Question Booklet No. 650014	Question Booklet Series : **B**

AUAT — 2022

2-Year M.Tech. in Mechanical Engineering (P22)

(TEST BASED ON MCQ)

Full M	Duration : 2 Hours

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23.07.2022

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IMPORTANT INSTRUCTIONS

Candidates should read the below instructions carefully and follow them accordingly.

1. The Question Booklet has paper seal pasted on it. Please do **NOT** open the Question Booklet until you are asked to do so by the Invigilator.
2. The Candidates must check immediately after breaking the seal that the Question Booklet contains **100 Multiple Choice Questions** in two parts (Part—I and Part—II).
3. Answer of questions of Part—I and Part—II both will have to be given on the **OMR Answer Sheet** provided for this purpose. Fill up the necessary fields that are intended for you by writing and/or shading appropriately. Otherwise the **OMR Answer Sheet *cannot*** be evaluated and will liable to be rejected. Question numbers progress from **1** to **100** continuously with alternative answers being shown as [A], [B], [C] and [D] for each question. Record your response by completely darkening the corresponding bubble. While responding, you should consider the best alternative answer and shade only one bubble with black/blue ball point pen only. For each correct response you will be awarded **1** mark. There will be negative marking for wrong responses. For each wrong response, **–0·25** mark will be awarded. Multiple responses against one **MCQ** will be treated as a wrong response.
4. On leaving the examination hall, candidates must submit the OMR Answer Sheet. They are allowed to keep the Question Booklet with them.
5. **OMR Answer Sheet** will be processed by electronic means. Any untoward/irrelevant remarks, folding or putting stray notes on the answer sheet, any damage to the answer sheet will lead to the rejection of the same and the sole liability shall remain with the candidate.
6. Rough Work may be done at the end of the Question Booklet.
7. No Candidate will be allowed to leave the examination hall before 60 minutes of the commencement of examination. Candidates leaving the examination hall before conclusions of the examination will not be allowed to take the Question Booklet with them while going outside the examination hall.
8. Use of any Electronic device like Mobile, Programmable Calculator etc. is strictly prohibited.

DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

1. A hydraulic turbine develops 1000 kW power for a head of 40 m. If the head is reduced to 20 m, the power developed (in kW) is

[A] 177·3

[B] 353·5

[C] 500·4

[D] 706·1

2. In order to have maximum power from a Pelton turbine, the bucket speed must be

[A] equal to the jet speed

[B] equal to half of the jet speed

[C] equal to twice of the jet speed

[D] independent of the jet speed

3. The complete phase recrystallization and fine grain structure is obtained in casting, forging and rolled parts by

[A] recrystallization annealing

[B] normalizing

[C] spheroidizing

[D] austenizing

4. The alloying element mainly used to improve the endurance strength of steel materials is

[A] nickel

[B] vanadium

[C] molybdenum

[D] tungsten

5. Presence of hydrogen in steel causes

[A] reduced neutron absorption cross-section

[B] improved weldability

[C] embrittlement

[D] corrosion resistance

6. A measure of Rockwell hardness is the

[A] depth of penetration of indenter

[B] surface area of indentation

[C] projected area of indentation

[D] height of rebound

7. An expandable pattern is used in

[A] slush casting

[B] squeeze casting

[C] centrifugal casting

[D] investment casting

8. Green sand mould indicates that

[A] polymeric mould has been cured

[B] mould has been totally dried

[C] mould is green in colour

[D] mould contains moisture

9. Excessive turbulence in the stream in molding process results in

[A] inclusion of dross or slag

[B] air aspiration into the mold

[C] erosion of the mold walls

[D] All of the above

10. The operation of removing the flash from the forged products is known as

[A] flashing

[B] lancing

[C] trimming

[D] burring

11. In blanking operation, the clearance provided is

[A] 50% on punch and 50% on die

[B] on punch

[C] on die

[D] on die or punch depending upon designer's choice

12. Metallic powders can be produced by

[A] atomization

[B] pulverization

[C] electro-deposition process

[D] All of the above

13. Two plates of the same metal having equal thickness are to be butt welded with electric arc. When the plate thickness changes, welding is achieved by

