

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Booklet Serial No. : **0822**

TEST BOOKLET SERIES

TEST BOOKLET

AE (M)-3/2014

B

Time Allowed : 2 Hours]

[Maximum Marks : 100

All questions carry equal marks.

INSTRUCTIONS

1. Immediately after the commencement of the examination, you should check that test booklet does not have any unprinted or torn or missing pages or items, etc. If so, get it replaced by a complete test booklet.
2. Encode clearly the test booklet series A, B, C or D as the case may be in the appropriate place in the answer sheet.
3. Write your Roll Number only in the box provided alongside.
Do not write anything else on the Test Booklet.
4. This Test Booklet contains 100 items (questions). Each item comprises four responses (answers). Choose only one response for each item which you consider the best.
5. After the candidate has read each item in the Test Booklet and decided which of the given responses is correct or the best, he has to mark the circle containing the letter of the selected response by blackening it completely with Black or Blue ball pen. In the following example, response "C" is so marked :

(A) (B) ● (D)
6. Do the encoding carefully as given in the illustrations. While encoding your particulars or marking the answers on answer sheet, you should blacken the circle corresponding to the choice in full and no part of the circle should be left unfilled.
7. You have to mark all your responses ONLY on the ANSWER SHEET separately given according to 'INSTRUCTIONS FOR CANDIDATES' already supplied to you. Responses marked on the Test Booklet or in any paper other than the answer sheet shall not be examined.
8. All items carry equal marks. Attempt all items. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet. There will be no negative marking.
9. Before you proceed to mark responses in the Answer Sheet fill in the particulars in the front portion of the Answer Sheet as per the instructions sent to you.
10. After you have completed the test, hand over the Answer Sheet only, to the Invigilator.

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P.T.O.

Time Allowed : 2 Hours]

[Maximum Marks : 100

1. The atmosphere air at dry bulb temperature of 15°C enters a heating coil maintained at 40°C . The air leaves the heating coil at 25°C . The by-pass factor of the heating coil is :

(A) 0.376	(B) 0.4
(C) 0.6	(D) 0.67

2. By-pass factor for a cooling coil :

(A) increase with increase in velocity of air passing through it	(B) decrease with increase in velocity of air passing through it
(C) remains unchanged with increase in velocity of air passing through it	(D) may increase or decrease with increase in velocity of air passing through it depending upon the condition of air entering

3. In case of sensible cooling of air, the coil efficiency is given by (BPF = by-pass factor) :

(A) $\text{BPF} - 1$	(B) $1 - \text{BPF}$
(C) $1/\text{BPF}$	(D) $1 + \text{BPF}$

4. In a saturated air-water mixture, the :
- (A) dry bulb temperature is higher than the wet bulb temperature
 - (B) dew point temperature is lower than the wet bulb temperature
 - (C) dry bulb, wet bulb and dew point temperatures are the same
 - (D) dry bulb temperature is higher than the dew point temperature
5. Which property of moist air remains constant during adiabatic cooling ?
- (A) Dry bulb temperature
 - (B) Specific humidity
 - (C) Relative humidity
 - (D) Wet bulb temperature
6. An IC engine has a bore and stroke of 2 units each. The area to calculate heat loss can be taken as :
- (A) 4π
 - (B) 5π
 - (C) 6π
 - (D) 8π
7. With increasing temperature of intake air, IC engine efficiency :
- (A) decreases
 - (B) increases
 - (C) remains the same
 - (D) depends on other factor

8. For the same maximum pressure and heat input :
- (A) the exhaust temperature of petrol engine is more than that of the diesel engine
 - (B) the exhaust temperature of diesel engine is more than that of the petrol engine
 - (C) the exhaust temperature of dual cycle engine is less than that of the diesel engine
 - (D) the exhaust temperature of dual cycle engine is more than that of the petrol engine
9. If the compression ratio of an engine working on Otto cycle is increased from 5 to 7, the % age increase in efficiency will be :
- (A) 4%
 - (B) 8%
 - (C) 14%
 - (D) 27%
10. The magneto in an automobile is basically :
- (A) transformer
 - (B) d.c. generator
 - (C) magnetic circuit
 - (D) a.c. generator

