

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Seventh Semester

AERONAUTICAL ENGINEERING

AER141: Vibration And Aero Elasticity

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. D'Alembert's principle considers.....forces
 - a) Static
 - b) Dynamic
 - c) Impact
 - d) Static and inertia
2. If M is the mass, K is the spring constant, C is damping constant, F is the forcing function, vibration will happen if... are present
 - a) M, K
 - b) M, C
 - c) M, F
 - d) M,K, F
3. If X_n is the amplitude after n cycles logarithmic decrement is
 - a) X_n/X_0
 - b) $\ln X_n/X_0$
 - c) $\ln X_0/X_n$
 - d) $1/n (\ln X_0/X_n)$
4. Vibrometer measures Of support motion
 - a) Amplitude
 - b) Frequency
 - c) Phase
 - d) Period
5. In a degenerating system of N masses the number of eigen values are
 - a) Zero
 - b) N
 - c) N-1
 - d) N+1
6. Eigen vectors indicate relativeof masses
 - a) Displacements
 - b) Velocities
 - c) Accelerations
 - d) Phases
7. Natural frequency of a multi degree of freedom system depends on the number of
 - a) Masses
 - b) Springs

Ns/m, calculate the critical damping constant.

(OR)

- b) (i) Derive expression for the amplitude ratio in forced vibration system. (10)
(ii) Explain resonance and its effects. (4)

23. a) (i) What is dynamic coupling? Explain. (4)
(ii) In a two degree of freedom spring-mass system $M_1=2\text{Kg}$, $M_2=1\text{Kg}$, $K_1=100\text{N/m}$, $K_2=50\text{N/m}$. Calculate the natural frequencies and the eigen vectors. (10)

(OR)

- b) (i) Derive the equations of motion of a double pendulum. (10)
(ii) What is an eigen vector? Explain. (4)

24. a) (i) Derive equation for the torsional vibration of a shaft. (5)
(ii) Two discs of $J_1=400\text{ N}$, $J_2=200\text{ N}$ are at the two ends of a shaft 1m long and torsional spring constant of $K_t=300\text{Nm/rad}$. Calculate the natural frequency and the location of the node. (9)

(OR)

- b) (i) Derive the equation for the Longitudinal vibration of a beam. (6)
(ii) A string of 1m length is supported at its ends. If the tension is 100N, mass per unit length is 0.1 Kg/m calculate the frequency of vibration. (8)

25. a) (i) Sketch Collar's aeroelastic triangle and indicate wing divergence, control surface reversal, flutter and vibration on it indicating the associated parameters of the triangle. (8)
(ii) Derive expression for the wing divergence speed. (6)

(OR)

- b) (i) What is flutter? Explain the methods used to delay it. (6)
(ii) Derive expression for the control surface reversal speed. (8)