[A] adjusting the current

[B] adjusting the duration of current

[C] changing the electrode size

[D] changing the electrode coating

14. Preheating before welding is done to

[A] make the steel softer

[B] burn away oil, grease, etc. from the plate surface

[C] prevent cold cracks

[D] prevent plate distortion

15. In a single point turning operation of steel with a cemented carbide tool, Taylor's tool life exponent is 0·25. If the cutting speed is halved, the tool life will increase

[A] two times

[B] four times

[C] eight times

[D] sixteen times

16. In ultrasonic machining process, the material removal rate will be higher for materials with

[A] higher toughness

[B] higher ductility

[C] lower toughness

[D] higher fracture strain

17. Machining of titanium is difficult due to

[A] high thermal conductivity

[B] chemical reaction between tool and titanium material

[C] low tool chip contact area

[D] None of the above

18. Cutting power consumption in turning can be significantly reduced by

[A] increasing rake angle of the tool

[B] increasing the cutting angles of the tool

[C] widening the nose radius of the tool

[D] increasing the clearance angle

19. The dimensional limits on a shaft of 25h7 are

[A] 25·000, 25·021 mm

[B] 25·000, 24·979 mm

[C] 25·000, 25·007 mm

[D] 25·000, 24·993 mm

20. A ring gauge is used to measure

[A] outside diameter but not roundness

[B] roundness but not outside diameter

[C] both outside diameter and roundness

[D] only external threads

21. A bevel protractor is used for

[A] angular displacements

[B] linear displacements

[C] flatness measurements

[D] surface roughness

22. NC contouring is an example of

[A] point-to-point positioning

[B] continuous path positioning

[C] absolute positioning

[D] incremental positioning

23. In a CNC machine tool, encoder is used to sense and control

[A] table position

[B] table velocity

[C] spindle speed

[D] coolant flow

24 Just-in-time production is also known as

[A] lean production

[B] group technology

[C] cellular production

[D] All of the above

25. The ABC analysis can be used for

[A] review of stocking levels

[B] periodicity of physical verification

[C] identifying items for alternate stocking

[D] All of the above

26. Air with initial condition P_1, V_1 expands to final condition of $P_1/2$, $3V_1$. The process is

[A] hyperbolic

[B] adiabatic

[C] polytropic with $n > 1$

[D] polytropic with $n < 1$

27. A person carrying on his hand a jewellery box of weight w jumped down from the 3rd floor of a building. Before touching the ground, he would feel load of magnitude

[A] zero

[B] $w/2$

[C] w

[D] infinity

28. Maximum shear stress developed on the surface of a solid circular shaft under your fashion is 240 MPa. If the shaft diameter is doubled, then the maximum stress developed corresponding to the same torque will be

[A] 120 MPa

[B] 60 MPa

[C] 30 MPa

[D] 15 MPa

29. A pin-ended column of length L, modulus of elasticity E and second moment of the cross-sectional area I is loaded eccentrically by a compressive load P. The critical buckling load (P_{cr}) is given by

[A] EI/π^2L^2

[B] $EI/3\pi^2L^2$

[C] $\pi EI/L^2$

[D] π^2EI/L^2

30. A rod of length L and diameter D is subjected to a tensile load P. Which of the following is sufficient to calculate the resulting change in diameter?

[A] Young's modulus

[B] Shear modulus

[C] Poisson's ratio

[D] Both Young's modulus and shear modulus

31. A thin cylinder of inner radius 500 mm and thickness 10 mm is subjected to an internal pressure of 5 MPa. The average circumferential (hoop) stress in MPa is

[A] 100

[B] 250

[C] 500

[D] 1000

32. The value of Poisson's ratio for any material cannot exceed

[A] 0·2

[B] 1·414

[C] 1·0

[D] 0·5

33. If the principal stresses and maximum shearing stresses are of equal numeral value at a point in a stressed body, the state of stress can be termed as

[A] isotropic

[B] uniaxial

[C] pure shear

[D] generalised plane state of stress

34. The shape of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its length is

[A] a straight line

[B] a hyperbola

[C] an ellipse

[D] a parabola

35. The number of inversions for a slider crank mechanism is

[A] 6

[B] 5

[C] 4

[D] 3

36. The speed of an engine varies from 210 rad/s to 190 rad/s. During a cycle, the change in kinetic energy is found to be 400 Nm. The inertia of the flywheel in kg-m^2 is

