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DGCA 2023

AERONAUTICAL ENGINEERING

(SET B)

Exam held on 17th Dec, 2023 Afternoon Session

QUESTIONS & ANSWER KEYS

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AERONAUTICAL ENGINEERING

AIR SAFETY OFFICER – 2023

1. What is the purpose of a pressure-regulating valve and regulator in combat aircraft oxygen systems?
   (A) To control cabin pressure
   (B) To cool the cockpit
   (C) To enable the pilot to select an oxygen-air mixture or pure oxygen.
   (D) To detect cabin air quality

2. How are the emergency exit doors typically designed in commercial aircraft and military transports?
   (A) They are designed to open inwards.
   (B) They are designed to open downwards.
   (C) They are designed to open outwards.
   (D) They are designed to open automatically.

3. A cylindrical pressure vessel has an internal diameter of 2 m and is fabricated from plates 20 mm thick. If the pressure inside the vessel is 1.5 N/ mm^2 and, in addition, the vessel is subjected to an axial tensile load of 2500 kN, what is the circumferential stress?
   (A) 37.5 N/mm^2
   (B) 47.5 N/ mm^2
   (C) 65 N/ mm^2
   (D) 75 N/ mm^2

4. Which one of the following is the maximum load that the aircraft is expected to experience in normal operation to ensure general minimum standards of strength and safety airworthiness regulations lay down several factors that the primary structure of the aircraft must satisfy?
   (A) Limit load
   (B) Proof load
   (C) Ultimate load
   (D) Aero load

5. The theory of the torsion of closed section beams is known as
   (A) Bredt-Batho theory
   (B) maximum stress theory
   (C) elementary torsion theory
   (D) Wagner torsion bending theory.

6. Consider the following statements regarding loads on structural components of aircraft:
   1. Ground loads encountered in landing and taxiing subject the aircraft to concentrated shock loads through the undercarriage system.
   2. Wings, tailplane and the fuselage are each subjected to direct, bending, shear and torsional loads.
   3. All the air loads are the result of the pressure distribution over the

surfaces of the skin produced by steady flight, maneuver or gust conditions.

Which of the above statements are correct?

(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

7. The dynamic instability of an elastic body in an airstream is known as
(A) flutter
(B) aerodynamic coupling
(C) centre of independence
(D) buffeting

8. At a particular point in a structural member, a two-dimensional stress system exists, where $\sigma_x = 60\ N/mm^2$, $\sigma_y = -40\ N/mm^2$, and $\tau_{xy} = 50\ N/mm^2$,. If Young's modulus, E = 200000 N/mm^2 and Poisson's ratio, v = 0.3, what is the direct strain in y-direction?
(A) -290×10^{-6}
(B) 290×10^{-6}
(C) 290×10^{-5}
(D) -290×10^{-5}

9. A rectangular element in a linearly elastic isotropic material is subjected to tensile stresses of 83 N/mm^2 and 65 N/mm^2on mutually perpendicular planes. What is the strain in the x-direction? (Take modulus of elasticity, E = 200000 N/mm^2 and Poisson's ratio, v = 0.3)
(A) 3.175×10^{-4}
(B) 2.005×10^{-4}
(C) -2.220×10^{-4}
(D) -4.070×10^{-4}

10. Consider the following statements regarding finite element method for continuum structures.
1. In finite element method, a coarse idealization involving number of large elements would provide a comparatively rapid but very approximate solution.
2. In finite element method, a fine idealization involving a small number of elements would provide a comparatively very approximate solution.
3. In finite element method, graded meshes are used in which small elements are placed in regions where high stress concentrations are expected.

Which of the above statements are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

11. Quadrilateral elements are frequently used in combination with which of the following elements to build up particular geometrical shapes?
    (A) Tetrahedral elements
    (B) Hexahedral elements
    (C) Triangular elements
    (D) Rectangular elements

12. What is the differential pressure for an airliner cruising at 35000 ft with a cabin altitude of 8000 ft across the cabin wall?
    (A) 10 kPa
    (B) 50 kPa
    (C) 350 kPa
    (D) 1000 kPa

13. Which one of the following terms is used for the condition that occurs when breathing air at reduced atmospheric pressure leads to a reduction in alveolar oxygen pressure, resulting in an oxygen supply deficiency to the body and brain tissues?
    (A) Hypoxia
    (B) Wessex
    (C) Winch
    (D) Zeolite

14. Why are fuel booster pumps, also known as engine feed pumps, used in aircraft systems?
    (A) To increase fuel efficiency
    (B) To reduce engine noise
    (C) To prevent aeration and cavitation issues
    (D) To enhance the aircraft's speed