11. Self-ignition temperature of petrol is of the order of :
- (A) 150°C (B) 370°C
(C) 450°C (D) more than 500°C
12. Which is *correct* statement about reaction time for autoignition of fuel and the fuel air ratio ?
- (A) Lean mixture has high reaction time
(B) Rich mixture has high reaction time
(C) Chemically correct mixture has minimum reaction time
(D) All of the above
13. For same power and same speed, the flywheel of a four-stroke engine as compared to two-stroke I.C. engine will be :
- (A) smaller
(B) bigger
(C) same size
(D) dependent on other engine parameters

14. The material used for coating the electrode is called :
- (A) protective layer (B) slag
(C) deoxidiser (D) flux
15. In thermit welding, the iron oxide and aluminium oxide are mixed in the proportion of :
- (A) 1 : 1 (B) 3 : 1
(C) 1 : 3 (D) None of these
16. Oxygen to acetylene ratio in case of neutral flame is :
- (A) 0.8 : 1.0 (B) 1 : 1
(C) 1.2 : 1 (D) 2 : 1
17. The core in the centrifugal casting is made of :
- (A) carbon steel (B) properly treated sand
(C) abrasive material (D) no core is used

18. Core prints are used to :
- (A) strengthen core
 - (B) form seat to support and hold the core in place
 - (C) fabricate core
 - (D) all of the above
19. Thread rolling is somewhat like :
- (A) cold extrusion
 - (B) cold machining
 - (C) cold rolling
 - (D) cold forging
20. Cutting and forming operations can be done in a single operation on :
- (A) Simple die
 - (B) Compound die
 - (C) Combination die
 - (D) None of these
21. The metal in machining operation is removed by :
- (A) Tearing chips
 - (B) Distortion of metal
 - (C) Shearing the metal across a zone
 - (D) Cutting the metal across a zone

22. Ultrasonic machining method is best suited for :
- (A) Brittle materials (B) Plastics
(C) Lead (D) Non-ferrous alloys
23. Feed rate in milling operation is equal to :
- (A) RPM
(B) $\text{RPM} \times \text{No. of teeth}$
(C) $\text{RPM} \times \text{Feed per tooth} \times \text{No. of teeth}$
(D) None of the above.
24. Machinability depends on :
- (A) microstructure, physical and mechanical properties and composition of workpiece material
(B) cutting forces
(C) type of chip
(D) tool life
25. Time taken to drill a hole through a 25 mm thick plate at 300 r.p.m. at a feed rate of 0.25 mm/revolution will be :
- (A) 10 sec (B) 20 sec
(C) 40 sec (D) 50 sec

26. The coordinate of any point on Mohr's circle represent :
- (A) State of stress at a point with reference to any arbitrary set of orthogonal axes passing through that point
 - (B) Principal stresses at a point
 - (C) One of the two direct stresses and shearing stress at a point
 - (D) Two direct stresses at a point
27. Shrinking a thick cylinder over another helps :
- (A) reduce the magnitude of tensile hoop stress
 - (B) reduce the difference between the higher and lower magnitude of tensile hoop stress
 - (C) remove the longitudinal stress
 - (D) reduce the cost
28. In fixed beam of length (l) with a concentrated central load two points of contraflexure will occur, each from supports at a distance of :
- (A) $l/3$
 - (B) $l/\sqrt{3}$
 - (C) $l/6$
 - (D) $l/4$

29. Load p_c and p_0 respectively acting axially upon close coiled and open coiled helical springs of same wire dia, coil dia, no. of coils and material to cause same deflection :

