

**COMBINED TECHNICAL SERVICES EXAMINATION
(INTERVIEW POST)**

COMPUTER BASED TEST

DATE OF EXAM: 22.07.2025 FN

**PAPER – II – CHEMICAL AND MECHANICAL
ENGINEERING**

(DEGREE STANDARD) (CODE: 528)

1. The primary difference between Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI) is
- ☒ (A) OSHA's power to enforce regulations, but ANSI offers guidelines that companies can adopt on a voluntary basis
 - (B) OSHA offers guidelines that companies can adopt on a voluntary basis, but ANSI's power to enforce regulations
 - (C) OSHA offers guidelines according to the working environments unlike ANSI
 - (D) ANSI offers guidelines according to the working environments and has power to enforce its guidelines unlike OSHA
 - (E) Answer not known
2. Which of the following statements about FMS implementation are incorrect?
- (I) FMS can be rapidly deployed in any manufacturing environment regardless of existing intra structure.
 - (II) FMS enhances adaptability to moderate design changes without substantial downtime.
 - (III) FMS is ideally suited for high product variety with very low production volume per variant.
 - (IV) The initial capital investment and integration complexity of FMS often act as barriers to adoption.
- (A) (III) only
 - (B) (IV) only
 - (C) (II) only
 - ☒ (D) (I) only
 - (E) Answer not known

3. OSHA stands for
- (A) Occupational Safety for Health Administration
 - ☒ (B) Occupational Safety and Health Administration
 - (C) Occupational Safety for Health Awareness
 - (D) Occupational Safety and Health Awareness
 - (E) Answer not known
4. Steps involved in method study
- (A) Examine, record, select, develop, install, define, maintain
 - ☒ (B) Select, record, examine, develop, define, install, maintain
 - (C) Install, define, maintain, develop, examine, record, select
 - (D) Select, develop, define, install, maintain, examine, record
 - (E) Answer not known
5. Assuming that the total observed time for an operation of assembling an electric switch is 1.00 min. if the rating is 120%. Find the normal time.
- (A) 1 min
 - ☒ (B) 1.20 min
 - (C) 2 min
 - (D) 0.5 min
 - (E) Answer not known
6. In PERT, which of the following is not related to determining the estimated time?
- ☒ (A) Most unlikely time
 - (B) Optimistic time
 - (C) Pessimistic time
 - (D) Most likely time
 - (E) Answer not known

7. The main difference between PERT and CPM in
- (A) CPM uses probabilistic time, PERT deals
 - ☒ (B) CPM deals with cost, PERT deals with time
 - (C) CPM deals with cost, PERT uses deterministic time
 - (D) CPM is for research, PERT is used for regular jobs
 - (E) Answer not known
8. Which of the following best describes the main reason why isoparametric elements converge to the exact solution as the mesh is refined?
- (A) The elements become more rigid as the mesh density increases
 - (B) The Jacobian matrix becomes close to the identity matrix as the mesh is refined
 - (C) The number of degrees of freedom increases, leading to better approximation of the solution
 - ☒ (D) The shape functions used in isoparametric elements ensure exact representation of displacement gradients at nodes
 - (E) Answer not known
9. Which of the following is not the right term associated with FEA?
- (A) Element
 - (B) Node
 - (C) Degree of freedom
 - ☒ (D) Degree of reaction
 - (E) Answer not known

10. While analyzing the spoke network of a bicycle wheel using FEA, the use of truss elements instead of bar elements would be more appropriate, because:
- ☒ (A) Spokes transmit only axial forces without bending
 - (B) Spokes require both shear and moment resistance at their ends
 - (C) Truss formulation adds torsional stiffness to the spoke model
 - (D) Bar elements allow easier rotational constraints at the hub
 - (E) Answer not known
11. In FEA, line element is a
- ☒ (A) One dimensional problem
 - (B) Two dimensional problem
 - (C) Three dimensional problem
 - (D) Non linear problem
 - (E) Answer not known
12. In FEA, the element stiffness matrix $[K] = [B]^T [D] [B] (A)(t)$ where matrix $[B]$ referred as
- ☒ (A) Strain displacement matrix
 - (B) Stress displacement matrix
 - (C) Stress-strain relation matrix
 - (D) Strain-stress relation matrix
 - (E) Answer not known

13. Identify the wrong statements regarding the structure of the OPTIZ part coding system.

- (I) The first five digits typically represent the form code of the part
 - (II) Digits 6 to 9 in the code always refer to main shape of the component
 - (III) Secondary codes can be optimized to suit production requirements
 - (IV) The system always uses a fixed 10-digit format
- (A) (II) and (III) only ~~(B)~~ (II) and (IV) only
(C) (III) and (IV) only (D) (I) and (III) only
(E) Answer not known

14. Which of the following characteristics of a photopolymer resin directly influence the dimensional accuracy of a printed part in SLA?

- (I) Polymerization shrinkage
 - (II) Light penetration depth
 - (III) Resin's elastic modulus
 - (IV) Viscosity of resin at rest
- ~~(A)~~ (I) and (II) only (B) (II) and (III) only
(C) (I), (II) and (III) only (D) (III) only
(E) Answer not known

15. Which of the following statement reflects safety standard applied in robotics?
- ☒ (A) ISO 10218 provides safety requirements for both industrial robots and their system
 - (B) ISO 16976 provides safety requirements for both industrial robots and their system
 - (C) ISO 12018 provides safety requirements for both industrial robots and their system
 - (D) ISO 9001 provides safety requirements for both industrial robots and their systems
 - (E) Answer not known
16. Which of the following factors most critically challenges the adoption of JIT in a small-scale chemical plant?
- (A) High employee turnover
 - (B) Fluctuating international chemical prices
 - ☒ (C) Unpredictable lead times for chemical deliveries
 - (D) Increased competition from multi-national corporations
 - (E) Answer not known

17. Which of the following best demonstrates FMS in action?
- (I) A car factory using fixed assembly lines for a single model
 - (II) A furniture factory that configures CNC machines for custom design on demand
 - (III) A textile mill producing the same fabric daily
 - (IV) A bottling plant using robotic arms for repetitive capping
- (A) (I) and (III) only ~~(B)~~ (II) only
(C) (IV) only (D) (I) and (IV) only
(E) Answer not known
18. Which of the following is CIM hardware?
- (A) Database management system
 - ~~(B)~~ Flexible manufacturing system
 - (C) Network management system
 - (D) Simulation programming system
 - (E) Answer not known
19. The function of OOPS command in geometric modeling is
- (A) Enlarge (or) shrink an object
 - (B) Trim the portion of entities
 - (C) Mirror the images of existing object
 - ~~(D)~~ To retrieve objects erased inadvertently
 - (E) Answer not known

20. Batch production means
- (A) Oldest method of production on a very small scale
 - (B) Large scale production
 - ☒ (C) Two or more type of products are manufactured in lots
 - (D) The plant and its equipment layout designed
 - (E) Answer not known
21. A wet pulp contains 75% water. After 100 kg water is removed in the dryer, it is found that the pulp is now containing 30% water. The weight of the original pulp is
- (A) 116.7 kg
 - (B) 291.6 kg
 - (C) 222.2 kg
 - ☒ (D) 155.6 kg
 - (E) Answer not known
22. A control system is unstable if the open-loop frequency response exhibits an AR exceeding unity at the frequency for which the phase lag is 180° . This frequency is called
- ☒ (A) Crossover frequency
 - (B) Cross frequency
 - (C) Loop frequency
 - (D) None of the above
 - (E) Answer not known
23. In extraction operation, a solvent with low interfacial tension leads to
- (A) Easy coalesce and rapid disengagement of phases
 - ☒ (B) Formation of stable emulsions difficult to settle
 - (C) Easy separation by gravity
 - (D) High rate of mass transfer
 - (E) Answer not known