15. Which factor(s) contribute(s) to the occurrence of cavitation in aircraft fuel systems at high altitudes?
    (A) Low engine demand
    (B) Low fuel temperature
    (C) High fuel vapor pressure
    (D) High engine demand and high fuel temperature

16. Which one of the following requires aerodynamic heating?
    (A) Sonic flow
    (B) Supersonic flow
    (C) Neutral flow
    (D) Radial flow

17. The mating of a wing with a fuselage in an aircraft is called,
    (A) wing mating
    (B) wing-body combination
    (C) fuselage body interaction
    (D) fuselage mating

18. What is the primary purpose of cooling hydraulic fluid in an aircraft hydraulic system?
    (A) To increase the viscosity of the hydraulic fluid
    (B) To remove impurities from the hydraulic fluid

(C) To prevent overheating of the hydraulic fluid
(D) To pressurize the hydraulic fluid

19. Why is it important to cool the flow in the pump case drain line before it enters the reservoir?
(A) To increase the pressure in the reservoir
(B) To prevent the pump from overheating
(C) To reduce the risk of hydraulic fluid contamination
(D) To maintain the cleanliness of the heat exchanger

20. What is the purpose of depressurizing the hydraulic system the engine start?
(A) To increase engine power offtake
(B) To reduce engine starting time
(C) To maintain hydraulic pressure
(D) To prevent hydraulic leaks

21. How is the nose gear of the tricycle landing gear system typically operated?
(A) Manually by the flight crew
(B) Electrically using motors
(C) Hydraulically
(D) Pneumatically

22. What is the primary function of the Dunlop automatic brake control system in aircrafts?
(A) To assist deployment with landing gear
(B) To automatically taxi the aircraft to the gate
(C) To allow the aircraft to be landed and stopped without pilot braking intervention.
(D) To provide backup power for the aircraft's avionics

23. What role does the commutator play in DC power generation in aircraft systems?
(A) It converts DC power to AC power.
(B) It converts high voltage to low voltage.
(C) It enables the generator's output voltage to be half-wave rectified.
(D) It provides additional electrical resistance to stabilize the voltage.

24. What is a limitation of compound generator in terms of speed and packaging in aircraft systems?
(A) They have no speed limitations.
(B) They are limited by their voltage output.
(C) There is no weight constraint for compound generators.
(D) There comes a point where it is not practicable to package the rotating elements within speed or weight constraints.

25. What happens to fuel temperature when the fuel flow is low in the aircraft systems?

(A) Fuel temperature decreases.
(B) Fuel temperature remains constant.
(C) Fuel temperature rises significantly.
(D) Fuel temperature depends on altitude.

26. What is the main source of conditioning air for both civil and military aircrafts?
(A) Ground-based air-conditioning unit
(B) Engine bleed air from the high-pressure compressor
(C) Exhaust from the aircraft engines
(D) Ambient air drawn through the aircraft's ventilation system.

27. When does humidity control become more challenging in aircraft cabins?
(A) At high altitude
(B) In hot, humid climates
(C) During takeoff and landing
(D) At cruising altitude

28. Which devices are commonly used to separate water droplets from the air in air cycle refrigeration systems for humidity control?
(A) Dehumidifiers
(B) Air filters
(C) Water, separators
(D) Ventilation fans

29. Why are windscreen wipers not suitable for use with plastic windscreens?
(A) They are too expensive.
(B) They tend to scratch the surface.
(C) They are not effective at high subsonic speeds,
(D) They do not work well in cold weather.

30. What term is commonly used to refer to an area in the cockpit or flight deck where multiple warnings are grouped together?
(A) Warning Central
(B) Control Centre
(C) Master Caution Panel
(D) Advisory Console

31. Which one of the following is the aircraft's central body that accommodates the crew and the payload (Passengers and cargo), and protects then from the exterior conditions?
(A) Fuselage
(B) Empennage
(C) Wing
(D) Tail

32. What is the temperature gradient in n How direction across a plane wall of 10 cm thickness with a constant thermal conductivity of 85 W/m-K, when the surface temperatures are steady at 100 °C and 30 °C? The wall area is 3 m^2.
(A) -700 °C/m
(B) -500°C/m
(C) -600°C/m
(D) -800°C/m

33. Air at 120 °C flows Overa plate 20 mm thick and the temperatures in the middle 10 mm layer of the plate were measured using thermocouples and were found to be 42 °C and 30 °C. The thermal conductivity of the material is 22.5 W/m-K. What is average the convection coefficient over the plate? (Assume the material to be isotropic and having constant thermal conductivity)

(A) 175 W/m^2-K
(B) 275 W/m^2-K
(C) 375 W/m^2-K
(D) 475 W/m^2-K

34. A closed container filled with hot coffee is in a room whose air and walls are at fixed temperature. Identify the order of hear transfer processes that contribute to colling of the coffee (hot coffee is separated from it cooler surroundings by a plastic flask, an air space and a plastic cover).

