

PART III

07 – AERONAUTICAL AND AEROSPACE ENGINEERING

(Answer ALL questions)

56. The 'work ratio' of gas turbine increases with
- increase in turbine inlet pressure
 - decrease in compressor inlet temperature
 - decrease in pressure ratio of the cycle
 - all of the above
57. In rocket engines the amount of expansion in nozzle determines the
- exit temperature
 - exit pressure
 - exit temperature and pressure
 - exit density
58. What is the value of propulsive efficiency when aircraft speed is equal to exhaust jet speed?
- 20%
 - 100%
 - 0
 - 50%
59. Nozzles with high pressure ratios have _____ area divergent sections.
- variable
 - constant
 - maximum
 - minimum
60. Convergent nozzles are used in jet engines up to nozzle pressure ratio of
- 0.8
 - 1.8
 - 2
 - 1.5
61. Over expansion occurs when exit area of nozzle is _____ inlet area of the nozzle.
- Equal to
 - Smaller than
 - Greater than
 - Independent on area of
62. What is the value of degree of reaction when the velocity triangle is symmetric?
- 80%
 - 20%
 - 10%
 - 0
63. A turbine having alternate blades and nozzles is called as
- Impulse turbine
 - Reaction turbine
 - Impulse and Reaction turbine
 - Francis turbine
64. Reaction turbine is also called as
- Impulse turbine
 - Curtis wheel
 - Parsons turbine
 - Pelton turbine
65. Due to turbine cascade the drag _____ the lift.
- increases
 - decreases
 - does not change
 - independent to
66. What is TIT?
- Turbine Inner Temperature
 - Turbine Interstate Temperature
 - Turbine Inlet Temperature
 - Theoretical Inlet Temperature
67. Rocket propulsion usually operates in _____ mixture ratio.
- Fuel rich
 - Oxidizer rich
 - Stoichiometric
 - Any of the above

68. The initial and final mass of the rocket engine are 200 kg and 130 kg respectively, average specific impulse of the propellant is 240 seconds and rocket operating duration is 3 seconds. What will be the value of thrust produced?
- 54 KN
 - 24 KN
 - 32 KN
 - 68 KN
69. Which of the following below is used to compare the relative performance of different chemical rocket propellant system designs and propellants?
- Effective exhaust velocity
 - Specific impulse
 - Characteristic velocity
 - Thrust
70. Lean mixtures give _____ efficiency.
- Optimal
 - Higher
 - Lower
 - Poor
71. The degree of reaction is usually kept _____ for all types of axial flow compressors.
- 0.2
 - 0.5
 - 0.3
 - 0.1
72. The following property is most important for material used for gas turbine blade
- Creep
 - Fatigue
 - Corrosion
 - Toughness
73. In a centrifugal compressor, the ratio of the _____ to the blade velocity is called slip factor.
- Inlet whirl velocity
 - Outlet whirl velocity
 - Inlet velocity of flow
 - Outlet velocity of flow
74. Only rocket engines can be propelled to space because
- They can generate very high thrust
 - They have high propulsion efficiency
 - These engines can work on several fuels
 - They are not air breathing engines
75. In combustion chamber the smaller molecules will _____ the combustion.
- Increase
 - Decrease
 - Not change
 - Stabilize
76. According to thin airfoil theory, the pitching moment of the airfoil at its quarter chord point is independent of
- angle of attack
 - camber
 - angle of attack and camber
 - camber and free-stream velocity
77. If M is the Mach number of the flow, M^* is the characteristic Mach number and ' γ ' is the ratio of specific heats, then as $M \rightarrow \infty$, $M^* \rightarrow ?$
- $\frac{\gamma + 1}{\gamma - 1}$
 - $\sqrt{\frac{\gamma + 1}{\gamma - 1}}$
 - $\sqrt{\frac{\gamma - 1}{\gamma + 1}}$
 - $\frac{2\gamma}{\gamma - 1}$
78. A curve of enthalpy as a function of entropy for a constant value of mass flux for one dimensional adiabatic flow with wall friction is known as
- Rayleigh line
 - Hugoniot line
 - Fanno line
 - Prandtl-Meyer line
79. Supersonic flow can be decelerated to subsonic if the passage ducts is
- Converging
 - Diverging
 - Converging-diverging
 - Diverging-converging