[A] 0·10

[B] 0·20

[C] 0·30

[D] 0·40

37. Tooth interference in an external involute spur gear pair can be reduced by

[A] decreasing the center distance between gear pair

[B] decreasing the module

[C] decreasing the pressure angle

[D] increasing the number of gear teeth

38. The connection between the piston and cylinder in a reciprocating engine corresponds to

[A] completely constrained kinematic pair

[B] incompletely constrained kinematic pair

[C] successfully constrained kinematic pair

[D] single link

39. Gear used to connect non-parallel and non-intersecting shafts include

[A] hypoid gears

[B] spiral gears

[C] worm gears

[D] All of the above

40. In involute gears, the pressure angle is

[A] dependent on the size of teeth

[B] dependent on the size of gears

[C] always constant

[D] always vary

41. A spring loaded governor is found unstable. It can be made stable by

[A] increasing the spring stiffness

[B] decreasing the spring stiffness

[C] increasing the ball weight

[D] decreasing the ball weight

42. The creep in a belt drive is due to the

[A] material of the pulleys

[B] material of the belt

[C] unequal size of the pulleys

[D] unequal tension on tight and slack sides of the belt

43. Vibration systems that have a finite number of degrees of freedom are called

[A] finite system

[B] discrete system

[C] continuous system

[D] homogeneous system

44. Rayleigh's method of computing the fundamental natural frequency is based on

[A] conservation of energy

[B] conservation of momentum

[C] conservation of masses

[D] laws of statics

45. What should be the length of the pendulum for a time period of 1 second?

[A] 2·5 cm

[B] 9·81 cm

[C] 24·84 cm

[D] indeterminate

46. If the damping factor in a vibrating system is unity, then the system will

[A] have no vibrations

[B] be highly damped

[C] be underdamped

[D] be critically damped

47. When failure occurs only after the stresses have been repeated a very large number of times, such type of failure is called

[A] ductile failure

[B] brittle failure

[C] fatigue failure

[D] creep

48. If the load on a ball bearing is halved, its life

[A] remains unchanged

[B] increases two times

[C] increases four times

[D] increases eight times

49. When can a piezometer be not used for pressure measurement in pipes?

[A] The pressure difference is low

[B] The velocity is high

[C] The fluid in the pipe is a gas

[D] The fluid in the pipe is highly viscous

50. In order to increase sensitivity of U-tube manometer, one leg is usually inclined by an angle θ. What is the sensitivity of inclined tube compared to sensitivity of U-tube?

[A] $\sin\theta$

[B] $1/\sin\theta$

[C] $1/\cos\theta$

[D] $\tan\theta$

51. The distance from the center of buoyancy to the meta center is given by I/V_d, where V_d is the volume of fluid displaced. What does I represent?

[A] Moment of inertia of a horizontal section of the body taken at the surface of the fluid

[B] Moment of inertia about its vertical centroidal axis

[C] Polar moment of inertia

[D] Moment of inertia about its horizontal centroidal axis

52. Existence of velocity potential implies that

[A] flow is in continuum

[B] flow is irrotational

[C] fluid is ideal

[D] fluid is compressible

53. The locus of elevations that water will rise in a series of Pitot tubes is called

[A] the hydraulic grade line

[B] the energy grade line

[C] the velocity head

[D] the pressure head

54. A liquid flows downward through a tapered vertical portion of a pipe. At the entrance and exit of the pipe, the static pressures are equal. If for a vertical height h, the velocity becomes four times, then the ratio of h to the velocity head at entrance will be

[A] 15

[B] 8

[C] 3

[D] 24

55. If a fluid flows through a capillary tube of length L and diameter D and the mass flow rate and pressure drops are measured, the viscosity of the fluid can be estimated from the

[A] Euler's equation

[B] Bernoulli's equation

[C] Hagen-Poiseuille equation

[D] None of the above

56. Hot oil is cooled from 80 °C to 50 °C in an oil cooler which uses air as the coolant. The air temperature rises from 30 °C to 40 °C. The designer uses an LMTD value of 26 °C. The type of heat exchanger is