1. Free convection from flask to air free convection from air to cover.
2. Free convection from coffee to flask, conduction through flask
3. Free convection from cover to free air, radiation exchange between outer surface of the cover and the surroundings
4. Radiation exchange between outer surface of the flask and inner surface of the cover, conduction through the cover

Select the correct answer using the code given below.

(A) 1, 4, 2, 3
(B) 2, 1, 4, 3
(C) 3, 2, 1, 4
(D) 2, 3, 4, 1

35. A plate-shaped nuclear fuel element of 24 mm thickness exposed on the sides to the convection at 200°C with a convective heat transfer coefficient of 900 W/m^2-K generates heat of 20 MW/m^3. The thermal conductivity of the material is 25 W/m-K. what is the temperature gradient at the surface?

(A) −7600 °C/m
(B) −8600 °C/m
(C) −9600 °C/m
(D) −5600 °C/m

36. A small cubical furnace 50 cm × 50 cm × 50 cm on the inside is constructed of fireclay brick (thermal conductivity, K = 1.04 W/m -°C) with a wall thickness of 10 cm. the inside of the furnace is maintained at 500 °C and the outside is maintained at 50°C. What is the heat lost through the walls?

(A) 8.592 kW
(B) 7.792 kW
(C) 6.592 kW
(D) 9.592 kW

37. Consider the following statements regarding the effectiveness of fin performance:
    1. Thermal conductivity of the fin material should be high to give large fin effectiveness.
    2. The ratio of pressure to area should be small.
    3. Effectiveness will be high if the heat transfer coefficient is higher.
    4. Fins reduce resistance to heat flow at the surface.

    Which of the above statements are correct?
    (A) 1 and 2
    (B) 2 and 3
    (C) 1 and 4
    (D) 2 and 4

38. Consider the following statements regarding lumped heat capacity system if a hot steel ball were immersed in a cool pan of water:
    1. The temperature distribution in the ball would depend on the thermal conductivity of the ball material and heat transfer conditions from the surface of the ball to surrounding fluid.
    2. Assumption of uniform ball temperature during cooling process and surface convection heat transfer coefficient exists.
    3. Lumped heat capacity assumes that the internal resistance of the body is higher in comparison to external resistance.

    Which of the above statements are correct?
    (A) 1 and 2 only
    (B) 2 and 3 only
    (C) 1 and 3 only
    (D) 1, 2 and 3

39. Consider the following statements regarding thermal boundary layer on a flat plate with $T_s$and T_α are surface and stream temperatures respectively:
    1. Thermal boundary layer will develop if the surface temperature and free stream temperature are different.
    2. At the leading edge, the temperature profile is nonuniform with $T_s \neq T_\alpha$.
    3. Thermal gradient not existing between the neighboring layers, with increasing distance in y-direction from the surface, the fluid temperature approaches to stream temperature.

    Which of the above statements is/are correct?
    (A) 1 only
    (B) 2 and 3 only
    (C) 3 only
    (D) 1, 2 and 3

40. Which one of the following is the maximum distance between the mean camber line and the chord line measured perpendicular to the chord line?
(A) Camber
(B) Chord
(C) Leading edge
(D) Trailing edge

41. Consider the following statements regarding aerodynamic efficiency:
1. The maximum lift-to-drag ratio, $(L/D)_{max}$, is an important parameter in airfoil performance; it is a direct measure of aerodynamic efficiency.
2. The higher the value of $(L/D)_{max}$, the more efficient is the airfoil.
3. The values of L/D for airfoils are quite large numbers in comparison to that for a complete airplane.

Which of the above statements are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2, and 3

42. A flow field is defined as supersonic if,
(A) the Mach number is 0.5.
(B) the Mach number is 0.
(C) the Mach number is less than 1 at every point.
(D) the Mach number is greater than 1 at every point.