24. The two basic steps involved in the overall process of crystallization are _____ and _____.
- (A) Solubility, crystal growth
 - (B) Super saturation, nucleation
 - (C) Crystal growth, super saturation
 - ☒ (D) Nucleation, crystal growth
 - (E) Answer not known
25. The major limitation of electrodialysis for desalination of sea water, over reverse osmosis is
- (A) The high pressure required for operation
 - (B) The scaling and fouling of membranes
 - ☒ (C) The inability to remove suspended solids and microorganisms
 - (D) The short membrane life expectancy
 - (E) Answer not known
26. Select the law associated with diffusion process from the options given
- (A) Kick's law of diffusion
 - (B) Kirchhoff's law of diffusion
 - (C) Fourier's law of diffusion
 - ☒ (D) Fick's law of diffusion
 - (E) Answer not known

27. According to penetration theory, the mass transfer coefficient (K_v) varies with the _____ of molecular diffusivity (D_v).
- (A) Square
(B) ☒ Square root
(C) First power
(D) Two-third
(E) Answer not known
28. What type of membrane is used in gas separation?
- (1) Porous membrane
(2) Non-porous membrane
(3) Dense membrane
- (A) Only (1)
(B) Only (2)
(C) Only (3)
(D) ☒ Only (1) and (2)
(E) Answer not known
29. In a distillation column, inside the column, the liquids and vapours are always at their bubble points and dew points, respectively. So that the highest temperatures are at the bottom, the lowest at the top. The entire device is called
- (A) Rectifier
(B) Stripping
(C) Reboiler
(D) ☒ Fractionator
(E) Answer not known
30. Lewis number = 1, signifies
- (A) $Pr = Re$
(B) ☒ $Pr = Sc$
(C) $Sc = Re$
(D) $Nu = Sh$
(E) Answer not known

31. Match Column I with Column II

Column I	Column II
(P) Reynolds Analogy	1. $\frac{K}{C_p \rho D_{AB}}$
(Q) Lewis number	2. $\frac{\mu}{\rho D_{AB}}$
(R) Schmidt number	3. $St_H = St_D = \frac{f}{2}$
(S) Chilton-Colburn Analogy	4. $J_H = J_D = \frac{f}{2}$

- | | (P) | (Q) | (R) | (S) |
|---|------------------|-----|-----|-----|
| (A) | 1 | 2 | 3 | 4 |
| ☒ (B) | 3 | 1 | 2 | 4 |
| (C) | 4 | 3 | 2 | 1 |
| (D) | 3 | 2 | 4 | 1 |
| (E) | Answer not known | | | |

32. The high value of Henry's law constant means

- (A) The gas solubility is high
- (B) Equilibrium partial pressure is low
- ☒ (C) The solubility is low
- (D) It is independent of gas solubility
- (E) Answer not known

33. Find the final value of the process control system whose transfer function is given as $G(S) = \frac{(S + 4)}{S(S + 1)(S + 2)}$
- (A) 4
(B) 2
(C) 1
(D) 0
(E) Answer not known
34. Identify the control system in which the input has control over the output.
- (A) Open-loop control system
(B) Distributed control system
(C) Closed-loop control system
(D) Non-Distributed control system
(E) Answer not known
35. A control system is stable if
- (A) All the roots of the characteristic equation has a negative real part
(B) All the roots of the characteristic equation has a positive real part
(C) Any root of the characteristic equation have negative real part
(D) Any root of the characteristic equation have positive real part
(E) Answer not known

36. The number of sign changes in the entries in the first column of Routh's array denotes
- (A) The number of open-loop zeros in RHP
 - (B) The number of open-loop zeros in LHP
 - (C) The number of zeros the system in RHP
 - ☒ (D) The number of roots of the characteristic polynomial in RHP (Right half of S-plane)
 - (E) Answer not known
37. The nature of roots for the over damped system are found to have
- ☒ (A) Two distinct and real poles
 - (B) Two real and equal poles
 - (C) Two complex conjugate poles
 - (D) One real and one complex pole
 - (E) Answer not known
38. The transfer function of a first order pure capacitive system is
- ☒ (A) $G(S) = \frac{K_P}{S}$
 - (B) $G(S) = \frac{\tau_P + 1}{S}$
 - (C) $G(S) = \frac{K_P}{\tau_P S + 1}$
 - (D) $G(S) = \frac{\tau_P S + 1}{K_P}$
 - (E) Answer not known

39. The Laplace transform of a transportation lag of 5 seconds is

☒ (A) e^{-5s}

(B) e^{5s}

(C) e^{-5}

(D) $\frac{1}{s+5}$

(E) Answer not known

40. The characteristic equation for a system is $s^3 + bs^2 + cs + 1 = 0$ what is the condition for stability of the system according to Routh's stability criterion?

☒ (A) $bc - 1 > 0$

(B) $bc - 1 < 0$

(C) $b > c$

(D) $b < c$

(E) Answer not known

41. The basic raw material for glass is

(A) Gypsum

(B) Clay

(C) Lime stone

☒ (D) Silica/Sand

(E) Answer not known

42. The chemical used for bleaching of pulp is

☒ (A) Chlorine

(B) Sodium chloride

(C) Magnesium sulfate

(D) Calcium carbonate

(E) Answer not known

43. In the polymeric chemical reaction, the molecules containing double or triple bonds or with oxo-ring compounds, are liberated and reaction is the rapid chain type is known as
- (A) Poly condensation reaction ~~(B)~~ Addition reaction
(C) Condensation reaction (D) Chain polymerisation
(E) Answer not known
44. Various types of stable greases are produced with working range from _____ to _____.
- (A) -30°C to 150°C (B) -75°C to 290°C
~~(C)~~ -75°C to 260°C (D) -75°C to 200°C
(E) Answer not known
45. Fibre mould making process mould release agent is
- ~~(A)~~ Polyvinyl alcohol (B) Glass wool
(C) Soda lime (D) Sodium sulphate
(E) Answer not known
46. Which is used for pulp digestion of water treatment in pulp and paper industry?
- ~~(A)~~ Soda Ash (B) Calcium carbonate
(C) CaO (D) Calcium sulphide
(E) Answer not known

47. Examples of semi drying and non-drying oils are

- (A) Linseed castor oil and butter fat
- ☒ (B) Untreated castor oil and coconut oil
- (C) Dehydrated castor oil and Herring oil
- (D) Salmon and cod liver oil
- (E) Answer not known

48. In Recycle process overall conversion =

☒ (A) Overall conversion =
$$\frac{\text{Moles of reactant fed into the fresh feed} - \text{Moles of reactant in the product from overall process}}{\text{Moles of reactant in fresh feed}}$$