(A) p_c/p_0 is 1, < 1 or > 1 depending upon α

(B) $p_c/p_0 = 1$

(C) $p_c/p_0 > 1$

(D) $p_c/p_0 < 1$

30. A bad observation which must be ignored can be identified by :

(A) observing the data

(B) using observation to calculate and see if result deviates too much

(C) finding arithmetic mean and seeing which observation deviates most

(D) plotting the result and seeing which observation deviates most from

the line

31. Select the *wrong* statement. Fatigue crack initiates on surface because :
- (A) in most cases stress is highest on surface
 - (B) surface is machined
 - (C) surface is inherently weaker than the inside
 - (D) there may exist some stress concentration on surface
32. Goodman straight line relation suggests that variable stress component in the presence of a positive mean stress :
- (A) decreases
 - (B) increases
 - (C) remains unaffected
 - (D) increases or decreases depending upon σ_u
33. A machine part made of steel of ultimate tensile strength of 500 MPa and carrying a compressive mean stress of 50 MPa can be made to carry a maximum tensile stress of :
- (A) 175 MPa
 - (B) 225 MPa
 - (C) 275 MPa
 - (D) 325 MPa

34. A fatigue crack in a sound and smooth specimens takes :
- (A) longer time in initiation than propagation
 - (B) longer time in propagation than initiation
 - (C) equal time in initiation and propagation
 - (D) no time in propagation
35. Ellipse of stress can be drawn only when a body is acted upon by :
- (A) one normal stress
 - (B) two normal stresses
 - (C) one shear stress
 - (D) two normal stresses and one shear stress
36. Strain energy stored in a body due to a suddenly applied load compared to when applied slowly is :
- (A) twice
 - (B) four times
 - (C) eight times
 - (D) half

37. Variation of bending moment in a cantilever carrying a load, the intensity of which varies uniformly from zero at the free end to w per unit run at the fixed end, is by :
- (A) cubic law (B) parabolic law
(C) linear law (D) none of these
38. Equivalent moment of inertia of the cross-section in terms of timber of a flitched beam made up of steel and timber is ($m = E_s/E_t$) :
- (A) $(I_t + mI_s)$ (B) $(I_t + I_s/m)$
(C) $(I_t + mI_s)$ (D) $(I_t + 2mI_s)$
39. Shear centre of a semicircular arc is at :
- (A) $4r/\pi$ (B) $3r/\pi$
(C) $2r/\pi$ (D) r/π
40. The three-moment theorem for continuous beams was forwarded by :
- (A) Bernoulli (B) Clapeyron
(C) Castigliano (D) Maxwell

41. If a small cut is made at a horizontal diameter of a ring under compression, the maximum stress :
- (A) decreases (B) increases
(C) does not change (D) becomes zero
42. Secant formula is applicable for :
- (A) short columns under axial loading
(B) long columns under axial loading
(C) short columns under eccentric loading
(D) long columns under eccentric loading
43. The use of compound tubes subjected to internal pressure are made to :
- (A) even out the stresses
(B) increase the thickness
(C) increase the diameter of the tube
(D) increase the strength

44. The initial hoop stress in a thick cylinder when it is wound with a wire under tension will be :

- (A) zero (B) tensile
(C) compressive (D) bending

45. The collapse speed of a rotating solid disc is given by :

- (A) $\omega = \frac{1}{R} \sqrt{\frac{3\sigma_y}{\rho}}$ (B) $\omega = \frac{1}{R} \sqrt{\frac{\sigma_y}{3\rho}}$
(C) $\omega = \frac{1}{R} \sqrt{\frac{2\sigma_y}{\rho}}$ (D) $\omega = \frac{1}{R} \sqrt{\frac{\sigma_y}{2\rho}}$

Where σ_y is yield stress, ρ is the density and R is the radius of the disc.