43. If M is the local Mach number at an arbitrary point in a flow field, then by definition the flow is locally sonic if.
(A) $M = 1$
(B) $M > 1$
(C) $M < 1$
(D) $M = 0$

44. Which one of the following is having no dissipative effects due to friction, thermal conduction or mass diffusion?
(A) Viscous flow
(B) Inviscid flow
(C) Neutral flow
(D) Steady flow

45. The slope of the velocity profile at the wall is of particular importance because it governs the wall shear stress. Let $(dV/dy)_{y=0}$ be defined as the velocity gradient at the wall. μ is the absolute viscosity coefficient, w indicates the wall. Then the shear stress at the wall is
(A) $\tau_w = \mu\left(\frac{dV}{dy}\right)_{y=0}$
(B) $\tau_w = \mu\left(\frac{dy}{dV}\right)_{y=0}$
(C) $\tau_w = -\mu\left(\frac{dy}{dV}\right)_{y=0}$
(D) $\tau_w = \left(\frac{dy}{dV}\right)_{y=0}$

46. A wooden block in the form if a rectangular prism floats with its axis vertical. The block is 40 cm long, 20 cm wide and 15 cm deep with a depth of

immersion of 12 cm. what is the position of meta centre? Comment on the stability on the block.

(A) 1.278 cm, the body is in stable equilibrium.

(B) 1.278 cm, the body is in unstable equilibrium.

(C) 2.178 cm, the body is in unstable equilibrium.

(D) 2.178 cm, the body is in stable equilibrium.

47. Consider the following statements regarding surface tension:

1. The pressure inside a droplet or a soap bubble will be higher than surrounding atmosphere.
2. The pressure inside will be higher, smaller the size of a droplet.
3. The pressure inside a droplet or soap bubble will be less than surrounding atmosphere.

Which of the above statements are correct?

(A) 2 and 3 only

(B) 1 and 2 only

(C) 1 and 3 only

(D) 1, 2 and 3

48. The right limb of a simple U-tube manometer containing mercury is open to atmosphere while the left limb is connected to a pipe in which fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in right limb. What is the pressure of the fluid in the pipe if the difference of mercury levels in the two limbs is 20 cm?

(A) 1.597 N/cm^2

(B) 4.597N/cm^2

(C) 2.597N/cm^2

(D) 3.597 N/cm^2

49. The barometric pressure at sea level is 760m m of Hg while that on a mountain top is 735 mm. If the density of air is assumed constant at 1.2 kg/m^3, what the elevation of the mountain top?

(A) 383.33 m

(B) 283.33 m

(C) 323.33 nm

(D) 223.33 m

50. A square aperture in the vertical side of a tank has one diagonal vertical and is completely covered by a plane plate hinged along one of the upper sides of aperture. The diagonals of aperture are 2 m long and the tank contains a liquid of specific gravity of 1.15. The centre of aperture is 1.5 m below the free surface. What is the position of the centre of pressure?

(A) 2.611 m

(B) 1.611 m

(C) 3.911 m

(D) 4.511 m

51. The stream function for a two-dimensional flow is given by $\Psi = 2xy$. What is the velocity at point P (2, 3)?
(A) 6.21 units/s
(B) 7.21 units/s
(C) 6.71 units/s
(D) 7.61 units/s

52. A closed cylinder of diameter 200 mm and height 150 mm is completely filled with water. What is the total pressure force exerted by water on the top of the cylinder if it is rotated about its vertical axis at 200 r.p.m.?
(A) 34.44 N
(B) 24.22 N
(C) 44.22 N
(D) 29.22 N

53. A torpedo is found to move in a sea at a speed of 25 m/s when submerged at a depth of 15 m. What is the pressure at the nose of the torpedo? (Take the density of seawater as 1025 kg/m^3)
(A) 471.2 kN/m^2
(B) 421.2 kN/m^2
(C) 371.2 kN/m^2
(D) 321.2 kN/m^2

54. Consider the following statements regarding rotorcrafts:
1. A rotorcraft (or rotary wing aircraft) is a heavier-than-air aircraft that uses lift generated by wings, called rotor blades that revolve around a mast.
2. A rotorcraft (or rotary wing aircraft) is a lighter-than-air aircraft that uses lift generated by wings, called rotor blades that revolve around a mast.
3. A helicopter is a rotorcraft whose rotors are driven by the engine (or engines) during the flight, to allow the helicopter to take off vertically, hover, fly forwards, backwards and laterally, as well as to land vertically.

Which of the above statements are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

55. Which one of the following instruments provides the information to the pilot on, for instance, whether the wings are leveled or whether the aircraft nose is pointing above or below the horizon?
(A) Heading indicator
(B) Altimeter
(C) Attitude indicator
(D) Magnetic compass

56. Which one of the following permits cabin crew to control the autopilot and related systems in an aircraft?
(A) Mode Control Panel
(B) Primary Flight Display
(C) Navigation Display
(D) Flight Management System

57. Which one of the following aircrafts became the first airliner to fly with an all-digital fly-by-wire control system?
(A) Airbus A320
(B) Airbus A380
(C) Boeing 737
(D) Boeing 777

58. Which one of the following converts a three-phase 115 V AC current into 28 V DC current in aircraft electrical generation sources?
(A) Transformer Rectifier Unit
(B) Differential Current Unit
(C) Frequency Protection Unit
(D) Current Phase Protection Unit

59. Consider the following statements regarding aerospace vehicles:
1. Aerodynes produce lift by moving a wing through air.
2. Aerodynes include fixed-wing aircraft and rotorcraft and are heavier-than-air aircrafts.
3. An aerostat is a craft that remains aloft primarily through the use of lighter-than-air gases, which produce lift to the vehicle with nearly the same overall density as air.