(B) Overall conversion =
$$\frac{\text{Input} - \text{Output}}{\text{Input}}$$

(C) Overall conversion =
$$\frac{\text{Reactant} - \text{Product}}{\text{Product}}$$

(D) Overall conversion =
$$\frac{\text{Total product} - \text{Total reactant}}{\text{product}}$$

(E) Answer not known

49. Purge = _____.

☒ (A) Purge =
$$\frac{\text{Feed rate} \times \text{mole fraction of inerts in the feed}}{\text{mole fraction of inerts in the recycle}}$$

(B) Purge =
$$\frac{\text{Feed ratio}}{\text{product ratio}}$$

(C) Purge =
$$F_0 + F_1/F_0$$

(D) Purge =
$$F_0 x_F / F_1 x_{F_1}$$

(E) Answer not known

50. Calculate relative saturation of vapour-gas mixture contains partial pressure of acetone mixture is 15 kpa. and vapour pressure of acetone is 26.36.
- (A) 50.06% ~~(B) 56.9%~~
(C) 49.01% (D) 51%
(E) Answer not known
51. Calculate the pressure developed by one kmol gasses ammonia contained in a vessels of 0.6 m³ capacity at a constant temperature of 473 K by using the ideal gas equation
- (A) 30 bar (B) 40 bar
~~(C) 65.54 bar~~ (D) 80 bar
(E) Answer not known
52. In Industrial Processes, the chemical reactions performed to utilise the valuable reactants to their maximum. So that the loss of reactants is minimised. This operation is called as
- (A) Bypassing operation ~~(B) Recycling operation~~
(C) Parallel operation (D) Reprocessing operation
(E) Answer not known
53. In Humidification operations, the temperature of the air-water vapour mixture recorded by the immersion of a thermometer in the mixture, is termed as
- (A) Wed-bulp temperature (B) Absolute humidity
~~(C) Dry-bulp temperature~~ (D) Percentage humidity
(E) Answer not known

54. _____ is the copolymer of vinyl chloride and _____ it is prepared by mixing the two components with catalyst and heating.
- ☒ (A) Saran, Vinylidene chloride
 - (B) Spandex, Vinyacetate
 - (C) Poly olefins, vinyl monomer
 - (D) Vinyls and vinyl polymer
 - (E) Answer not known
55. Polyolefin fibers are usually made of
- (A) Spandex
 - (B) Vinyl chloride
 - ☒ (C) Poly ethylene and Polypropylene
 - (D) Dynel material
 - (E) Answer not known
56. The work required for crushing a given material is proportional to the logarithm of the ratio between the initial and final diameter called as
- (A) Rittinger's Law
 - ☒ (B) Kick's Law
 - (C) Bonds Law
 - (D) Work index
 - (E) Answer not known
57. _____ impellers are used for large scale mixing of solid/liquid suspension.
- ☒ (A) Axial flow impellers
 - (B) Radial flow impellers
 - (C) Propellers
 - (D) Turbines
 - (E) Answer not known

58. Which of the following is carried out by adding inexpensive materials such as lime, Alumina or sodium silicate, which form loose agglomerates that carry fines down with them is
- ☒ (A) Flocculation (B) Agglomeration
(C) Sedimentation (D) Settling
(E) Answer not known
59. In size reduction machine, which one of the following is used for coarse reduction of hard solids to give relatively few fines
- ☒ (A) Compression (B) Impact
(C) Rubbing (D) Cutting
(E) Answer not known
60. _____ is the product of the solids-concentration C and the downward velocity u .
- (A) Agitation flux (G_A) (B) Mixing flux (G_m)
(C) Settling flux (G_s) ☒ (D) Transport flux (G_t)
(E) Answer not known
61. Kohlberg's theory of moral development "Obeying rules to avoid punishment" represents
- ☒ (A) Pre-conventional stage (B) Formal operation stage
(C) Conventional stage (D) Post conventional stage
(E) Answer not known

62. Environmental Ethics is study of
- ☒ (A) Moral issues and values of human concerning the Environment
 - (B) Moral issues concerning the human being
 - (C) Moral issues concerning the Animals
 - (D) Moral issues concerning the Industry
 - (E) Answer not known
63. People-centred advocacy is possible link between _____ and _____.
- (A) Strategic and unknown reason
 - (B) Learning and Actionable
 - ☒ (C) Rights and Participation
 - (D) Training and Practices
 - (E) Answer not known
64. Validity of patents right is for _____ years from filling.
- (A) 10
 - ☒ (C) 20
 - (B) 15
 - (D) 5
 - (E) Answer not known
65. Who is responsible for the preparation of off-site emergency plan as per Factories Act, 1948?
- (A) Occupier
 - ☒ (C) District Collector
 - (B) Factory Inspection
 - (D) Factory Manager
 - (E) Answer not known

66. In 5's technique of house keeping, English equivalent of the term Seiton is

- (A) Tidiness
(B) ☒ Orderliness
(C) Cleanliness
(D) Discipline
(E) Answer not known

67. Match Column I with Column II :

Column I		Column II
(P) Asphyxiant		1. Carbon tetrachloride
(Q) Irritant		2. Carbon monoxide
(R) Anaesthetics		3. Arsinic
		4. Ammonia

- | | (P) | (Q) | (R) |
|--------------------------------------|------------------|-----|-----|
| (A) | 4 | 1 | 2 |
| ☒ (B) | 2 | 4 | 1 |
| (C) | 3 | 2 | 1 |
| (D) | 4 | 3 | 2 |
| (E) | Answer not known | | |

68. Match Column I with Column II :

Column I	Column II
(P) Cooling	1. Halogenated hydrocarbons
(Q) Smothering	2. Foam
(R) Starving	3. Water
(S) Interrupting fine chain reaction	4. Shut off supply of oil by closing valves

	(P)	(Q)	(R)	(S)
(A)	4	3	2	1
(B)	1	2	3	4
☒ (C)	3	2	4	1
(D)	3	1	4	2
(E)	Answer not known			

69. Identify the safety documentation systems which is implemented in industries to ensure that written instructions and guidelines are available and followed from the options given

- | | |
|----------------------|---|
| (A) SCBA | (B) Safety harness |
| (C) BLEVE | ☒ (D) Work permit system |
| (E) Answer not known | |

70. A group of different diseases that have the same feature, the uncontrolled growth and spread of abnormal cells is known as

- | | |
|---|--------------------------|
| ☒ (A) Cancer | (B) Fever |
| (C) Cyanosis | (D) Respiratory problems |
| (E) Answer not known | |

71. Which type of fire extinguisher is used for flammable liquids?
- ☒ (A) Foam (B) Water jet
(C) CO₂ (D) DCP
(E) Answer not known
72. The ratio of total contaminant in a unit volume of aquifer to the contaminant dissolved in ground water is called
- ☒ (A) Retardation factor (B) Equilibrium factor
(C) Molecular diffusion (D) Hydrodynamic dispersion
(E) Answer not known
73. The presence of unwanted sound is called as
- ☒ (A) Noise pollution (B) Air pollution
(C) Annoyance (D) Chronic exposure
(E) Answer not known

