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TRB Polytechnic Lecturer Exam 2017
Mechanical Engineering

1. Which one of the following is **not** a casual forecasting method ?

    (A) Trend adjusted exponential smoothing

    (B) Econometric models

    (C) Linear regression

    (D) Multiple regression

2. Which one of the following scheduling measures is **not** related to due date or delivery time ?

    (A) Flow time   (B) Tardiness

    (C) Lateness   (D) Number of tardy jobs

3. The correct sequence of operations in production planning and control is :

    (A) Routing - Scheduling - Despatching - Follow up

    (B) Scheduling - Follow up - Routing - Despatching

    (C) Despatching - Scheduling - Routing - Follow up

    (D) Routing - Follow up - Despatching - Scheduling

4. The rent for the stores where materials are kept falls under :

    (A) Set-up cost   (B) Shortage cost

    (C) Holding cost   (D) Ordering cost

5. In a fixed order quantity-constant lead time inventory system, the safety stock is dependent on :

    (A) Service level

    (B) Demand variation during lead time

    (C) Service level and demand variation during lead time

    (D) Order quantity

6. Torque acting on a body of moment of Inertia (I) and angular acceleration (α) is :

    (A) $2 I \alpha$ (B) $2^2 I \alpha$ (C) $2^3 I \alpha$ (D) $I \alpha$

7. Virtual work refers to :
   (A) Virtual work done by Virtual forces
   (B) Virtual work done by Actual forces
   (C) Actual work done by Actual forces
   (D) Actual work done by Virtual forces

8. A body moving from rest along a straight line with an acceleration which equation is

   $a = 4 - \dfrac{t^2}{g}$ where a-m/s^2, t-seconds. Its velocity and distance travelled in 6 seconds :

   (A) 10 m/s, 40 m   (B) 12 m/s, 50 m   (C) 16 m/s, 60 m   (D) 14 m/s, 55 m

9. Co-efficient of expansion and modulus of elasticity for steel and aluminum are :
   (A) 12×10^{-6}/°C, 18×10^{-6}/°C, 200 Gpa, 80 Gpa
   (B) 14×10^{-6}/°C, 20×10^{-6}/°C, 220 GPa, 90 Gpa
   (C) 11×10^{-6}/°C, 17×10^{-6}/°C, 190 GPa, 70 Gpa
   (D) 13×10^{-6}/°C, 19×10^{-6}/°C, 210 Gpa, 80 Gpa

10. If a body is stressed within its elastic limit, the lateral Strain bears a constant ratio to the linear Strain. This constant known as :
    (A) Poisson's Ratio   (B) Volume Ratio
    (C) Stress Ratio   (D) Strain Ratio

11. If one litre of a fluid has a mass of 7.5 kg then its specific gravity is :
    (A) 0.75   (B) 7.5   (C) 75   (D) 750

12. A plate 0.02 mm distant from a fixed plate moves at 20 cm/s requires a shear stress of 4 N/m^2 to maintain this speed. Viscosity of fluid available inside these plates is :

    (A) 4×10^{-4} poise   (B) 4×10^{-6} poise   (C) $4 \times 10^{-5} \dfrac{\text{Ns}}{\text{m}^2}$ (D) $4 \times 10^{-4} \dfrac{\text{Ns}}{\text{m}^2}$

13. It is required to find pressure difference between two horizontal pipes through which water is flowing using inverted manometer. Two manometric fluids with specific gravities 13.6 and 0.8 and are available.

    Which manometric fluid is to be used now ?
    (A) Fluid with specific gravity 13.6   (B) Fluid with specific gravity 0.8
    (C) Both fluids can be used   (D) None can be used

14. A continuous line drawn through the fluid so that it has the direction of velocity vector at every point is known as :

   (A) Streak line   (B) Path line   (C) Stream tube   (D) Stream line

15. Which of the following devices is having working principle based on Bernoulli equation :

   (A) Venturi meter   (B) Pitot tube   (C) Orifice meter   (D) All of the above

16. Which of the following is not a point function of the system.

   (A) Temperature   (B) Pressure   (C) Specific volume (D) Heat

17. During melting the volume of a pure substance other than water :

   (A) Decreases   (B) Increases

   (C) Remains constant   (D) First increases and then decreases

18. The work done during an isothermal process is :

   (A) $P_1 V_1 \log_e\left(\dfrac{v_2}{v_1}\right)$ (B) $P_1 V_2 \log_e\left(\dfrac{v_1}{v_2}\right)$