Which of the above statements are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

60. Which one of the following is a missile that follows a suborbital flight path with the objective to a predetermined target?
(A) Cruise missile
(B) Ballistic missile
(C) Antimissile
(D) Antiradar missile

61. How is an airway defined in aviation terminology?
(A) By air traffic controllers
(B) By the centerline defined by radio navigation aids
(C) By the approach line
(D) By the end line

62. Consider the following regarding visual flight rule traffic patterns:
1. **UPWIND:** A flight path parallel to of landings runway in the direction and departures
2. **CROSSWIND:** A flight path at right the landing runway on the departure end
3. **DOWNWIND:** A flight path parallel to the landing runway in the direction opposite to landing.

Which of the above are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

63. Which one of the following receives raw radar data from the primary surveillance radar system and beacon derived information from the secondary surveillance system?
(A) Data processing subsystem
(B) Data entry subsystem
(C) Display subsystem
(D) Data acquisition subsystem

64. What are taxiways at an airport primarily used for?
(A) Aircraft takeoffs and landings
(B) Passenger boarding
(C) Storing airport equipment
(D) Aircraft movement to and from Runways

65. Which one of the following is used to describe an aircraft operation in which it lands on a runway and immediately takes off again without stopping or exiting the runway?
(A) Touch-and-go clearance
(B) Touchdown clearance
(C) Runway clearance
(D) Touchdown maneuver

66. Which one of the following components of a runway visual range system is responsible for determining the visibility of a runway?
(A) Radar
(B) Transmitter
(C) Transmissometer
(D) Transponder

67. What incentives can a State Government provide to an airport company to facilitate the setting up of an airport, according to the guidelines?
(A) Financial grants and subsidies
(B) Shares in the airport company
(C) Land, either at market rates or concessional
(D) Transportation services such as taxi services

68. What type of assistance can a State Government provide to facilitate airport development, according to the guidelines?
(A) Legal representation
(B) Software development
(C) Financial incentives in the form of exemptions from State taxes
(D) Advertising services

69. What is the process for obtaining approval for a greenfield airport beyond 150 km of an existing civilian airport?
(A) Direct approval from the DGCA from the Steering.
(B) Approval from the Steering Committee and the Ministry of Civil Aviation.
(C) No approval required.
(D) Approval from the local authorities.

70. What is the prescribed form for applying for the grant of an aerodrome license?
(A) Form DGCA-1

(B) Form CA 96(A)
(C) Form AAI-101
(D) Form FAA-47

71. How should the fee for the aerodrome license application be remitted?
(A) Cash payment to the DGCA office
(B) Fee exempted for all.
(C) Crossed Demand Draft/Bank transfer in favor of Pay and accounts office, DGCA.
(D) IPO payment to the DGCA office

72. Which legislation governs the development, maintenance and operation of all airports, including greenfield airports in India?
(A) The Airport Authority Act, 1957
(B) The Civil Aviation Act, 1981
(C) The Aircraft Act, 1934
(D) The Air Navigation Act, 1964

73. Which of the following is the primary authority responsible for granting a license for setting up an airport in India?
(A) State Government
(B) Local Airport Authority
(C) Central Government
(D) International Airport Authority

74. Consider the following statements regarding control volume in the application of linear momentum equation:
1. Its boundaries are tangential to direction of flow at inlets and outlets.
2. It is inside the flow boundary and has same alignment as flow boundary.
3. If the magnitudes of the boundary forces are not known, their resultant is taken as reaction force R, which is the force acting on the fluid control volume due to the reaction from boundary.

Which of the above statements are correct?
(A) 1 and 3 only
(B) 1 and 2 only
(C) 2 and 3 only
(D) 1, 2 and 3

75. Consider the following statements regarding static pressure in flow measurement:
1. For the flow of real and Stokesian fluid, the static or thermodynamic pressure becomes equal to negative arithmetic average of normal stresses at a point.
2. The static pressure at a point in fluid flow is the pressure which could result if the fluid were brought to rest isentropically.
3. The static pressure is obtained by adding stagnation pressure and dynamic pressure.

Which of the above statements is/are correct?