74. Which of the following is the correct statement about control of CO₂ emission?
- (1) Use of alternative energy sources
 - (2) Prevention of deforestation and growing of more trees
 - (3) Trapping CO₂ at source as carbonate materials by using MgO or CaO.
 - (4) Ironing of Natural water bodies like oceans.
- (A) Only (1)
(B) Only (4)
(C) Only (2)
☒ (D) All the (1), (2), (3), (4)
(E) Answer not known
75. High COD and BOD ratio of an organic pollutant represents
- (A) High biodegradability of the pollutant
☒ (B) Low biodegradability of the pollutant
(C) Presence of the oxygen for aerobic decomposition
(D) Presence of toxic material in pollutant
(E) Answer not known
76. Which of the following air pollution control device has maximum removal efficiency for suspended particle removal?
- | | |
|--------------------------|--|
| (A) Spray tower | (B) Wet cyclonic scrubber |
| (C) Dynamic precipitator | ☒ (D) Electrostatic precipitator |
| (E) Answer not known | |

77. Pathogenic bacteria, enter waste waters primarily from

- (A) Industrial waste
- ☒ (B) Domestic waste
- (C) Both domestic waste and industry waste
- (D) Infiltration in sewers from the surrounding soils
- (E) Answer not known

78. Match the following :

List I		List II	
Treatment Units		Type of process	
(P)	Trickling filter	1.	Symbiotic
(Q)	Activated sludge process	2.	Extended aeration
(R)	Oxidation ditch	3.	Suspended growth
(S)	Oxidation pond	4.	Attached growth

	(P)	(Q)	(R)	(S)
(A)	3	4	2	1
(B)	4	3	1	2
(C)	3	4	1	2
☒ (D)	4	3	2	1

(E) Answer not known

79. The maximum sound level, beyond which it is certainly regarded as pollutant is

- (A) 20 dB
- ☒ (B) 80 dB
- (C) 40 dB
- (D) 50 dB
- (E) Answer not known

80. Match the following :

List I		List II	
Pollutants		Effects produced	
(P) CO		1. Green house effect	
(Q) CO ₂		2. Acid rains	
(R) SO ₂		3. Acute toxicity	
(S) NO ₂		4. Ozone liberation at ground level	

	(P)	(Q)	(R)	(S)
(A)	3	4	1	2
(B)	3	4	2	1
☒ (C)	4	1	3	2
(D)	4	3	1	2
(E)	Answer not known			

81. The ratio of heat flow rate by convection to flow rate by conduction is known as

- | | |
|---|-------------------|
| ☒ (A) Nusselt number | (B) Graetz number |
| (C) Fourier number | (D) Peclet number |
| (E) Answer not known | |

82. Heat flow mechanism through solids is known as

- | | |
|----------------------|---|
| (A) Convection | ☒ (B) Conduction |
| (C) Radation | (D) Forced convection |
| (E) Answer not known | |

83. Graetz Number (G_z) is defined by the equation

(A) $\frac{K_L}{\dot{m}C_P}$

(B) $\frac{K_L\dot{m}}{C_P}$

☒ (C) $\frac{\dot{m}C_P}{K_L}$

(D) $\frac{C_P}{K_L\dot{m}}$

(E) Answer not known

84. Which is the major mean of heat transfer in double pipe heat exchanger?

(A) Convection

(B) Conduction

(C) Radiation

☒ (D) Combined convection and conduction

(E) Answer not known

85. The ratio of actual heat transfer to maximum possible heat transfer is known as

☒ (A) Effectiveness of heat exchanger

(B) Number of transfer units

(C) Nusselts number

(D) LMTD

(E) Answer not known

86. _____ states that the boiling point of a given solution is a linear function of the boiling point of pure water at the same pressure.
- ☒ (A) Duhring's rule
 - (B) Bernoulli's equation
 - (C) Emissivity
 - (D) Ficks law
 - (E) Answer not known
87. The economy of a multiple effect evaporator depends on
- ☒ (A) Heat balance
 - (B) Boiling point elevation
 - (C) Rate of heat transfer
 - (D) Capacity
 - (E) Answer not known
88. Name the device used to measure the local or point velocity by measuring the difference between impact and static pressure
- (A) Orifice meter
 - (B) Venturimeter
 - ☒ (C) Pitot tube
 - (D) Rotameter
 - (E) Answer not known
89. Name the type of manometer used to measure the pressure differences between the fluids
- (A) Mercury barometer
 - (B) Simple manometer
 - ☒ (C) Two-fluid manometer
 - (D) Piston and spring
 - (E) Answer not known

93. The ratio of inertial forces to elastic forces is called _____ number.
- (A) Reynolds ☒ (B) Mach
 (C) Euler (D) Weber
 (E) Answer not known
94. At a given temperature and pressure, a fluid possesses a definite density. If the density changes only slightly with moderate changes in temperature and pressure, the fluid is said to be
- (A) Compressible ☒ (B) Incompressible
 (C) Ideal fluid (D) Non ideal fluid
 (E) Answer not known
95. Helmholtz free energy is defined as
- where, U is internal energy
 T is temperature
 S is Entropy
- ☒ (A) $A = U - TS$ (B) $A = U + TS$
 (C) $G = H - TS$ (D) $G = H + TS$
 (E) Answer not known
96. Power plant generates steam at 600 K and discards heat to river at 300 K. The actual thermal efficiency of the plant if operating at 70 percent of the maximum possible value is
- (A) 1 (B) 0.5
☒ (C) 0.35 (D) 0.2
 (E) Answer not known

97. The residual Gibbs Energy G^R is provided by the expression

(A) $RT \int_0^P (z) \frac{dp}{p}$ (B) $RT \int_0^P (z+1) \frac{dp}{p}$

☒ (C) $RT \int_0^P (z-1) \frac{dp}{p}$ (D) $RT \frac{dp}{p}$

(E) Answer not known

98. The relation among reduced properties, P_r , T_r and V_r is also known as

(A) Universal gas law (B) Compressibility factor

☒ (C) Law of corresponding states (D) Cubic equation of state

(E) Answer not known

99. The ideal solution is a fluid that obeys

☒ (A) Lewis Randell rule

(B) Gibbs-Duhem equation

(C) Raoult's law

(D) First law of thermodynamics

(E) Answer not known

100. Standard Gibb's energy change of reaction ΔG° is related to equilibrium constant K of a reaction by the expression

(A) $RT / \ln K$

(B) $\ln K / RT$

(C) $RT \ln K$

☒ (D) $-RT \ln K$

(E) Answer not known

101. A three stage centrifugal pump delivers 3.6 m^3 of water per minute when running at 920 rpm. Determine the specific speed. Take manometric head = 25.23 m
- (A) 20 (B) 25
(C) 30 (D) 35
(E) Answer not known
102. In general, for a centrifugal pump running at speed N and giving a discharge Q , the manometric head is expressible in the form :
- [A, B, C $\rightarrow$ constants]
- (A) $H_{\text{mano}} = AN + BQ + CQ$ (B) $H_{\text{mano}} = AN^2 + BN + CQ$
(C) $H_{\text{mano}} = AN^2 + BNQ + CQ^2$ (D) $H_{\text{mano}} = AN^2 + BQ + CN$
(E) Answer not known
103. A centrifugal pump has whirl velocity and flow velocity at exit are 11.75 m/s and 2.8 m/s respectively. Find the velocity head at exit.
- (A) 8.53 m of water (B) 7.44 m of water
(C) 6.13 m of water (D) 5.27 m of water
(E) Answer not known
104. The impeller of a centrifugal pump having external diameter is 500 mm and running at 1200 rpm works against a head of 48 m. The whirl velocity at the outlet is 27.83 m/s. Find the manometric efficiency.
- (A) 53.86% (B) 72.12%
(C) 68.43% (D) 66.53%
(E) Answer not known