[A] parallel flow

[B] double pipe

[C] counterflow

[D] cross-flow

57. With an increase in thickness of insulation around a circular pipe, heat loss to surroundings due to

[A] convection increases, while that due to conduction decreases

[B] convection decreases, while that due to conduction increases

[C] convection and conduction decrease

[D] convection and conduction increase

58. Which one of the following configurations has the highest fin effectiveness?

[A] Thin, closely spaced fins

[B] Thin, widely spaced fins

[C] Thick, widely spaced fins

[D] Thick, closely spaced fins

59. A body, in which at any instant of time, there is always a point where the effect of heating (or cooling) at one of its boundary is not felt at all, is known as

[A] finite body

[B] semi-infinite body

[C] infinite body

[D] unaffected body

60. A composite wall of a furnace has 2 layers of equal thickness having thermal conductivities in the ratio of 3 : 2. What is the ratio of the temperature drop across the two layers?

[A] 2 : 3

[B] 3 : 2

[C] 1 : 2

[D] ln 2 : ln 3

61. A cylinder made of metal of conductivity 40 W/mK is to be insulated with a material of conductivity 0·1 W/mK. If the convective heat transfer coefficient with the ambient atmosphere is 5 W/m^2K, the critical radius of insulation is

[A] 2 cm

[B] 4 cm

[C] 8 cm

[D] 50 cm

62. The time constant of thermocouple is

[A] the time taken to attain 100% of initial temperature difference

[B] the time taken to attain 63·2% of initial temperature difference

[C] the time taken to attain 50% of initial temperature difference

[D] the minimum time taken to record a temperature reading

63. According to Newton's law of cooling, the rate of heat transfer in convection is

[A] proportional to the temperature difference

[B] proportional to the area of heat transfer

[C] Both [A] and [B]

[D] None of the above

64. Dimensionless time is represented by

[A] Biot number

[B] Fourier number

[C] Euler number

[D] Reynolds number

65. An industrial heat pump operates between the temperatures of 27 °C and 13 °C. The rates of heat addition and heat rejection are 750 W and 1000 W respectively. The COP for the heat pump is

[A] 7·5

[B] 6·5

[C] 4·0

[D] 3·0

66. A reversible thermodynamic cycle containing only three processes and producing work is to be constructed. The constraints are

(i) there must be one isothermal process

(ii) there must be one isentropic process

(iii) the maximum and minimum cycle pressures and the clearance volume are fixed

(iv) polytropic processes are not allowed

Then the number of possible cycles is

[A] 1

[B] 2

[C] 3

[D] 4

67. If a closed system is undergoing an irreversible process, the entropy of the system

[A] must increase

[B] always remains constant

[C] must decrease

[D] can increase, decrease or remains constant

68. One kilogram of water at room temperature is brought into contact with a high temperature thermal reservoir. The entropy change of the universe is

[A] equal to entropy change of the reservoir

[B] equal to entropy change of water

[C] equal to zero

[D] always positive

69. The values of enthalpy of steam at the inlet and outlet of a steam turbine in a Rankine cycle are 2800 kJ/kg and 1800 kJ/kg respectively. Neglecting pump work, the specific steam consumption in kg/kW-hour is

[A] 3·60

[B] 0·36

[C] 0·06

[D] 0·01

70. Thermodynamic work is the product of

[A] two intensive properties

[B] two extensive properties

[C] an intensive property and change in an extensive property

[D] an extensive property and change in an intensive property

71. In a throttling process, which one of the following parameters remains constant?

[A] Temperature

[B] Pressure

[C] Enthalpy

[D] Entropy

72. A reversible engine has ideal thermal efficiency of 30%. When it is used as a refrigeration machine with all other conditions unchanged, the coefficient of performance will be

[A] 3·33

[B] 3·00

[C] 2·33

[D] 1·33

73. When the lower temperature is fixed, COP of a refrigerating machine can be improved by

[A] operating the machine at higher speed

[B] operating the machine at lower speed

[C] raising the higher temperature

[D] lowering the higher temperature

74. Which one of the following thermodynamic processes approximates the steaming of food in a pressure cooker?

[A] Isenthalpic

[B] Isobaric

[C] Isochoric

[D] Isothermal

75. Molar specific heat of an ideal gas depends on

[A] its pressure

[B] its temperature

[C] its both pressure and temperature

[D] the number of atoms in a molecule

76. The clearance volume of a reciprocating compressor reflects

[A] piston speed

[B] noise level

[C] volumetric efficiency

[D] temperature of air after compression

77. The use of regenerator in a gas turbine cycle

[A] increases efficiency but has no effect on output

[B] increases output but has no effect on efficiency

[C] increases both efficiency and output

[D] increases efficiency but decreases output

78. In the window air conditioner, the expansion device used is

[A] capillary tube

[B] thermostatic expansion valve

[C] automatic expansion valve

[D] float valve

79. Water at 42 °C is sprayed into a stream of air at atmospheric pressure, dry bulb temperature of 40 °C and a wet bulb temperature of 20 °C. The air leaving the spray humidifier is not saturated. Which of the following statements is ***true***?