   (C) $P_2 V_2 \log_e\left(\dfrac{P_2}{P_1}\right)$ (D) $\dfrac{P_2 V_2 - P_1 V_1}{n-1}$

19. For winter air conditioning, the relative humidity should not be more than :

   (A) 60%   (B) 75%   (C) 40%   (D) 90%

20. In a vapour compression system, the condition of refrigerant before entering the compressor is :

   (A) Saturated liquid   (B) Wet vapour

   (C) Superheated vapour   (D) Dry saturated vapour

21. Metre is defined as distance between the centre portion of two lines engraved on polished surface of a bar of :

   (A) 90% platinum and 10% irridium at 15°C

   (B) 90% platinum and 10% irridium at 0°C

   (C) 75% platinum and 25% irridium at 15°C

   (D) 75% platinum and 25% irridium at 0°C

22. The type of energy used in electrical discharge wire cutting is :

   (A) Mechanical Energy   (B) Chemical Energy

   (C) Electrical Energy   (D) Thermal Energy

23. The size by which it is referred to as a matter of convenience :

   (A) Actual size   (B) Basic size   (C) True size   (D) Nominal size

24. Four parts with the following dimensions are to be assembled in random. What should be tolerance on the assembled length ?

   Part $1 = 25.32^{+0.02}_{-0.01}$ mm   Part $2 = 18.91 \pm 0.03$ mm

   Part $3 = 62.17^{+0.05}_{-0.07}$ mm   Part $4 = 46.25 \pm 0.04$ mm

   (A) $152.65^{+0.15}_{-0.14}$ (B) 152.65 (C) $152.65^{+0.14}_{-0.15}$ (D) $145.52^{+0.02}_{-0.07}$

25. Why the Bezier curve is smoother than the cubic spline curve ?

   (A) Because of higher order derivatives

   (B) Because of control points

   (C) Because the curve passes through all the data points

   (D) All of the above

26. If $A = \begin{pmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{pmatrix}$, the eigen values of adj A and of $A^2 - 2A + I$ are :

(A)   2, 4, 3 and 49, 121, 25

(B)   8, 12, 6 and 49, 121, 25

(C)   4, 16, 9 and 16, 256, 81

(D)   8, 12, 6 and -49, 100, 12

27. The function $f(x) = \dfrac{\ln x + \tan^{-1} x}{x^2 - 1}$ is :

(A)   Continuous in the interval $(-\infty, \infty)$

(B)   Continuous in the intervals $(-\infty, -1), (-1, 1)(1, \infty)$

(C)   Continuous in the interval $(0, 1)$ and $(1, \infty)$

(D)   Continuous in the interval $(-\infty, \infty)$, except at integer points

28. The extreme values of $f(x, y) = y^2 - x^2$ are :

(A)   3, -2

(B)   0

(C) $-1, 1$

(D) f has no extreme value

29. A student takes an 18 question multiple choice exam, with four choices per question. Suppose one of the choices is obviously incorrect, and the student makes an "educated" guess of the remaining choices, then the expected number of correct answer is

(A)   9

(B)   10

(C)   8

(D)   6

30. Simpson's $\frac{1}{3}$rd rule and direct integration give the same result if :

(A)   The entire curve is a cycloid

(B)   The entire curve is a hyperbola

(C)   The entire curve is itself a parabola

(D)   The entire curve is a straight line

31. In a four bar Mechanism, if the shortest link is fixed, the Mechanism obtained is known as :

    (A) Double rocker Mechanism   (B) Six bar Mechanism

    (C) Double Crank Mechanism   (D) Crank and rocker Mechanism

32. Rotating shaft's tend to vibrate violently in _____ at critical speeds.

    (A) Longitudinal direction   (B) Transverse direction

    (C) Torsional direction   (D) None of the above

33. Damping is beneficial only when :

    (A) $\dfrac{\omega}{\omega_n}=1$ (B) $\dfrac{\omega}{\omega_n}<1$ (C) $\dfrac{\omega}{\omega_n}<\sqrt{2}$ (D) $\dfrac{\omega}{\omega_n}>\sqrt{2}$