105. A turbine is to operate under a head of 25 m at 200 rpm. Determine the speed of the turbine under a head of 20 m.

- (A) 143.71 rpm ☒ (B) 178.88 rpm
(C) 153.53 rpm (D) 162.31 rpm
(E) Answer not known

106. A vertical shaft Francis turbine runs at 420 rpm while the discharge is $15 \text{ m}^3/\text{s}$. The velocity and pressure head at entrance of the runner are 10 m/s and 230 m respectively. The elevation above the tail race is 5 m. Calculate total head across the turbine

- (A) 216.52 m (B) 539.35 m
☒ (C) 240.09 m (D) 725.61 m
(E) Answer not known

107. The following data related to a double overhang pelton unit :

Jet ratio = 12

Size of jet = 300 mm

Find the mean diameter of runner :

- (A) 4.2 m ☒ (B) 3.6 m
(C) 5.3 m (D) 4.8 m
(E) Answer not known

108. In a _____ turbine, water flow takes place tangentially.

- (A) Kaplan turbine (B) Francis turbine
(C) Radial turbine ☒ (D) Pelton turbine
(E) Answer not known

109. The Darcy – Weisbach friction factor 'f' which is a direct measure of resistance to flow in pipes depends on which of the following?
- (A) Relative roughness, velocity and viscosity
 - (B) Relative roughness, diameter and viscosity
 - (C) Roughness height, diameter and velocity
 - ☒ (D) Roughness height, diameter, velocity and kinematic viscosity
 - (E) Answer not known
110. _____ profile occurred in turbulent flow through a pipe.
- (A) Parabolic profile
 - ☒ (C) Logarithmic profile
 - (B) Square profile
 - (D) Cubic profile
 - (E) Answer not known
111. Thickness of boundary layer _____ as distance from leading edge increases.
- (A) Decreases
 - ☒ (B) Increases
 - (C) No change
 - (D) Boundary layer thickness has no effect on leading edge
 - (E) Answer not known
112. Two parallel plates kept 100 mm apart have laminar flow of oil between them with a maximum velocity of 1.5 m/s. Calculate the discharge per meter width.
- (A) $0.4 \text{ m}^3/\text{s per m}$
 - ☒ (B) $0.1 \text{ m}^3/\text{s per m}$
 - (C) $0.6 \text{ m}^3/\text{s per m}$
 - (D) $0.8 \text{ m}^3/\text{s per m}$
 - (E) Answer not known

113. A fluid flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 210 N/m^2 . Find the pressure gradient
- (A) $-9500 \text{ N/m}^2 \text{ per m}$ (B) $-7500 \text{ N/m}^2 \text{ per m}$
(C) $-6700 \text{ N/m}^2 \text{ per m}$ ~~(D)~~ $-8400 \text{ N/m}^2 \text{ per m}$
(E) Answer not known
114. Flow of gases through orifices, nozzles, gas turbine, etc., is an example of
- (A) Incompressible flow (B) Rotational flow
~~(C)~~ Compressible flow (D) Irrotational flow
(E) Answer not known
115. The concept of stream function which is based on the principle of continuity is applicable to
- (A) irrotational flow only ~~(B)~~ two – dimensional flow only
(C) three – dimensional flow (D) uniform flow only
(E) Answer not known
116. The co-efficient of discharge of an orificemeter is _____ that of a venturimeter.
- (A) equal to
~~(B)~~ smaller than
(C) more than
(D) orificemeter does not have a coefficient of discharge
(E) Answer not known

117. If a body sinks in a fluid, which of the following is true?

- ☒ (A) Buoyant force is less than weight
- (B) Buoyant force is equal to weight
- (C) Buoyant force is greater than weight
- (D) Fluid density is greater than body density
- (E) Answer not known

118. If the dynamic viscosity of a fluid is 0.01 Pa.s and its density is 1000 Kg/m³, what is its kinematic viscosity?

- ☒ (A) $1 \times 10^{-5} \text{ m}^2/\text{s}$
- (B) $1 \times 10^{-2} \text{ m}^2/\text{s}$
- (C) $1 \times 10^{-3} \text{ m}^2/\text{s}$
- (D) $1 \times 10^{-4} \text{ m}^2/\text{s}$
- (E) Answer not known

119. For power transmitted through a pipeline, the maximum transmission efficiency equals

- (A) 20%
- (B) 45%
- ☒ (C) 66.67%
- (D) 71.5%
- (E) Answer not known

120. Ball pen works on the principle of

- (A) Viscosity
- (B) Shear stress
- (C) Boyle's law
- ☒ (D) Capillary action
- (E) Answer not known

121. Which of the following forms of water will have the highest value of thermal conductivity?
- (A) Boiling water (B) Steam
(C) Solid ice (D) Melting ice
(E) Answer not known
122. Air at 20° C blows over a hot plate 50 by 75 cm maintained at 250° C. The convection heat transfer coefficient is 25 W/m² °C. Calculate the heat transfer.
- (A) 1.156 kW (B) 2.156 kW
(C) 3.156 kW (D) 4.156 kW
(E) Answer not known
123. For a perfectly black body
- (A) $\alpha = Z = 0, \rho = 1$ (B) $\alpha = \rho = 0, Z = 1$
(C) $\alpha = 1, \rho = 0, Z = 0$ (D) $\alpha = \rho = Z = 0$
(E) Answer not known
124. The direction of heat transfer is in accordance with
- (A) First law of thermodynamics
(B) Second law of thermodynamics
(C) Faraday's law
(D) Stefan's law
(E) Answer not known

125. A steel rectangular container having walls 16 mm thick is used to store gaseous hydrogen at elevated pressure. The molar concentrations of hydrogen in the steel at the inside and outside surfaces are 1.2 kg mole/m^3 and zero respectively. Assuming the diffusion coefficient for hydrogen in steel as $0.248 \times 10^{-12} \text{ m}^2/\text{s}$. Calculate the molar diffusion flux for hydrogen through the steel.
- (A) $15.6 \times 10^{-12} \text{ kg mole/s.m}^2$
 - (B) $16.6 \times 10^{-12} \text{ kg mole/s.m}^2$
 - (C) $17.6 \times 10^{-12} \text{ kg mole/s.m}^2$
 - ☒ (D) $18.6 \times 10^{-12} \text{ kg mole/s.m}^2$
 - (E) Answer not known
126. Why are baffles provided in heat exchangers?
- (A) To reduce heat transfer rate
 - ☒ (B) To increase heat transfer rate
 - (C) To remove dirt
 - (D) To reduce vibrations
 - (E) Answer not known
127. The inner surface of the plane brick wall is at 50° C and the outer surface is at 25° C . Calculate the rate of heat transfer per m^2 of the surface area of the wall, which is 220 mm thick. The thermal conductivity of the bricks is $0.51 \text{ W/m}^\text{k}$.
- (A) 20.65 W/m^2
 - (B) 32.75 W/m^2
 - (C) 47.62 W/m^2
 - ☒ (D) 57.95 W/m^2
 - (E) Answer not known

