

**TEST BOOKLET**

**AE (M)-3/2014**



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.

Time Allowed : 2 Hours]

1. 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
  
2. 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
  
3. 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

4. In convergent-divergent nozzle, shock waves generally occur :
- (A) along the divergent portion and throat
  - (B) along the convergent portion
  - (C) anywhere along the length
  - (D) near the inlet
5. 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
6. In flow through convergent nozzle, the ratio of back pressure to the inlet pressure is given by the ratio :

$$\frac{P_b}{P_1} = \left( \frac{2}{\gamma + 1} \right)^{\frac{\gamma}{\gamma - 1}}$$

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

7. 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

8. 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

9. If the velocity of propagation of small disturbance in air at  $27^{\circ}\text{C}$  is  $330\text{ m/s}$ , then at a temperature of  $54^{\circ}\text{C}$ , its speed would be :

- (A)  $660\text{ m/s}$
- (B)  $330\sqrt{2}\text{ m/s}$
- (C)  $330/\sqrt{2}\text{ m/s}$
- (D)  $330\sqrt{327/300}\text{ m/s}$

10. 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)  $M_2 > M_1, p_1 < p_2$

11. The stagnation temperature of an isentropic flow of air ( $\gamma = 1.4$ ) is 400 K. If the temperature is 200 K at a section, then the Mach number of the flow will be :

- (A) 1.046
- (B) 1.264
- (C) 2.236
- (D) 3.211

12. Isentropic flow is :

- (A) irreversible adiabatic flow
- (B) reversible adiabatic flow
- (C) ideal fluid flow
- (D) frictionless reversible flow

13. An aeroplane is flying at a speed of 800 kmph at an altitude, where the air temperature is  $0^{\circ}\text{C}$ . The flight Mach number at this speed is nearly :
- (A) 1.5 (B) 0.254  
(C) 0.67 (D) 2.04
14. In a vapor compression refrigeration system, liquid to suction heat exchanger is used to :
- (A) keep the COP constant  
(B) prevent the liquid refrigerant from entering the compressor  
(C) sub-cool the liquid refrigerant leaving the condenser  
(D) sub-cool the vapor refrigerant from the evaporator
15. 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

16. 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
17. 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
18. 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

19. 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

20. In a vapor absorption refrigerator, heat is rejected in :

- (A) Condenser only
- (B) Generator only
- (C) Absorber only
- (D) Condenser and absorber

21. The atmosphere air at dry bulb temperature of  $15^{\circ}\text{C}$  enters a heating coil maintained at  $40^{\circ}\text{C}$ . The air leaves the heating coil at  $25^{\circ}\text{C}$ . The by-pass factor of the heating coil is :

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



22. By-pass factor for <http://sarkarirecruitment.com/>

- (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

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

- (A)  $BPF - 1$
- (B)  $1 - BPF$
- (C)  $1/BPF$
- (D)  $1 + BPF$

24. 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

25. Which property of air is not affected during adiabatic cooling ?
- (A) Dry bulb temperature                      (B) Specific humidity  
(C) Relative humidity                         (D) Wet bulb temperature
26. An IC engine has a bore and stroke of 2 units each. The area to calculate heat loss can be taken as :
- (A)  $4 \pi$     (B)  $5 \pi$   
(C)  $6 \pi$     (D)  $8 \pi$
27. With increasing temperature of intake air, IC engine efficiency :
- (A) decreases                                      (B) increases  
(C) remains the same                         (D) depends on other factor
28. 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

29. If the compression ratio of the cycle is increased from 5 to 7, the % age increase in efficiency will be :
- (A) 4% (B) 8%  
(C) 14% (D) 27%
30. The magneto in an automobile is basically :
- (A) transformer (B) d.c. generator  
(C) magnetic circuit (D) a.c. generator
31. Self-ignition temperature of petrol is of the order of :
- (A) 150°C (B) 370°C  
(C) 450°C (D) more than 500°C
32. 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

33. 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
34. The material used for coating the electrode is called :
- (A) protective layer
  - (B) slag
  - (C) deoxidiser
  - (D) flux
35. 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
36. 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

- (A) carbon steel (B) properly treated sand  
(C) abrasive material (D) no core is used

38. 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

39. Thread rolling is somewhat like :

- (A) cold extrusion (B) cold machining  
(C) cold rolling (D) cold forging

40. 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

41. 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
42. Ultrasonic machining method is best suited for :  
(A) Brittle materials  
(B) Plastics  
(C) Lead  
(D) Non-ferrous alloys
43. 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
44. Machinability depends on :  
(A) microstructure, physical and mechanical properties and composition of workpiece material  
(B) cutting forces  
(C) type of chip  
(D) tool life

