Total No. of Questions : 8]

SEAT No. :

P-6479

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B.E. (Automobile Engineering)

MACHINE & VEHICLE DYNAMICS

(2019 Pattern) (Semester - VII) (416482)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Logarithmic tables, slide rule, electroinc pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Derive the differential equation of motion for forced vibration in spring damper mass system. **[6]**

b) In a vibratory system, a mass of 3 kg is suspended by a spring of stiffness 1200 N/m and it is subjected to harmonic excitation of 20 N. If the viscous damper is provided with the damping coefficient of 75 N-s/m, determine : **[12]**

i) The resonance frequency

ii) The phase angle at resonance

iii) The amplitude at resonance

iv) The frequency corresponding to peak amplitude

v) The damped frequency

OR

Q2) a) Explain : **[8]**

i) Forced Vibrations

ii) Resonance

iii) Quality Factor of the vibratory system

iv) Bandwidth of the vibratory system

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b) The rotating machine, having total mass of 20 kg, is having an eccentric mass of 1.5 kg with eccentricity of 25 mm. The machine rotates at 720 r.p.m. If the amplitude of vibrations, which is 20 mm, lags the eccentric mass by 90°, determine : **[10]**

i) The natural circular frequency of the system;

ii) The damping factor; and

iii) The amplitude and phase angle when eccentric mass rotates at 1440 r.p.m

Q3) a) Explain earth fixed coordinate system and vehicle coordinate system with neat diagram. **[9]**

b) Explain : **[8]**

i) Gradability

ii) Drawbar pull

iii) Rolling resistance

iv) Tractive effort

OR

Q4) a) Derive the equation for normal reactions acting on axles of a vehicle, when vehicle is on a slope and in rest state. **[7]**

b) Explain the different cases of dynamic axle loading with neat diagram and mathematical equations. **[10]**

Q5) a) Explain automatic transmission with respect to torque versus speed ratio. **[7]**

b) Explain engine power limited acceleration. **[10]**

OR

Q6) a) A car weighing 2000 kg travelling at a speed of 40 km/hr. The driver puts on the brakes with a steady brake force or 9000 N, when he sees a stop sign. Determine, the : **[12]**

i) Deceleration of the car.

ii) Stopping distance of the car.

iii) Time to stop the car.

iv) Energy dissipated during braking.

v) Brake power dissipated at point of brake application.

vi) Brake power dissipated average at the stop.

Neglect, aerodynamic, rolling and drawbar pull resistances.

b) Derive the generalized equation for braking performance of a vehicle on slope. **[5]**

Q7) a) Explain mathematical model of handling. **[9]**

b) Explain : **[9]**

i) Yaw velocity

ii) Neutral steer

iii) Constant speed test

OR

Q8) Write short note on : **[18]**

a) Semi-active suspension system

b) Active suspension system.

c) Excitation sources For vehicle ride model.

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