128. The basic law of heat conduction is called
- (A) Newton's law of cooling ☒ (B) Fourier's law
(C) Kirchhoff's law (D) Stefan's law
(E) Answer not known
129. If the rate of heat transfer is variable, it is known as
- (A) Steady state heat transfer
☒ (B) Un-steady state heat transfer
(C) Uniform heat transfer
(D) Non-uniform heat transfer
(E) Answer not known
130. An enclosure consists of four surfaces 1, 2, 3 and 4. The view factors for radiation heat transfer are $F_{11} = 0.1$, $F_{12} = 0.4$ and $F_{13} = 0.25$. The surface areas A_1 and A_4 are 4 m^2 and 2 m^2 respectively. The view factor F_{41} is
- (A) 0.10 (B) 0.25
☒ (C) 0.50 (D) 0.75
(E) Answer not known
131. Glass is
- ☒ (A) transparent at short wavelengths
(B) opaque for high temperature radiation
(C) opaque for low temperature radiation
(D) transparent at long wavelengths
(E) Answer not known

132. Which of the following is incorrect regarding combustion of hydrogen?

- (1) 2 volumes of H_2 combined with 1 volume of O_2 gives 3 volumes of H_2O
- (2) Volumetric expansion takes place during combustion of hydrogen
- (A) (1) only
- (B) (2) only
- ☒ (C) Both (1) and (2) are incorrect
- (D) Both (1) and (2) are correct
- (E) Answer not known

133. Which of the following are true regarding EGR?

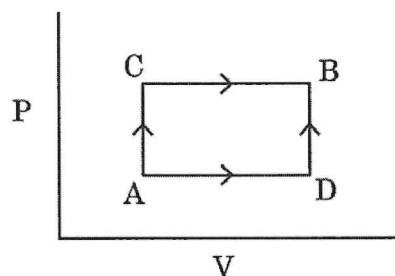
- (1) It is the most effective way of reducing emission
- (2) It increases thermal efficiency
- (3) It increases HC emission
- (A) (1) and (2) only
- ☒ (B) (1) and (3) only
- (C) (2) and (3) only
- (D) (1), (2) and (3) are correct
- (E) Answer not known

134. The inversion temperature of Joule-Thompson expansion applied to a Vander-Waal's gas equation is

- (A) $\frac{2b}{Ra}$
- ☒ (B) $\frac{2a}{Rb}$
- (C) $\frac{Rb}{2a}$
- (D) $\frac{Ra}{2b}$
- (E) Answer not known

135. A balloon is inflated by filling compressed air to a volume of 10 m^3 . The work done by the balloon upon the atmosphere during the process when the barometer reads 760 mmHg is
- (A) 1.01325 kJ (B) 10.1325 kJ
 (C) 101.325 kJ (D) 1013.25 kJ
 (E) Answer not known

136. A system is taken from State A to State B via path A-C-B in the course of which 80 kJ of heat flows into the system which executes 30 kJ of work. If the same State B is reached via the path A-D-B during which the work done by the system is 10 kJ , the amount of heat flow into the system will be



- (A) 100 kJ (B) 80 kJ
 (C) 70 kJ (D) 60 kJ
 (E) Answer not known
137. For a given fuel and given pressure and the temperature of the reactants, the maximum adiabatic flame temperature that can be achieved is with a
- (A) Rich mixture (B) Lean mixture
 (C) Stoichiometric mixture (D) Equivalence mixture
 (E) Answer not known

138. Which of the following are true regarding flashed steam system?

- (1) Requires larger total mass flow rates.
- (2) Lesser corrosion of piping.
- (3) Temperature and pressure of the water may not be sufficient to produce flash steam.
- (A) (1) and (2) only
- (B) (2) and (3) only
- ☒ (C) (1) and (3) only
- (D) (1), (2) and (3)
- (E) Answer not known

139. For a closed system undergoing a polytropic expansion, the work output

- (1) is independent of n
- (2) increases with the increase of n
- (3) increases with the decrease of n
- (4) is maximum when $n = \infty$ (infinity)
- (5) is maximum when $n = 0$
- (A) (1), (3) and (4)
- (B) (1), (3) and (5)
- (C) (2) and (4)
- ☒ (D) (3) and (5)
- (E) Answer not known

140. Which one of the following is not belongs to the low grade energy?

- (A) Heat available from combustion of fuels
- ☒ (B) Kinetic energy of jets
- (C) Thermal energy
- (D) Nuclear energy
- (E) Answer not known

141. A ball and a Socket Joint form a

- (A) turning pair
- (B) rolling pair
- (C) sliding pair
- ~~(D) spherical pair~~
- (E) Answer not known

142. The amount of energy absorbed by a flywheel is found from

- (A) Speed – Energy diagram
- (B) Velocity – Crank angle diagram
- (C) Acceleration – Crank angle diagram
- ~~(D) Torque – Crank angle diagram~~
- (E) Answer not known

143. Two springs are connected in series with a stiffness of K_1 and K_2 respectively. What is frequency of vibrating system with mass m , if

(a) $K_1 = K_2$ and (b) $K_1 = 2K_2$.

- (A) $\frac{1}{2\pi} \sqrt{\frac{2m}{K_2}}, \frac{1}{2\pi} \sqrt{\frac{3m}{2K_2}}$
- (B) $\frac{1}{2\pi} \sqrt{\frac{2K_2}{m}}, \frac{1}{2\pi} \sqrt{\frac{3K_2}{2m}}$
- (C) $\frac{1}{2\pi} \sqrt{\frac{2K_2}{3m}}, \frac{1}{2\pi} \sqrt{\frac{K_2}{2m}}$
- ~~(D) $\frac{1}{2\pi} \sqrt{\frac{K_2}{2m}}, \frac{1}{2\pi} \sqrt{\frac{2}{3} \frac{K_2}{m}}$~~
- (E) Answer not known

144. Match the following :

- | | |
|--|---------------------------------|
| (1) Bolt and nut | (a) Higher pair |
| (2) Crank shaft and bearing | (b) Lower pair |
| (3) Cam and follower | |
| (4) Toothed gear | |
| (A) (1, b) (2, b) (3, a) (4, a) | (B) (1, a) (2, b) (3, a) (4, b) |
| (C) (1, a) (2, a) (3, b) (4, b) | (D) (1, b) (2, a) (3, b) (4, a) |
| (E) Answer not known | |

145. _____ is the device used to transmit the rotary motion of one shaft to another when desired. The axes of two shafts are coincident.

