AE - 2014

EE24BTECH11064 - Harshil Rathan

1 Mark each

1) A damped single degree of freedom system whose undamped natural frequency, ω_n = 10 Hz, is subjected to sinusoidal external force. Power is half of the maximum for the two frequencies of 60.9469 rad/s and 64.7168 rad/s. The damping factor associated with the vibrating system (in %) is _____.

2) The boundary conditions for a rod with circular cross-section, under torsional vibration, are changed from fixed-free to fixed-fixed. The fundamental natural frequency of the fixed-fixed rod is k times that of the fixed-free rod. The value of k is

a) 1.5
b) π
c) 2.0
d) 0.5

3) Match the appropriate engine (in right column) with the corresponding aircraft (in left column) for most efficient performance of the engine.

a. Low speed transport aircraft	i. Ramjet
b. High subsonic civilian aircraft	ii. Turboprop
c. Supersonic fighter aircraft	iii. Turbojet
d. Hypersonic aircraft	iv. Turbofan

(A) a – iv, b – iii, c – i, d – ii
(B) a – ii, b – i, c – iii, d – iv
(C) a – i, b – ii, c – iv, d – iii
(D) a – ii, b – iv, c – iii, d – i

4) For a given fuel flow rate and thermal efficiency, the take-off thrust for a gas turbine engine burning aviation turbine fuel (considering fuel-air ratio < 1) is

(A) Directly proportional to exhaust velocity
(B) Inversely proportional to exhaust velocity
(C) Independent of exhaust velocity
(D) Directly proportional to the square of the exhaust velocity

5) For a fifty percent reaction axial compressor stage, following statements are given:

i. Velocity triangles at the entry and exit of the rotor are symmetrical.
ii. The whirl or swirl component of absolute velocity at the entry of rotor and entry of stator are the same.

Which of the following options are correct?

(A) Both I and II are correct statements
(B) I is correct but II is incorrect
(C) I is incorrect but II is correct
(D) Both I and II are incorrect

6) A small rocket having a specific impulse of 200 s produces a total thrust of 98 kN, out of which 10 kN is the pressure thrust. Considering the acceleration due to gravity to be 9.8 m/s^2, the propellant mass flow rate in kg/s is

(A) 55.1
(B) 44.9
(C) 50
(D) 60.2

7) The thrust produced by a turbojet engine

(A) Increases with increasing compressor pressure ratio
(B) Decreases with increasing compressor pressure ratio
(C) Remains constant with increasing compressor pressure ratio
(D) First increases and then decreases with increasing compressor pressure ratio

8) The moment coefficient measured about the centre of gravity and about aerodynamic centre of a given wing-body combination are 0.0065 and -0.0235 respectively. The aerodynamic centre lies 0.06 chord lengths ahead of the centre of gravity. The lift coefficient for this wing-body is _____.

9) the vertical ground load factor on a stationary aircraft parked in its hangar is:

(A) 0
(B) -1
(C) Not defined
(D) 1

10) Under what conditions should a glider be operated to ensure minimum sink rate?

(A) Maximum C_L/C_D
(B) Minimum C_L/C_D
(C) Maximum $C_D/C_L^{1/2}$
(D) Minimum $C_D/C_L^{1/2}$

11) In most airplanes, the Dutch roll mode can be excited by applying

(A) A step input to the elevators
(B) A step input to the rudder
(C) A sinusoidal input to the ailerons
(D) An impulse input to the elevators

12) Considering **R** as the radius of the moon, the ratio of the velocities of two spacecraft orbiting moon in circular orbit at altitudes **R** and **2R** above the surface of the moon is _____.

13) If $\left(A\right) = \begin{pmatrix} 3 & -3 \\ -3 & 4 \end{pmatrix}$. Then $\det\left(-[A]^2 + 7[A] - 3[I]\right)$ is

a) 0
b) −324
c) 324
d) 6