

# Assignment 14

AI24BTECH11008- Sarvajith

14. The period of revolution of earth about the sun is 365.256 days, approximately. The semi major axis of the earth's orbit is close to  $1.4953 \times 10^{11}$  m. The semi major axis of the orbit of Mars is  $2.2783 \times 10^{11}$  m. The period of revolution of Mars, about the sun, is x Earth days. What is the value of x (in three decimal place).
15. Consider a system consisting of certain amount of perfect gas enclosed in a cylinder fitted with a frictionless piston. This system can undergo following process:
- a) Expansion with finite pressure difference with the surroundings.
  - b) Compression with infinitesimal pressure difference with the surroundings.
  - c) Heat transfer with finite temperature difference with the reservoir.
  - d) Heat transfer with infinitesimal temperature difference with the reservoir.
- Out of these which processes are reversible?
- (A) a and c
  - (B) a and d
  - (C) b and c
  - (D) b and d
16. Among the following engines, which one is expected to have the maximum Specific Impulse?
- (A) Cryogenic Rocket
  - (B) Solid Propellant Rocket
  - (C) Liquid propellant Rocket
  - (D) SCRAM jet
17. The maximum gas flow rate that can be handled by a multistage axial compressor at a given rotational speed is dictated by
- (A) Compressor Surge
  - (B) Rotating Stall
  - (C) Choking
  - (D) Optimum Design Pressure Ratio
18. For a turbine stage, which one of the following losses occurs due to the turning of the wall boundary layer through an angle due to curved surface?
- (A) Profile Loss
  - (B) Annulus Loss
  - (C) Tip clearance loss
  - (D) Secondary flow loss
19. In the vane-less space between the impeller and the diffuser vanes in a Centrifugal Compressor, the angular momentum varies in the following manner in the radial direction.
- (A) Increases

- (B) Remains constant
  - (C) Decreases
  - (D) First Increases and then Decreases
20. Which of the following statements about the neutral axis of a beam with unsymmetrical cross section is true:
- (A) The product of second moment of area about the neutral axis is always zero.
  - (B) The normal stress along the neutral axis is always zero.
  - (C) The shear stress along the neutral axis is always zero.
  - (D) The product of second momentum of area about the neutral axis and the normal stress about the neutral axis are always zero.
21. Assuming that the aircraft is flying straight, the top spar cap/ flange of wing is most likely to fail in:

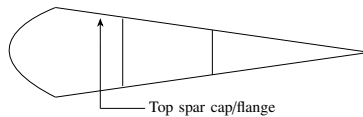


Fig. 0.1: 1

- (A) Yielding
  - (B) Buckling
  - (C) Crushing
  - (D) Creep
22. A 2-DOF undamped spring mass sysytem with two masses and two springs has natural frequencies  $\omega_1 = 0.79 \frac{rad}{s}$  and  $\omega_2 = 1.538 \frac{rad}{s}$ . The mode shapes for the system are given by  $\phi_1 = [0.732]^T$  and  $\phi_2 = [-2.731]^T$ . If the first mass is displaced by 1cm, the mimimum displacement in cms to be given to second mass to make the system vibrate in first mode alone is (in three decimal places)
23. An aircraft landing gear can be idealized as a single degree of freedom spring-mass-damper system. The desirable damping characteristics of such a system is
- (A) Under damped
  - (B) Over damped
  - (C) Critically damped
  - (D) Undamped
24. A single degree of freedom spring-mass system of natural frequency 5Hz is modified in the following manners:  
 Case 1: Viscous damping with damping ratio  $\zeta = 0.2$  is introduced in parallel to the spring  
 Case 2: The original undamped spring-mass system is moved to a surface with coefficient of friction,  $\mu = 0.01$   
 The ratio of damped natural frequency for the cases 1 and 2 is given by (in three decimal places).
25. Which of the following statements about the compatibility equations are true:

- a) Strain compatibility equations must be satisfied in the solution of three-dimensional problems in elasticity.
- b) Six strains are defined in terms of three displacement functions and can have arbitrary values.
- c) Compatibility equations are an expression of the continuity of displacements.

(A) a and b

(B) b and c

(C) a and c

(D) a, b and c

26. Matrix  $[A] = \begin{bmatrix} 2 & 0 & 2 \\ 3 & 2 & 7 \\ 3 & 1 & 5 \end{bmatrix}$  and vector  $\{b\} = \begin{bmatrix} 4 \\ 4 \\ 5 \end{bmatrix}$  are given. If vector  $\{x\}$  is the solution to the system of equations  $[A]\{x\}=\{b\}$ , which of the following is true for  $\{x\}$ :

(A) Solution does not exist

(B) Infinite solutions exist

(C) Unique solution exists

(D) Five possible solutions exist