34. Considering safe design, friction clutch should be designed :

    (A) Assuming uniform pressure

    (B) Assuming uniform wear

    (C) Either uniform pressure (or) uniform wear

    (D) Uniform pressure for high torque and uniform wear for low torque

35. Which is not a type of rolling Contact bearings :

    (A) Deep groove ball bearing   (B) Cylindrical roller bearing

    (C) Journal bearings   (D) Spherical roller bearing

36. Ratio between inertia force to elastic force is known as :

    (A) Reynold number   (B) Mach number

    (C) Euler number   (D) Froude number

37. A boundary is known as hydrodynamically smooth if :

    (A) $\dfrac{K}{S'} = 0.3$ (B) $\dfrac{K}{S'} > 0.3$ (C) $\dfrac{K}{S'} < 0.25$ (D) $\dfrac{K}{S'} = 0.5$

38. Which of the following is not a minor energy loss ?

(A) Loss due to sudden enlargement

(B) Loss due to friction

(C) Loss due to entrance of pipe

(D) Loss due to bend in pipe

39. Inlet velocity triangle of Pelton wheel is :

(A) Straight line

(B) Triangle

(C) Inverted triangle

(D) None of the above

40. Hydraulic efficiency of Francis turbine whose vanes are radial at inlet is (α – guide blade angle) :

(A) $\dfrac{2+\tan^2\alpha}{2}$

(B) $\dfrac{\tan^2\alpha}{2}$

(C) $\dfrac{2}{2+\tan^2\alpha}$

(D) $\dfrac{2}{\tan^2\alpha}$

41. A graphical device used to determine the break even point and profit potential under varying conditions of output and costs is known as :

(A) Gantt chart

(B) Flow chart

(C) Break-even chart

(D) PERT chart

42. Select the wrong statement.

Bin card will show :

(A) The amount received

(B) Amounts issued

(C) The amount balance on hand

(D) The quantity allocated for issue or about quantities on order

43. What does the symbol ⇨ imply in work study ?

(A) Operation

(B) Inspection

(C) Transport

(D) Storage

44. Basic tool in work study is :

(A) Graph paper

(B) Stop watch

(C) Process chart

(D) Planning chart

45. In forecasting by exponential smoothing, if α is a smoothing constant, then :

(A) New Forecast $= \alpha$ (latest sales figure) $+ (1 - \alpha)$ (old forecast)

(B) New Forecast $= \alpha$ (latest sales figure) $- (1 - \alpha)$ (old forecast)

(C) New Forecast $= \alpha$ (latest sales figure) $+ (1 + \alpha)$ (old forecast)

(D) New Forecast $= \alpha$ (latest sales figure) $- (1 + \alpha)$ (old forecast)

46. Hungarian algorithm is used to solve :

(A) Transportation problem

(B) Assignment problem

(C) Unconstraint non-linear programming problem

(D) Constrained non-linear programming problem

47. The rule used for numbering events involved in a project scheduling network is :

(A) Johnson's rule

(B) Fulkerson's rule

(C) Hungarian rule

(D) Simplex rule

48. The additional cost incurred in reducing the activity time in project scheduling is called :

(A) Normal cost

(B) Crashing cost

(C) Break - even cost

(D) Activity cost

49. A queuing system, using Kendall's notation, is expressed in the symbolic form as (M/M/3); (FCFS/6). How many number of servers in the system ?

(A) 6   (B) 3   (C) 2   (D) 1

50. In the queuing theory, the relationship between expected number of customers in the system (or queue) and expected waiting time in the system (or queue) is known as :

(A) Kendall's formula

(B) Little's formula

(C) Bellman's formula

(D) Erlang formula

51. In an Linear programming problem, the restrictions or limitations under which the objective function is to be optimised are called :

(A) Constraints

(B) Objective function

(C) Decision variables

(D) None of the above

52. The variable that is included in the '≤' type inequality constraint for the purpose of converting general form of LPP to standard form of LPP is called :

(A) Surplus variable

(B) Slack variable

(C) Artificial variable

(D) Basic variable

53. When there exists a non basic variable whose relative profit $(ie\ \overline{C}j)$ is zero in the optimal table , then the nature of solution is ?