- | | |
|-----------------------|----------------|
| (A) Clutch | (B) Gear |
| (C) CAM | (D) Belt drive |
| (E) Answer not known | |

146. If the lines of action of three or more forces intersect at a point, it is known as _____ point.

- | | |
|----------------------|----------------------------|
| (A) equilibrium | (B) zero |
| (C) central | (D) concurrency |
| (E) Answer not known | |

147. Match the following :

- | | |
|---------------------|---|
| (a) Undamped | (1) damping factor < 1 |
| (b) Under damped | (2) Time period = $2\pi/\text{damping frequency}$ |
| (c) Critical damped | (3) damping factor = 0 |
| (d) Over damped | (4) Timeperiod = infinity |
| | (5) Damping factor > 1 |
| | (6) Damping factor = 1 |
| | (7) Time period = $\frac{2\pi}{\text{natural frequency}}$ |

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 1,7 | 3,2 | 5,4 | 6,7 |
| (B) | 3,7 | 1,2 | 6,4 | 5,4 |
| (C) | 5,2 | 5,7 | 1,7 | 3,4 |
| (D) | 6,7 | 6,2 | 3,2 | 1,2 |
| (E) | Answer not known | | | |

148. Match the following :

- | | |
|--|----------------------------|
| (a) Critical damping coefficient (C_c) | (1) $\frac{C}{2\sqrt{Km}}$ |
| (b) Damping coefficient (C) | (2) $\xi W_n T_d$ |
| (c) Damping factor (ξ) | (3) $2\xi m W_n$ |
| (d) Logarithmic decrement (δ) | (4) $2\sqrt{Km}$ |

Where K = stiffness coefficient

m = mass

T_d = damping time period

W_n = natural frequency

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 4 | 3 | 2 | 1 |
| (B) | 1 | 2 | 3 | 4 |
| (C) | 4 | 3 | 1 | 2 |
| (D) | 1 | 2 | 4 | 3 |
| (E) | Answer not known | | | |

149. The velocity of the belt for maximum power is :

Where m = mass of the belt in Kg per metre length

- | | |
|--------------------------------------|---------------------------|
| (A) $\sqrt{\frac{T}{3m}}$ | (B) $\sqrt{\frac{T}{4m}}$ |
| (C) $\sqrt{\frac{T}{5m}}$ | (D) $\sqrt{\frac{T}{6m}}$ |
| (E) Answer not known | |

150. Moment of inertia of a semi-circle about its XX-axis is given by
- (A) $0.22 r^3$ (B) $0.11 r^4$
(C) $0.14 r^4$ (D) $0.2 r^4$
(E) Answer not known
151. The centroid of a semicircle of radius R about its centroidal axis parallel to its diametric axis is
- (A) $3R/4\pi$ (B) $3R/8\pi$
(C) $4R/\pi$ (D) $4R/3\pi$
(E) Answer not known
152. Which of the following theories is suitable for ductile materials?
- (A) Maximum principle stress theory
(B) Maximum principle strain theory
(C) Maximum shear stress theory
(D) Distortion energy theory
(E) Answer not known

153. Match the following :

- | | |
|----------------------------------|---------------------|
| (a) Rivet head-snap head | 1. Maximum strength |
| (b) Rivet head-counter sunk head | 2. Hand hammering |
| (c) Rivet head-conical head | 3. Ship building |
| (d) Rivet head-Pan head | 4. Structural work |

- | | (a) | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A) | 1 | 2 | 3 | 4 |
| (B) | 4 | 3 | 2 | 1 |
| (C) | 1 | 4 | 2 | 3 |
| (D) | 4 | 2 | 3 | 1 |
| (E) | Answer not known | | | |

154. Which one is not a positive locking device?

- | | |
|----------------------|------------------------------|
| (A) Cotter pin | (B) Spring wire lock |
| (C) Tongued washer | (D) Spring washer |
| (E) Answer not known | |

155. A rod of length l and diameter d is subjected to a tensile tone 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 Poisson's ratio
 (E) Answer not known

156. A cantilever of length (l) is carrying a uniformly distributed load of (w) per unit run over the whole span. The deflection of the free end is given as

(A) $wl^3 / 4EI$

(B) $wl^2 / 4EI$

☒ (C) $wl^4 / 8EI$

(D) $wl^4 / 16EI$

(E) Answer not known

157. Two shaft will have equal strength, if

(A) Diameter of both the shafts is same

(B) Angle of twist of both the shafts is same

(C) Material of both the shafts is same

☒ (D) Twisting moment of both shafts is same

(E) Answer not known

158. Connecting rod of an I.C. Engine subjected to

☒ (A) Tensile $\times$ Compressive stress

(B) Tensile $\times$ Shear stress

(C) Shear $\times$ bending stress

(D) Bending $\times$ Compressive stress

(E) Answer not known

159. Torsional resilience of a solid shaft is

☒ (A) $U = \frac{\tau^2}{4C} \times V$

(B) $U = \frac{\tau^3}{4C} \times V$

(C) $U = \frac{\tau^2}{2C} \times V$

(D) $U = \frac{\tau^3}{2C} \times V$

(E) Answer not known

160. The distance between the center of a rivet and the center of the adjacent rivet along the same row is called as
- (A) ☒ Pitch (B) Back pitch
 (C) Gauge line (D) Gauge distance
 (E) Answer not known
161. Bolzano method used for solving algebraic and transcendental equation is also known as
- (A) Secant method (B) ☒ Bisection method
 (C) Falsi method (D) Root squaring method
 (E) Answer not known
162. The order of convergence of Newton's method of solving non linear equation is
- (A) 1 (B) ☒ 2
 (C) 3 (D) 4
 (E) Answer not known
163. The solution for $\frac{dy}{dx} = f(x, y)$ with initial condition $y(x_0) = y_0$ of the form $y^{(n)} = y_0 + \int_{x_0}^x f(x, y^{(n-1)}) dx$ and this formula is called as
- (A) Taylor's formula (B) Newton's formula
 (C) ☒ Picard's iteration formula (D) Euler method
 (E) Answer not known

164. Simpson's $3/8^{\text{th}}$ rule is applicable to solve $\int_{x_0}^{x_n} y(dx)$, $n = \frac{x - x_0}{h}$ where h is interval of differencing only when n is
- (A) Multiple of 5 (B) Multiple of 3
 (C) Multiple of 2 (D) Multiple of 8
 (E) Answer not known
165. Hyperbolic equation is represented in the form of
- (A) $u_{xx} + u_{yy} = 0$ (B) $u_{xx} + u_{yy} = f(x, y)$
 (C) $a^2 u_{xx} - u_{tt} = 0$ (D) $a u_{xx} = u_{x,t}$
 (E) Answer not known
166. The matrix Eigen value problem can be stated in the form of
- (A) $Hx = \lambda x$ (B) $H - \lambda = 0$
 (C) $H - \lambda I = 0$ (D) $(H + \lambda I)x = 0$
 (E) Answer not known
167. The error in Simpson one third formula to solve $\int_{x_0}^{x_n} f(x)dx$ with h as interval of differencing will be in the order of
- (A) h (B) h^2
 (C) h^3 (D) h^4
 (E) Answer not known

168. What is a common cause of catalyst deactivation?
- (A) Poisoning (B) Sintering
(C) Fouling (D) All the above
(E) Answer not known
169. In the chemical reaction, no fluid enters or leaves the reaction mixture during reaction time is called as
- (A) Ideal batch reactor
(B) Plug flow reactor
(C) Continuous stirred tank reactor
(D) Fluidized reactor
(E) Answer not known
170. In non-ideal flow, the two-phase system, A stream of solids always behaves as a
- (A) Micro fluid (B) Macro fluid
(C) Ideal fluid (D) Flowing fluid
(E) Answer not known
171. Let A be a square matrix of order 3 and λ be a scalar (eigen value), the column matrix $X = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$ which satisfies $(A - \lambda_1)x = 0$ is called
- (A) Eigen vector (B) Eigen values
(C) Eigen function (D) Vectors
(E) Answer not known