46. In circular plates with edges clamped and with a uniformly distributed load, the maximum radial stress occurs at :

- (A) clamp edge (B) the centre
(C) the mean radius (D) none of these

47. In which of the following mechanism, the Coriolis acceleration exists ?

- (A) whitworth quick return mechanism
(B) tangent cam mechanism
(C) both (A) and (B)
(D) one of the above

48. In case of pivot bearing, the wear is :

- (A) maximum at the centre
- (B) zero at the centre
- (C) uniform throughout the contact arc
- (D) minimum at maximum radius

49. The crowning of pulley is done to :

- (A) improve power
- (B) improve pulley strength
- (C) increase velocity ratio
- (D) prevent the belt running off the pulley

50. Which of the following governor cannot be isochronous ?

- (A) Watt
- (B) Hartnell
- (C) Proell
- (D) Porter

51. Which of the following gears are used to connect two non-parallel non-intersecting shafts ?

- (A) Spur
- (B) Helical
- (C) Bevel
- (D) Worm gear

52. From the point of view of strength which gear profile is better ?
- (A) Involute (B) Cycloidal
(C) Conjugate (D) None of these
53. A rigid body is said to be in equilibrium if :
- (A) $\Sigma F_x = 0$ (B) $\Sigma F_y = 0$
(C) $\Sigma M_z = 0$ (D) All of these
54. Lanchester technique of balancing can be used for balancing of :
- (A) Primary forces (B) Secondary forces
(C) Pitching moments (D) All of these
55. Mass m attached to a shaft rotating at ω rad/s at radius r from the axis of shaft is balanced by mass m_b at radius r_b from the axis. If the speed of the shaft is doubled for balance, the value of mass m_b is :
- (A) Doubled (B) Quadruple
(C) Halved (D) Unaffected

56. In damped free vibrating system :

- (A) the spring force vector acts in the direction opposite to the displacement
- (B) the damping force vector acts in the direction opposite to the velocity
- (C) the inertia force vector acts in the direction opposite to the acceleration
- (D) all of the above statements are true

57. The transmissibility is same for all values of damping factors at frequency ratio of :

- (A) 1
- (B) 2
- (C) $\sqrt{2}$
- (D) $1/\sqrt{2}$

58. In a force vibration at the resonance, the phase angle is :

- (A) 0°
- (B) 45°
- (C) 90°
- (D) 180°

59. The axis of spin, the axis of precession and axis of applied gyroscopic torque are contained in :
- (A) one plane
 - (B) two planes perpendicular to each other
 - (C) three planes perpendicular to one another
 - (D) none of the above
60. When a naval ship is pitching with the bow rising, rotor rotating clockwise when seen from stern the gyroscopic effect acting on it will be :
- (A) to move it towards the port
 - (B) to raise the bow and lower the stern
 - (C) to move it towards the starboard
 - (D) to raise the stern and lower the bow
61. Which of the following names *does not* belong to Lawn Tennis ?
- (A) Anand Amritraj
 - (B) Novak Djokovic
 - (C) Nenad Zimonjic
 - (D) Mutaz Essa Barshim

62. Who of the following is associated with Muslim Brotherhood in Egypt ?
- (A) Mohammad Morsi (B) Abdel Fattah al-Sisi
- (C) Hosni Mubarak (D) Basil Jarret (from Zamaica)
63. ISIS stands for :
- (A) Islamic System of Iraq and Syria
- (B) Islamic State of Iraq and Syria
- (C) Islamic State of Iraq and Sudan
- (D) Islamic State of Iran and Sudan
64. The main focus of Energy Efficiency and Renewable Energy Management Centre is on :
- (A) Thermal Power (B) Nuclear Power
- (C) Solar Power (D) Both nuclear and solar power
65. How many glacial lakes are there in HP ?
- (A) 200 (B) 230
- (C) 239 (D) 249

66. Which of the following statements about Lalpani in Himachal Pradesh is correct ?
- (A) It is a reserve Forest near Shimla
 - (B) It is a glacial Lake of HP
 - (C) It is a river in HP
 - (D) It is a glacier
67. The Himachal Pradesh government imposed a blanket ban on the non-biodegradable disposable plastic cups, plates and glasses in which of the following years ?
- (A) 2010
 - (B) 2011
 - (C) 2012
 - (D) 2013
68. The overall glacier area has reduced from 1962-2001 to :
- (A) 2077 sq. km
 - (B) 2000 sq. km
 - (C) 1628 sq. km
 - (D) 1600 sq. km