(A) Unbounded

(B) Infeasible

(C) Unique optimal

(D) Alternate optimal

54. If the ith constraint of a primal (maximisation) is an equation, then the dual (minimisation) variable $'y_i'$ is :

(A) ≥ O

(B) ≤ O

(C) Unrestricted in sign

(D) None of the above

55. In the balanced transportation problem, with 'm' sources and 'n' destinations, the number of basic variables is :

(A) $m+n$

(B) $m+n+1$

(C) $m+n-1$

(D) $m \times n$

56. Engine oil flows in a 15 cm diameter horizontal tube with a velocity of 1.3 m/s, experiencing a pressure drop of 12 kPa. The pumping power requirement to overcome this pressure drop is,

(A) 190 w

(B) 276 w

(C) 407 w

(D) 655 w

57. A double pipe (shell and tube) heat exchanger is constructed of a stainless steel inner tube of inner diameter is 1.5 cm (D_i) and outer diameter is (1.9 cm.) The thermal resistance of the heat exchanger /unit length as 0.0532°C/w. Determine the overall heat transfer co-efficient for inner and outer surface area of the tube respectively.

   (A) 350 and 450 W/m²°C   (B) 399 and 315 W/m²°C

   (C) 299 and 215 W/m²°C   (D) 350 and 315 W/m²°C

58. In a parallel flow heat exchanger, the NTU is calculated to be 2.5. The lowest possible effectiveness for this heat exchanger is,

   (A) 92%   (B) 50%   (C) 41%   (D) 27%

59. A 2 shell passes and 4 tube passes heat exchanger is used to heat glycerin from 20°C to 50°C by hot water, which enters the thin walled 2 cm diameter tubes at 80°C and leaves at 40°C. The total length of the tubes in the heat exchanger is 60 m. The convection heat transfer co-efficient is 25 W/m²°C on the glycerin and 160 W/m²°C on the water side. Determine, the rate of heat transfer in the heat exchanger before any fouling occures on the outer surfaces of the tubes. Place [Corrider as F = 0.91 $(\Delta T)_{LMTD}$, CF = 24.7°C]

   (A) 2.65 kW   (B) 1.62 kW   (C) 1.83 kW   (D) 1.81 kW

60. Consider a surface at 0°C that may be assumed to be a black body in an environment at 25°C. If 300 W/m² of radiation is incident on the surface the radiosity of this black surface is,

   (A) 0 W/m²   (B) 132 W/m²   (C) 300 W/m²   (D) 315 W/m²

61. Which one of the following statements applicable to a perfect gas will also be true for an irreversible process ?

   (A) $dQ = du + pdv$ (B) $dQ = Tds$

   (C) $Tds = du + pdv - dh$ (D) $pdv - du = ds$

62. Which one of the following represents unavailability ?

   (A) $T_0(\Delta S_0)$ (B) $T(\Delta S)$ (C) $T_0(\Delta S)$ (D) $T(\Delta S_0)$

63. A Carnot cycle operates between temperatures of 727°C and 227°C, the efficiency of the engine is :

   (A) 40%   (B) 50%   (C) 60%   (D) 45%

64. A refrigerating machine working on reversed carnot cycle takes out 2 kW of heat from the system while working between temperature limits of 300 k and 200 k. Cop and power consumed by the cycle will be _____ respectively.