45. Time taken to drill a hole of diameter 10 mm in a 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
46. 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.
47. 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

48. 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)  $l/4$

49. Load  $p_c$  and  $p_o$  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)  $p_c/p_o$  is 1,  $< 1$  or  $> 1$  depending upon  $\alpha$

(B)  $p_c/p_o = 1$

(C)  $p_c/p_o > 1$

(D)  $p_c/p_o < 1$

50. 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



51. Select the *wrong* statement.
- (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
52. 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  $\sigma_m$
53. 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 |

54. A fatigue crack in a steel plate under tension 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
55. 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
56. 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

57. Variation of bending stress in a cantilever beam 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

58. 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)  $(I_t + 2mI_s)$

59. Shear centre of a semicircular arc is at :

- (A)  $4r/\pi$
- (B)  $-3r/\pi$
- (C)  $2r/\pi$
- (D)  $r/\pi$

60. The three-moment theorem for continuous beams was forwarded by :

- (A) Bernoulli
- (B) Clapeyron
- (C) Castigliano
- (D) Maxwell

61. If a small cut is made at a horizontal line in a ring under compression, the maximum stress :
- (A) decreases
  - (B) increases
  - (C) does not change
  - (D) becomes zero
62. 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
63. 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

64. The initial hoop stress <http://sarkarirecruitment.com/> wound with a wire under tension will be :

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

65. 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  $\sigma_y$  is yield stress,  $\rho$  is the density and R is the radius of the disc.

66. 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

67. 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

68. In case of pivot bearing, the pressure is
- (A) maximum at the centre
  - (B) zero at the centre
  - (C) uniform throughout the contact arc
  - (D) minimum at maximum radius
69. 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
70. Which of the following governor cannot be isochronous ?
- (A) Watt
  - (B) Hartnell
  - (C) Proell
  - (D) Porter
71. Which of the following gears are used to connect two non-parallel non-intersecting shafts ?
- (A) Spur
  - (B) Helical
  - (C) Bevel
  - (D) Worm gear

72. From the point of view of profile is better ?

- (A) Involute (B) Cycloidal  
(C) Conjugate (D) None of these

73. 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

74. Lanchester technique of balancing can be used for balancing of :

- (A) Primary forces (B) Secondary forces  
(C) Pitching moments (D) All of these

75. Mass  $m$  attached to a shaft rotating at  $\omega$  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

76. 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
77. The transmissibility is same for all values of damping factors at frequency ratio of :
- (A) 1
  - (B) 2
  - (C)  $\sqrt{2}$
  - (D)  $1/\sqrt{2}$
78. In a force vibration at the resonance, the phase angle is :
- (A)  $0^\circ$
  - (B)  $45^\circ$
  - (C)  $90^\circ$
  - (D)  $180^\circ$



79. The axis of spin, the axis of precession and the 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
80. 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
81. Which of the following names *does not* belong to Lawn Tennis ?
- |                    |                        |
|--------------------|------------------------|
| (A) Anand Amritraj | (B) Novak Djokovic     |
| (C) Nenad Zimonjic | (D) Mutaz Essa Barshim |

82. Who of the following was associated with Muslim Brotherhood in Egypt ?

- (A) Mohammad Morsi (B) Abdel Fattah al-Sisi  
(C) Hosni Mubarak (D) Basil Jarret (from Zamaica)

83. 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

84. 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

85. How many glacial lakes are there in HP ?

- (A) 200 (B) 230  
(C) 239 (D) 249

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

87. The Himachal Pradesh government imposed a blanket ban on the non-biodegradable disposadable plastic cups, plates and glasses in which of the following years ?

- (A) 2010
- (B) 2011
- (C) 2012
- (D) 2013

88. 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

89. In 2005, the non-bio-degradable waste in India 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
90. 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
91. Mary Kom, a renowned Boxer, belongs to which of the following States ?
- (A) Assam
  - (B) Nagaland
  - (C) Manipur
  - (D) Mizoram
92. 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

93. India and Australia signed in September 2001, which of the following agreements ?

- (A) Thermal power supply
- (B) Civil Nuclear deal
- (C) Nuclear Non-proliferation Agreement
- (D) Indo-Australia Defence Agreement

94. 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

95. Kala Azar is most prevalent in which of the following states ?

- (A) Himachal Pradesh
- (B) West Bengal
- (C) Jharkhand
- (D) Bihar

96. 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
97. 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
98. 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

99. 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

100. 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)