[A] Air gets cooled and humidified

[B] Air gets heated and humidified

[C] Air gets heated and dehumidified

[D] Air gets cooled and dehumidified

80. Dew point temperature is the temperature at which condensation begins when the air is cooled at constant

[A] volume

[B] entropy

[C] pressure

[D] enthalpy

PART—II

(General Knowledge, General English & Islamic History and Culture)

81. The first Masjid that was built by the Holy Prophet (PBUH) was

[A] Masjid ul Haram

[B] Masjid ul Aqsa

[C] Masjid e Quba

[D] Masjid e Nabavi

82. What does Zam Zam mean?

[A] Water

[B] Water well

[C] Stop

[D] Drink

83. What is Abu Bakr's (R.A.) full name?

[A] Abdul Rahman ibn Uthman

[B] Uthman ibn Abdullah

[C] Abdullah ibn Abdur Rahman

[D] Abdullah ibn Uthman

84. In which battle did some Muslim archers disobey the order of Prophet Muhammad (PBUH)?

[A] Battle of Badr

[B] Battle of Uhud

[C] Battle of Khaybar

[D] Battle of Khandaq

85. Which is ***not*** one of the five pillars of Islam?

[A] Roza

[B] Namaz

[C] Zakat

[D] Paradise

86. Big Bang theory explains

[A] origin of Universe

[B] origin of Sun

[C] origin of gravitation

[D] origin of bacteria

87. Visva-Bharati is situated in the district of

[A] Purulia

[B] Bankura

[C] Birbhum

[D] Medinipur

88. Dhyan Chand was associated with the sports

[A] Running

[B] Football

[C] Boxing

[D] Hockey

89. Gatidhara Prakalpa is introduced by the Government of

[A] West Bengal

[B] Odisha

[C] Maharashtra

[D] Gujarat

90. The founder of the organisation Bengal Chemical was

[A] Nil Ratan Sarkar

[B] Prafulla Chandra Roy

[C] Dwarakanath Tagore

[D] Alamohan Das

91. Fill in, with relative pronoun, the blank space below :

The man, _____ briefcase was lost, reported to the police.

[A] that
[B] whose
[C] which
[D] whom

92. Select the option that is the indirect form of the given sentence :

Rupa said, "I am very busy now".

[A] Rupa told that she might be very busy then.
[B] Rupa said that she is very busy now.
[C] Rupa said that she was very busy then.
[D] Rupa said that she will be very busy then.

93. Fill in the blank with the most appropriate option :

_____ you like to drink milk twice daily?

[A] When
[B] Does
[C] Do
[D] What

94. Fill in the blank with the most appropriate option :

_____ has taken my new red pen?

[A] Who
[B] Why
[C] Where
[D] What

95. Fill in the blank with the most appropriate option :

_____ she get good marks in the Bengali test?

[A] Has
[B] Don't
[C] Hasn't
[D] Didn't

96. Hadrat Umer was Caliph for

[A] 2 years
[B] 4 years
[C] 10 years
[D] None of the above

97. Which country is called the "Land of Prophets"?

[A] Saudi Arabia
[B] Syria
[C] Palestine
[D] Iraq

98. Hadrat Ali's (R.A.) wife was

[A] Ruqayyah (R.A.)
[B] Fatima (R.A.)
[C] Umm Kulthum (R.A.)
[D] Hadrat Aisha (R.A.)

99. The Pre-Islamic Era is known as

[A] Modern Age
[B] Age of Ignorance
[C] Golden Age
[D] None of the above

100. Which prayer is not obligatory for women?

[A] Maghrib Prayer
[B] Isha Prayer
[C] Juma Prayer
[D] Fajar Prayer