(A) 1 only
(B) 2 only
(C) 1 and 3
(D) 1 and 2

76. What is the primary characteristic of the foundation in the context of plates resting on an elastic foundation?
(A) Rigid
(B) Flexible
(C) Compressive
(D) Expansive

77. What are the three key assumptions for obtaining a better approximation of subgrade behavior in the case of a coherent subgrade?
(A) The foundation is frictionless, the plate is floating and there is perfect contact.
(B) The plate is heavy, the foundation is rigid and the plate is floating.
(C) The foundation is semi-infinite elastic, the plate is frictionless and there is perfect contact.
(D) The foundation is soft, the plate is rigid and the plate is floating.

78. In which type of machine parts are circular plates of nonuniform thickness commonly found?
(A) Gears and pulleys
(B) Diaphragms of steam turbines and pistons of reciprocating engines
(C) Bolts and screws
(D) Bearings and shafts

79. What shape typically bounds plates used as floor slabs for skew bridges?
(A) Rectangular
(B) Circular
(C) Oblique parallelogram
(D) Square

80. What is the primary purpose of studying stress distribution around a hole in a plate?
(A) To increase the size of the hole
(B) To design stronger plates
(C) To understand how stress concentrates around holes
(D) To create plates of irregular shapes

81. Why is it suggested to consider a very large plate when investigating stress distribution around a hole?
(A) To make the analysis more complex
(B) To ensure that results are applicable to plates of any shape.
(C) To simplify the analysis
(D) To increase the accuracy of results

82. What is the indication of flashing green color when the aircraft is on the ground?
(A) Cleared for takeoff.
(B) Cleared to taxi.

(C) Taxi clear of landing area or runway in use
(D) Stop

83. Which type of leans is used in runway lights to collect and focus the light towards the approach ends of the runways?
(A) Frequency lens
(B) Glide lens
(C) Fresnel lens
(D) Doppler lens

84. A clutter map is.
(A) a real-time visualization of radar interference
(B) a stored series of values that define all the moving objects routinely detected by the radar system.
(C) a stored series of values that define the nonmoving objects routinely detected by the radar system.
(D) a map showing cockpit view.

85. What do threshold lights at the runway identify?
(A) The centerline of the runway
(B) The approach end of the runway
(C) The midpoint of the runway
(D) The runway threshold

86. What is the primary function of Global Positioning System?
(A) To control weather conditions
(B) To provide global internet access in aircrafts
(C) To regulate cabin pressure in aircrafts
(D) To provide precise position, velocity and time information

87. What is the primary purpose of Lead-In Light (LDIN) system in aviation?
(A) To provide positive visual guidance along an approach path
(B) To show approach area of a non-precision runway
(C) To control air traffic flow
(D) To indicate the runway lighting at nights

88. The approximate distance between the Global Positioning System receiver antenna and satellite based upon signal timing is called.
(A) signal range
(B) pseudo range
(C) normal range
(D) satellite distance

89. Which one of the following components of a rotating radar antenna is responsible for directing microwave radar energy towards the reflecting antenna?
(A) Altimeter
(B) Aircraft transponder
(C) Feedhorn
(D) Base stand

90. What is the primary function of Flight Management System in an aircraft?
(A) To allow routes to be preprogrammed and fed into the system by means of a data loader.
(B) To communicate with cabin crew
(C) To monitor the weather inside the cockpit
(D) To provide cabin entertainment

91. What is the thrust equation for a rocket engine (where m is mass flow rate of propellent, P_e is nozzle exit pressure, P_a is ambient pressure, A_e is area at nozzle exit)?
(A) $F = mV_e + (P_e - P_a)A_e$
(B) $F = mV_e - (P_e + P_a)A_e$
(C) $F = mV_e/(P_e - P_a)A_e$
(D) $F = mV_e/(P_e + P_a)A_e$

92. A rocket engine with chamber pressure of 4-5 MPa and nozzle throat diameter of 110 mm produces thrust of 17 kN by consuming propellent flow rate of 7-5 kg/s with calorific value of 25 MJ/kg. If the flight velocity happens to be 850 m/s, what is the effective exhaust velocity?
(A) 1066.7 m/s
(B) 2266.7 m/s
(C) 3466.7 m/s
(D) 4566.7 m/s

93. The ratio of thrust power to the rate of kinetic energy available at the inlet of exhaust nozzle is.
(A) thrust coefficient.
(B) specific impulse
(C) propulsive efficiency
(D) thrust efficiency.