69. In 2005, the non-biodegradable waste in Kullu was :
- (A) 16.9% of the total waste (B) 26.2% of the total waste
(C) 32.4% of the total waste (D) 34.8% of the total waste
70. Which of the following report of the National Law Commission contains the guidelines for making the criminal justice system more effective and responsive ?
- (A) 239 (B) 249
(C) 259 (D) 269
71. Mary Kom, a renowned Boxer, belongs to which of the following States ?
- (A) Assam (B) Nagaland
(C) Manipur (D) Mizoram
72. Which of the following statements about the Prime Minister's Jan Dhan Yojna is *not* true ?
- (A) It is a financial inclusion based scheme for the poor
(B) It provides for accident insurance cover of rupees 1 lakh
(C) It provides for medical insurance cover of Rs. 30,000.00
(D) It provides for a free debit card for those who open bank accounts before

31st December, 2014

73. India and Australia signed in September 2014 which of the following agreements ?
- (A) Thermal power supply
 - (B) Civil Nuclear deal
 - (C) Nuclear Non-proliferation Agreement
 - (D) Indo-Australia Defence Agreement
74. According to the Supreme Court, the under trial prisoners having served half the maximum term for the crime for which they have been charged should be released under which of the following section of the Criminal Procedure Code ?
- (A) Section 432 A
 - (B) Section 433 A
 - (C) Section 436 A
 - (D) Section 439 A
75. Kala Azar is most prevalent in which of the following states ?
- (A) Himachal Pradesh
 - (B) West Bengal
 - (C) Jharkhand
 - (D) Bihar

76. Boko Haram is :
- (A) An Islamic Extremist Group
 - (B) A political Party in Nigeria
 - (C) An extremist Organization in Afghanistan
 - (D) An Islamic Political Party in Iran

77. The international Security Assistance force in Afghanistan would come to an end on :
- (A) November 21, 2014
 - (B) November 30, 2014
 - (C) December 25, 2014
 - (D) December 31, 2014

78. According to Ivo Daalder, Ukrainian crisis can be solved by which of the following steps ?

- (i) Ending support to the separatists by Russia
- (ii) Withdrawal of Russian troops and equipment
- (iii) Recognition by Russia of the Ukrainian sovereignty and integrity
- (iv) A more robust intervention by Russia in Ukrain

Select the *correct* answer from the codes given below :

Codes :

- (A) (i), (ii), (iii) and (iv) only
- (B) (i), (ii) and (iii) only
- (C) (ii) and (iii) only
- (D) (i), (iii) and (iv) only

79. Scotland became a part of the United Kingdom effectively on :

(A) May 1, 1706

(B) May 1, 1707

(C) May 1, 1708

(D) August 1, 1708

80. All women police stations are operational in which of the following cities/towns of Himachal Pradesh ?

(i) Chamba

(ii) Shimla

(iii) Dharmashala

(iv) Mandi

Select the *correct* answer from the codes given below :

Codes :

(A) (i), (ii), (iii) and (iv)

(B) (i), (ii) and (iii)

(C) (ii), (iii) and (iv)

(D) (iii) and (iv)

81. For a given set of operating pressure limits of a Rankine cycle, the highest efficiency occurs for :
- (A) Saturated cycle (B) Superheated cycle
(C) Reheat cycle (D) Regenerative cycle
82. The main advantages of a reheat Rankine cycle is :
- (A) reduced moisture content in low pressure side of turbine
(B) increase efficiency
(C) reduced load on condenser
(D) reduced load on pump
83. Which one of the following is *correct* ? In ideal regenerative cycle, the temperature of steam entering the turbine is same as that of :
- (A) Water entering the turbine
(B) Water leaving the turbine
(C) Steam leaving the turbine
(D) Water at any section of the turbine