172. Let $u = f(x, y)$ be a function of two independent variables. Differentiating u with respect to ' x ' keeping y constant is known as
- (A) ☒ The partial differential co-efficient of u w.r. to ' x '.
 - (B) Eigen value
 - (C) Eigen function
 - (D) Algebraic equations
 - (E) Answer not known
173. The reactant may produce aside product which deposits on and of deactivates the surface, this phenomena is called as
- (A) Series deactivation
 - (B) Side-by-side deactivation
 - (C) ☒ Parallel deactivation
 - (D) Independent deactivation
 - (E) Answer not known
174. The most common example of a unimolecular reaction is
- (A) ☒ Radioactive decay
 - (B) Combustion of coal
 - (C) Synthesis of ammonia
 - (D) Manufacture of soap
 - (E) Answer not known
175. Name the type of reactor, in which the composition of the fluid varies from point to point along a flow path
- (A) Mixed flow
 - (B) Batch
 - (C) Semi batch
 - (D) ☒ Plug flow
 - (E) Answer not known

176. An impurity in the feed may deposit on and deactivate the surface is called as
- (A) Series deactivation (B) Parallel deactivation
(C) Independent deactivation ☒ (D) Side-by-side deactivation
(E) Answer not known
177. Cracking of crude oil is an example of
- (A) Non catalytic reaction ☒ (B) Catalytic reaction
(C) Homogeneous reaction (D) Enzyme reaction
(E) Answer not known
178. The fluid elements of a single flowing stream can mix with each other by delayed in their flow through the vessel is termed as
- (A) Earlier mixing
☒ (B) Late mixing
(C) State of Aggregation
(D) Residence Time distribution
(E) Answer not known
179. In an ideal Plug Flow Reactor (PFR), the composition of reactants :
- ☒ (A) Changes along the length of the reactor
(B) Remains constant through out the reactor
(C) Is same as the exit composition
(D) Is same at every cross section
(E) Answer not known

180. Which reactor gives the highest conversion for a first order reaction with the same resistance time?
- (A) Plug Flow Reactor
 - (B) Batch Reactor
 - (C) Fluidized bed Reactor
 - (D) Continuous stirred tank reactor
 - (E) Answer not known
181. The secondary texture (or) waviness on surface results due to
- (A) Normal action of the tool in production process
 - (B) Vibrations and non-uniformity of cutting process
 - (C) Flaws in material
 - (D) Dominant direction of tool marks (lay)
 - (E) Answer not known
182. Relative Precision Index (RPI) used to evaluate the process capability compatibility is defined as
- (A) Average Range / Tolerance
 - (B) Tolerance / Average Range
 - (C) Number of Samples / Average range
 - (D) Number of Samples / Tolerance
 - (E) Answer not known
183. Statistical quality control was developed by
- (A) Frederick Taylor
 - (B) Walter Shewhart
 - (C) George Danzig
 - (D) W.E. Deming
 - (E) Answer not known

184. In limits and fits system, basic shaft system is one whose
- (A) Lower deviation is zero
 - ☒ (B) Upper deviation is zero
 - (C) Minimum clearance is zero
 - (D) Maximum clearance is zero
 - (E) Answer not known
185. The control charts for attribute is concerned with
- ☒ (A) Qualitative checking of defects
 - (B) Direct measurement of the variable for control
 - (C) Checking if the variable is out of control
 - (D) Actual measurement of the parameter, comparing with a standard
 - (E) Answer not known
186. Surface roughness on a drawing is represented by
- (A) Squares
 - ☒ (C) Triangles
 - (B) Circles
 - (D) Dots
 - (E) Answer not known
187. To improve the self lubricating capacity of a powder metallurgy part, the following finishing operation is used
- (A) Repressing
 - (B) Sizing
 - (C) Infiltration
 - ☒ (D) Impregnation
 - (E) Answer not known

188. Addition of Magnesium to Cast iron increases its

- (A) Hardness
- ☒ (B) Ductility and strength in tension
- (C) Corrosion resistance
- (D) Creep strength
- (E) Answer not known

189. Tempered Martensite is a combination of

- (A) Ferrite and austenite
- ☒ (B) Ferrite and Carbide
- (C) Ferrite and Cementite
- (D) Ferrite and Bainite
- (E) Answer not known

190. The Fick's first law of diffusion is given by

- (A) $\frac{dm}{dt} = \frac{d}{dx} \left(D \cdot \frac{dc}{dx} \right)$
- (B) $\frac{dm}{dt} = D \cdot A \cdot \frac{dc}{dx}$
- ☒ (C) $\frac{dm}{dt} = - D \cdot A \cdot \frac{dc}{dx}$
- (D) $\frac{dm}{dt} = D \cdot \frac{dc}{dx}$
- (E) Answer not known

191. An atmospheric pressure (Pressure arbitrary chosen), a material of unknown composition shown four phases in equilibrium at 710 °C. What is the minimum number of components in the system?

- (A) 1
- (B) 2
- ☒ (C) 3
- (D) 4
- (E) Answer not known

192. The process of introducing Carbon and Nitrogen into a solid ferrous alloy is known as
- (A) ☒ Carbonitriding
 - (B) Nitriding
 - (C) Carburizing
 - (D) Cyaniding
 - (E) Answer not known
193. If f = feed per revolution of drill, L = Length of hole to be drilled and N = rpm of drill, then drilling time (T) in minutes is given by
- (A) $T = N \times L \times f$
 - (B) $T = N \times L / f$
 - (C) $T = f / N \times L$
 - (D) ☒ $T = L / N \times f$
 - (E) Answer not known
194. Inter electrode gap in Electro Chemical Grinding [ECG] is controlled by
- (A) Controlling the pressure of electrolyte flow
 - (B) Controlling the applied static load
 - (C) ☒ Controlling the size of diamond particle in the wheel
 - (D) Controlling the texture of the workpiece
 - (E) Answer not known
195. Internal gears are made by
- (A) Hobbing
 - (B) ☒ Shaping with Pinion cutter
 - (C) Shaping with Rack cutter
 - (D) Milling
 - (E) Answer not known

196. Deep hole drilling of small diameter, say 0.2 mm is done with EDM by selecting the tool material as
- (A) Copper wire
 - (B) Tungsten wire
 - (C) Brass wire
 - ☒ (D) Tungsten carbide
 - (E) Answer not known
197. Brasses and Bronzes are welded by :
- (A) Neutral flame
 - (B) Reducing flame
 - ☒ (C) Oxidising flame
 - (D) Carburizing flame
 - (E) Answer not known
198. For press forging which one of the following statement is correct?
- (A) Press forging is done with the help of hammer
 - (B) Small parts like rivets, bolts can not be produced
 - ☒ (C) Shape of the product is accurate
 - (D) Can not be used for mass production
 - (E) Answer not known
199. During the cupola melting of cast iron, which one of the following element is picked up from the furnace?
- (A) Manganese
 - (B) Phosphorous
 - ☒ (C) Sulphur
 - (D) Silicon
 - (E) Answer not known

200. Which one of the following metals is not suitable for testing with Ultrasonics?

(A) Cu

(B) Al

☒ (C) Cast Iron (CI)

(D) Stainless Steel

(E) Answer not known