94. A booster rocket engine with nozzle exit diameter of 225 nm is designed to propel a satellite to altitude of 20 km. The chamber pressure at 12 MPa is expanded to exit pressure and temperature of 105 kPa and 1400 K respectively. If the mass flow rate happens to be 15 kg/s, what is the exit jet velocity at altitude of 20 km? The molecular weight of the propellent is 25 kg/kmol. (Assume one-dimensional flow at the exit of nozzle and assume ideal gas law)
(A) 1673.65 m/s
(B) 1573.65 m/s
(C) 1473.65 m/s
(D) 1373.65 m/s

95. Consider the following statements regarding flow in the nozzle for exhaust velocity:
1. The flow in the nozzle is 3-D in nature, and temperature, pressure and composition of gas vary, along the length of the nozzle.
2. The flow becomes more complex due to the, presence of shock and flow separation in the nozzle.

3. The shape of the nozzle does not affect the thrust produced by the rocket engine.

Which of the above statements are correct?

(A) 2 and 3 only
(B) 1 and 2 only
(C) 1 and 3 only
(D) 1, 2 and 3

96. What is the transit time for typical carrier and adhesive combinations in the context of strain gauges?

(A) 10 ns
(B) 50 ns
(C) 100 ns
(D) 500 ns

97. What is the main advantage of the cyanoacrylate adhesive commonly employed in strain gauge applications?

(A) It requires high temperature for curing.
(B) It needs a catalyst for polymerization,
(C) It cures at room temperature without heat or a catalyst.
(D) It requires external heating in a furnace.

98. What is the term used to describe the angular change between two-line segments that Were originally perpendicular?

(A) Deformation
(B) Strain
(C) Rigid-body motion
(D) Shearing strain

99. How is a plane body defined in the context of elasticity theory?

(A) A body with irregular thickness
(B) A body bounded by parallel planes and a closed lateral surface.
(C) A body with varying thickness
(D) A body with no lateral surfaces

100. According to Maxwell's theory, what type of wave motion is associated with electromagnetic radiation?

(A) Longitudinal wave motion
(B) Transverse wave motion
(C) Circular wave motion
(D) Radial wave motion

101. What happens to the middle surface of a plate, when it is bent to a non-developable surface?

(A) It remains unchanged.
(B) It compresses.
(C) It stretches.
(D) It becomes the neutral surface.

102. What is the primary purpose of beams in building construction?

(A) Providing lateral stability
(B) Distributing loads to supports
(C) Enhancing insulation
(D) Aesthetic design

103. Which type of support is commonly used for the exterior walls in building construction?
(A) Pinned support.
(B) Fixed support
(C) Hinged support
(D) Roler support

104. What is the primary function of floor slabs in a building?
(A) To provide structural support
(B) To enhance insulation
(C) To distribute electrical wiring
(D) To serve as decoration

105. What is the primary characteristic of a plate structure that is symmetrical with respect to a centre?
(A) Vertical loading
(B) Lateral loading
(C) No loading
(D) Rotational loading

106. Which feature assists in applying brakes automatically during landing and rejected takeoffs in advanced braking systems?
(A) Manual braking
(B) Reverse thrust
(C) Autobraking
(D) Redundancy

107. How is the hydraulic reservoir pressurized in aircraft using pneumatic pressure?
(A) By electrical power
(B) By fuel injection
(C) By regulated bleed air from the pneumatic system
(D) By manual pumping

108. What is the maximum temperature at which semiconductor components can safely operate without significantly affecting reliability in avionics conditioning?
(A) Below 0°C
(B) Around 25°C
(C) Above 100°C
(D) Exactly 70°C

109. When does misting typically occur on aircraft transparencies?
(A) During takeoff
(B) During cruising at an altitude where air is cold and relatively dry
(C) During landing
(D) During maintenance

110. What is the (IFOV) if it is the angular coverage of the imagery which can be seen by the observer at any specific instant, where D is the diameter of collimating lens and L is the distance of observer's edge from collimating lens?
(A) $\text{IFOV} = 2\tan^{-1}(\text{D}/2\text{L})$
(B) $\text{IFOV} = 2\tan^{-1}(\text{A}/2\text{F})$
(C) $\text{IFOV} = 2\tan^{-1}(2\text{L}/\text{D})$
(D) $\text{IFOV} = 2\tan^{-1}(2\text{F}/\text{A})$

111. For an airfoil, the reaction force resulting from the rate of change of momentum of the moving airstream by the action of the aerofoil in deflecting the airstream from its original direction is.
(A) drag
(B) lift
(C) wing drag.
(D) aerodynamic force