84. In convergent-divergent nozzle, normal shock can generally occur :
- (A) along the divergent portion and throat
 - (B) along the convergent portion
 - (C) anywhere along the length
 - (D) near the inlet
85. In flow through steam nozzle, the actual discharge will be greater than the theoretical value when :
- (A) Steam at inlet is superheated
 - (B) Steam at inlet is saturated
 - (C) Steam gets supersaturated
 - (D) Steam at inlet is wet
86. In flow through convergent nozzle, the ratio of back pressure to the inlet pressure is given by the ratio :

$$\frac{p_b}{p_1} = \left(\frac{2}{\gamma + 1} \right)^{\frac{2\gamma}{\gamma - 1}}$$

If the back pressure is lower than p_b given by the above equation, then :

- (A) the flow in the nozzle is supersonic
- (B) a shock wave exists inside the nozzle
- (C) the gases expand outside the nozzle and a shock wave appears outside the nozzle
- (D) a shock wave appears at the nozzle exit

87. For a adiabatic expansion with the friction through the nozzle, the following remains constant :
- (A) Entropy (B) Static enthalpy
(C) Stagnation enthalpy (D) Stagnation pressure
88. The effect of friction on flow of steam through nozzle is to :
- (A) decrease the mass flow rate and to increase the wetness at the exit
(B) increase the mass flow rate and to increase the exit temperature
(C) decrease the mass flow rate and to decrease the wetness at the exit
(D) increase the exit temperature without any effect on the mass flow rate
89. If the velocity of propagation of small disturbance in air at 27°C is 330 m/s , then at a temperature of 54°C , its speed would be :
- (A) 660 m/s (B) $330\sqrt{2}\text{ m/s}$
(C) $330/\sqrt{2}\text{ m/s}$ (D) $330\sqrt{327/300}\text{ m/s}$
90. For one-dimensional isentropic flow in a diverging passage, if the initial static pressure is p_1 , and the initial Mach number is M_1 , then for the downstream flow :
- (A) $M_2 < M_1, p_1 < p_2$ (B) $M_2 < M_1, p_1 > p_2$
(C) $M_2 > M_1, p_1 > p_2$ (D) $M_2 > M_1, p_1 < p_2$

95. Excessive pressure drop in the liquid line in a refrigerating system causes :
- (A) high condenser pressure
 - (B) flashing of the liquid refrigerant
 - (C) higher evaporator pressure
 - (D) under cooling of the liquid refrigerant
96. The enthalpies at the beginning of compression at the end of compression and at the end of condensation are 185 kJ/kg, 210 kJ/kg and 85 kJ/kg, respectively. The COP of the vapor compression refrigeration system is :
- (A) 0.25
 - (B) 5.0
 - (C) 4.5
 - (D) 1.35
97. The effect of super-heating of vapor in the evaporator and sub-cooling of condensate in the condenser, for the same compressor work is :
- (A) increase the COP
 - (B) decrease the COP
 - (C) super-heating increases COP, but sub-cooling decreases COP
 - (D) super-heating decreases COP, but sub-cooling increases COP

98. For the same condenser and evaporator temperatures, the COP of absorption refrigeration system is less than that of mechanical vapor compression refrigeration system since in the absorption refrigeration system :
- (A) a liquid pump is used for compression
 - (B) a refrigerant as well as a solvent is used
 - (C) absorber requires heat rejection
 - (D) low grade energy is used to run the system
99. In the absorption refrigeration cycle, the compressor of the vapor compression refrigeration cycle is replaced by :
- (A) liquid pump
 - (B) generator
 - (C) absorber and generator
 - (D) absorber, liquid pump and generator
100. In a vapor absorption refrigerator, heat is rejected in :
- (A) Condenser only
 - (B) Generator only
 - (C) Absorber only
 - (D) Condenser and absorber