.



**Fig. 1**

(15)

2. Find the natural frequencies of the car with the following specifications:

Total mass of the car = 300 kg

Wheel lease = 3 M

C G. of the front axle= 1.50 M

Radius of gyration = 1 M

Spring constants  $K_1 = K_2 = 70 \times 10^3$

(15)

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[P.T.O.]

**SECTION - B**

3. Derive an expression for motion of a vehicle along a level road when the tractive force passes through (a) Centre of gravity (b) Does not pass through centre of gravity. (15)
4. A motor car of mass 800 kg has a wheel base of 2.75 m width with C.G. 0.85 m above the ground level and 1.15 m behind the front axle calculate the maximum possible acceleration of the car, if the coefficient of adhesion between the tyres and ground is 0.6 and when the car has (i) Rear wheel drive (2) Front wheel drive (3) Four wheel drive. (15)

**SECTION - C**

5. Explain in details:
- (i) Suspension spring rate
  - (ii) How to calculate the effective spring rate
  - (iii) Wheel shimmy (3×5=15)
6. Describe the following in details:
- (i) Effect of braking on the suspension system
  - (ii) Transient effects in the cornering
  - (iii) Oversteer and under steer (3×5=15)

**SECTION - D**

7. Find the lowest natural frequency of transverse vibrations for the beam shown in Fig 2. By Rayleigh method.

$$E = 1.96 \times 10^{11} \text{ N/m}^2. I = 10^{-6} \text{ m}^4.$$

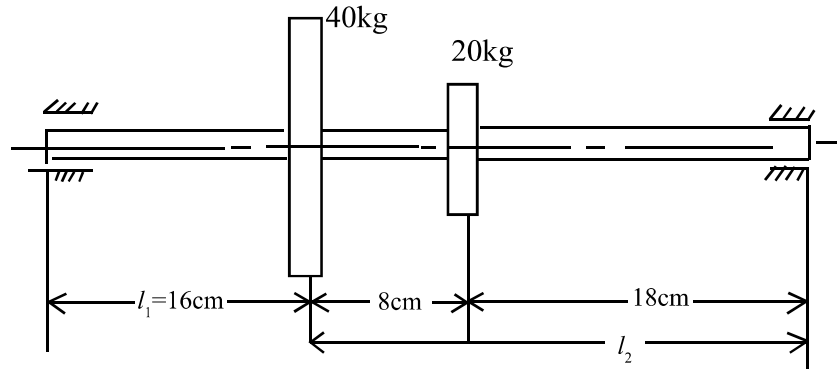


Fig. 2

(15)

8. State and prove Holzer method for closed coupled system. Using suitable assumptions. (15)

### SECTION - E

9. (i) Define degree of freedom  
 (ii) What is the difference between free and forced vibration?  
 (iii) Define time of response.  
 (iv) State the principle of virtual work.  
 (v) What do you mean by damping?  
 (vi) Name the various types of damping.  
 (vii) What do you mean by banking of roads?  
 (viii) What are the approximate methods used to determine the fundamental frequency?  
 (ix) How the tyre is specified?  
 (x) What are the various design parameters are used for tyres and wheels?

[P.T.O.]

- (xi) What are the effects on tyre when vehicle is under steer and over steer?
- (xii) What is transient effect?
- (xiii) Where model analysis is to be used?
- (xiv) What do you mean by load distribution in case of stability of vehicle?
- (xv) What is tyre carcass?
- (xvi) What is aspect ratio of a tyre?
- (xvii) What is unsprung weight?
- (xviii) "Laminated leaf springs are self damping?" How?
- (xix) What material is used for making a torsion bar?
- (xx) What do you mean by whirling of shaft? **(2×20)**