112. The basic parameters for a hypothetical aircraft are Aircraft mass, m is 30000 kg; wing area, S is 75m^2; Maximum lift coefficient, C_{Lmax} is 1.2; Maximum angle of incidence, α_{max} is 15°; C_L versus a relationship is assumed to be linear. Air data: Air density, ρ, at 30000ft (9144m) is 0.4583 kg/m^3. What is the wing incidence, α, when flying straight and level at a speed of 80 m/s (160 knots approx.) at a height of 200 ft in the approach to the airfield?
(A) 12.5°
(B) 10.5°
(C) 14.5°
(D) 8.5 °

113. Consider the following statements for aerodynamic centre of the wing:
1. It is the point about which the pitching moment does not change with angle of incidence.
2. All aerofoils (Except symmetrical ones) even at zero lift tend to pitch and experience a pitching moment or couple.
3. The aerodynamic centre is generally around the half chord point of the wing (measured from the leading edge).

Which if the above statements are correct?
(A) 1 and 3 only
(B) 1 and 2 only
(C) 2 and 3 only
(D) 1, 2 and 3

114. Collimated display in HUD is mainly used for.
(A) more screen display.
(B) wide view of display
(C) information displayed at infinity.
(D) fast screen refresh rates

115. The correct order for the path of light in an HUD is.
(A) CRT-collimating lens- mirror-combiner glass-pilot
(B) CRT-mirror-collimating lens-combiner glass-pilot
(C) CRT-mirror combiner glass-collimating lens-pilot
(D) Collimating lens-CRT-mirror-combiner glass-pilot

116. What is the weight if the pilot will feel on his head while executing a 9g maneuver with an HMD helmet of weight 800 g?
(A) 7.2 kg
(B) 0.72 kg
(C) 70.06 kg
(D) 9 kg

117. For displaying the image projected directly to the retina of the pilot, which one of the following displays is used?
(A) Virtual retinal display
(B) Binocular HMD
(C) God's eye view display
(D) Optical display

118. Consider the following statements for ramjet:
1. It is a form of jet engine where incoming air is compressed by rotary compressor.
2. It cannot produce thrust at zero airspeed.
3. For supersonic ramjets, supersonic flow is decelerated to subsonic at inlet.

Which of the above statements are correct?
(A) 1 and 2 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

119. Consider the following statements regarding turbo rocket engine:
1. It is a type o non-air-breathing engine combining the elements of a jet engine and rocket.
2. The engine has a low-pressure compressor driven by multistage turbine.
3. It is used in aircrafts where high speed and low altitudes are required.

Which of the above statements is/are correct?
(A) 1 only
(B) 2 only
(C) 3 only
(D) 1, 2 and 3

120. Consider the following statements regarding variation of thrust with altitude:
1. When the rocket propels, thrust increases with increase in altitude because of decrease of atmospheric pressure.
2. Thrust of a rocket engine is dependent on the flight velocity, unlike the gas turbine engine.
3. 40%-60% of overall thrust changes may occur due to change in altitude.

Which of the above statements is/are correct?
(A) 1 only
(B) 2 and 3 only
(C) 3 only
(D) 1, 2 and 3

*****

Answer Keys **AIR SAFETY OFFICER_2023 SET – B**

1	C	21	C	41	D	61	B	81	D	101	D
2	C	22	C	42	D	62	C	82	B	102	B
3	D	23	C	43	A	63	D	83	C	103	B
4	A	24	D	44	B	64	D	84	A	104	A
5	A	25	C	45	A	65	A	85	D	105	B/D
6	D	26	B	46	A	66	C	86	D	106	C
7	A	27	B	47	B	67	C	87	A	107	C
8	A	28	C	48	C	68	C	88	B	108	C
9	A	29	B	49	B	69	B	89	C	109	B
10	C	30	C	50	B	70	B	90	A	110	A
11	C	31	A	51	B	71	C	91	A	111	D
12	B	32	A	52	A	72	A	92	B	112	A
13	A	33	C	53	A	73	C	93	C	113	B
14	C	34	B	54	C	74	C	94	A	114	B
15	C	35	C	55	C	75	A	95	B	115	B
16	B	36	A	56	A	76	A	96	B	116	A
17	B	37	C	57	A	77	C	97	C	117	A
18	C	38	A	58	A	78	B	98	D	118	B
19	B	39	A	59	D	79	C	99	D	119	C
20	D	40	A	60	B	80	C	100	B	120	A

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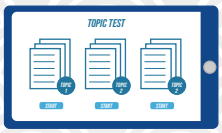

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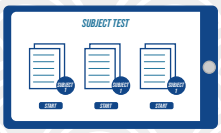

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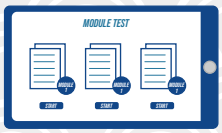

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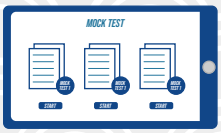

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