80. Consider a two-dimensional body in supersonic flow with an attached oblique shock. An increase in freestream Mach number will cause the oblique shock wave to
- move closer to the body
 - move away from the body
 - become a normal shock
 - detach from the body
81. The Schlieren flow visualization technique depends on
- the variation of the value of density in the flow
 - the first derivative of density with respect to spatial coordinate
 - the second derivative of density with respect to spatial coordinate
 - the third derivative of density with respect to spatial coordinate
82. If ' θ ' is flow deflection angle, ' V ' is upstream velocity and ' M ' is upstream Mach number of an expansion wave, then the differential governing equation for Prandtl-Meyer flow can be written as
- $d\theta = \sqrt{(M^2 - 1)} \frac{dV}{V}$
 - $d\theta = \sqrt{(M^3 - 1)} \frac{dV}{V}$
 - $d\theta = -\sqrt{(M - 1)} \frac{dV}{V}$
 - $d\theta = -\sqrt{(M^2 - 1)} \frac{dV}{V}$
83. The statement that 'the product of upstream and downstream velocities across a normal shock wave is equal to square of critical speed of sound' denotes
- Euler's relation
 - Prandtl's relation
 - Meyer's relation
 - Rankine's relation
84. The tangential component of velocity in upstream and downstream regions across an oblique shock wave
- remains constant
 - increases
 - decreases
 - becomes zero in downstream
85. Consider an elliptic lift distribution over a wing. Let ' K_0 ' be the circulation at mid span and ' $2s$ ' be the span of major axis. Then the downwash is given by
- K_0 / s
 - $K_0 / 2s$
 - $K_0 / 4s$
 - $K_0 / 8s$
86. The concept of zero drag on bodies immersed in a steady flow of ideal fluid is called
- D'Alemberts paradox
 - Kelvin theorem
 - Helmholtz theorem
 - Biot Savart law
87. The optimum angle of attack of an aerofoil is the angle at which
- the aerofoil produces maximum lift
 - the aerofoil produces zero lift
 - the highest lift/drag ratio is produced
 - the lowest lift/drag ratio is produced
88. As air flows over the upper cambered surface of an aerofoil, what happens to velocity and pressure?
- Velocity increases, pressure increases
 - Velocity increases, pressure decreases
 - Velocity decreases, pressure decreases
 - Velocity decreases, pressure increases
89. In a forced vortex
- the fluid velocity is inversely proportional to the radius
 - the fluid rotates without any relative velocity
 - the rise depends on the specific weight
 - the rise is proportional to the cube of angular velocity
90. According to small perturbation theory, the linearized pressure coefficient for a planar irrotational flow can be approximated as (where u' is perturbation in flow direction and V_∞ is freestream velocity)
- u' / V_∞
 - $2u' / V_\infty$
 - $-u' / V_\infty$
 - $-2u' / V_\infty$

102. A closely coiled helical spring absorbs 80 N-mm of energy while extending by 4mm. The stiffness of the spring is
- 5 N/mm
 - 10 N/mm
 - 16 N/mm
 - 20 N/mm
103. Angle ply laminate have
- Higher shear strength
 - Higher bending stiffness
 - Higher tensile strength
 - Lower shear strength
104. For a linear strain triangular element the order of approximation for displacement is
- 1
 - 3
 - 4
 - 2
105. Maximum stress failure and maximum strain failure theories gives identical results when
- Equal to zero
 - The Poisson's ratio is greater than one
 - The Poisson's ratio is less than one
 - Equal to one
106. In a thick cylinder pressurized from inside, the Hoop stress is maximum
- At the center of the wall thickness
 - At the outer radius
 - At the inner radius
 - Both the inner and outer radii.
107. The compatibility conditions in theory of elasticity ensures that
- There is compatibility between stress components
 - Relationships between stresses and strains are consistent with the constitutive relations
 - Displacements are single valued and continuous
 - Stresses satisfy the bi-harmonic equation
108. A mild steel beam is subject to a bending moment such that a stress of 100 N/mm² is developed at a layer which is 10 cm from the neutral axis. If $E = 200 \text{ kN/mm}^2$, the radius of curvature of the beam is
- 400 m
 - 200 m
 - 100 m
 - 50 m
109. Two prismatic beams A and B have same length. The one having larger _____ will be stronger in flexure.
- Moment of inertia
 - Section modulus
 - Product of inertia
 - Area of cross section
110. A plate is a member subjected to
- Bending only
 - Twisting only
 - Both bending and twisting
 - Axial load
111. Divergence speed of a wing may be increased by
- Decreasing the wing stiffness
 - Increasing the offset distance between aerodynamic center and center of twist
 - Decreasing the offset distance between aerodynamic center and center of gravity
 - Decreasing the offset distance between aerodynamic center and center of twist
112. A linear mass-spring-dashpot system is over-damped. In free vibration, this system undergoes
- Non-oscillatory motion
 - Random motion
 - Oscillatory and periodic motion
 - Oscillatory and non-periodic motion
113. If the loading is with respect to the natural axis of a unidirectional lamina, then the lamina is called
- Isotropic
 - Orthotropic
 - Anisotropic
 - Quasi isotropic
114. Flutter is associated with
- Steady amplitude oscillation
 - Unsteady amplitude oscillation
 - Quasi steady amplitude oscillation
 - Neutrally damped oscillation
115. Shape function expression for a beam element with two degrees of freedom per node is of order
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