(A) 1 kW and 1 kW (B) 1 kW and 2 kW

(C) 2 kW and 1 kW (D) 2 kW and 2 kW

65. With reheat Rankine cycle :

(A) Quality of exhaust steam is improved

(B) Network output of cycle increases

(C) Specific steam consumption decreases

(D) All the above

66. To improve the self lubricating capacity of a powder metallurgy part the following finishing operation is used :

(A) Repressing (B) Sizing (C) Infilliation (D) Impregnation

67. Shrinkage allowance is added to pattern dimensions to take care of :

(A) Liquid shrinkage (B) Liquid and solid shrinkage

(C) Solid shrinkage (D) None of these

68. Fine grain size during the solidification of a metal is acheived by :

(A) Lower nucleation rate

(B) Higher nucleation rate with lower growth rate

(C) Higher nucleation rate with higher growth rate

(D) Larger growth rate

69. Sheet metal drawing operation is used to make :

(A) Wire (B) Cup shaped parts

(C) Tubes (D) Rods

70. Spring back during the sheet metal operation is caused because of the :

(A) release of stored energy during elastic and plastic deformation

(B) release of stored energy during plastic deformation

(C) release of stored energy during elastic deformation

(D) excess energy that was utilized during the forming process

71. A semi - circle of radius 'a' is defined in first and fourth quadrants. Write down its co-ordinates of centroid :

(A) $\left(0, \dfrac{49}{3\pi}\right)$ (B) $(0, 0)$ (C) $\left(\dfrac{49}{3\pi}, 0\right)$ (D) $\left(\dfrac{49}{3\pi}, \dfrac{59}{3\pi}\right)$

72. A truss hinged at one end, supported on rollers at the other, is subjected to horizontal load only. Its reaction at the hinged end will be :

(A) Horizontal

(B) Vertical

(C) Resultant of horizontal and vertical

(D) Difference between horizontal and vertical

73. The relation between modulus of elasticity (E), modulus of rigidity (C) and bulk modulus (K) is given by :

(A) $E = \dfrac{3KC}{C+9K}$ (B) $E = \dfrac{9KC}{C+3K}$ (C) $E = \dfrac{C+9K}{3KC}$ (D) $E = \dfrac{C+3K}{9KC}$

74. A beam of uniform strength has constant :

(A) Shear force   (B) Bending moment

(C) Cross - sectional area   (D) Deflection

75. An inverted T-section is subjected to a shear force F. The maximum shear stress will occur at :

(A) Top of the section   (B) Junction of web and flange

(C) Neutral axis of the section   (D) Bottom of the section

76. Tool-life criterion normally used is :

(A) Flank wear   (B) Crater wear

(C) Crater wear and flank wear   (D) Flank wear and nose radius

77. The simplest and low-cost clamp used in Jigs and Fintures is :

(A) Strap clamp   (B) Can clamp   (C) Toggle clamp   (D) Equiliser

78. Consider the following components :

   (a) A dedicated computer

   (b) Bulk memory

   (c) Telecommunication lines

   Which of these components are required for a DNC system ?

   (A) (a), (b), and (c)   (B) (b) and (c)   (C) (a) and (b)   (D) (a) and (c)

79. The heat generated in metal cutting is dissipated in different proportions into environment, tool, chip, workpiece. The correct order of this proportion in decreasing magnitude is :

   (A) tool, work, chip, environment   (B) work, tool, environment, chip

   (C) work, tool, chip, environment   (D) chip, tool, work, environment

80. The mechanism of material removal in EDM process is :

   (A) melting and evaporation   (B) melting and corrosion

   (C) erosion and cavitation   (D) cavitation and evaporation

81. If Rank (A) = 2 and Rank (B) = 3 then rank (AB) is :

   (A) 6   (B) 5

   (C) Data Inadequate   (D) 3

82. By Lagrange's mean value theorem which of the following statement is true :

   (a) If a curve $\overline{AB}$ has a tangent at each of its points then there exists atleast one point C on this curve, the tangent at which is parallel to chord AB

   (b) If $f'(x) = 0$ in the interval then $f(x)$ has same value for every value of x in (a, b)

   (A) (a) alone is true   (B) (b) alone is true

   (C) Both (a) and (b) are true   (D) Neither (a) nor (b) is true

83. What is the chance that a leap year selected at random will have 53 wednesdays ?

   (A) $3/7$ (B) $\dfrac{53}{365}$ (C) Data Inadequate   (D) $\dfrac{2}{7}$

84. In regula falsi method the point of intersection of curve AB and x axis is replaced by :

   (A) Point of intersection of y axis and curve AB

   (B) Point of intersection of y axis and chord AB

   (C) Point of intersection of x axis and chord AB

   (D) Point of intersection of x axis and y axis

85. Which of the following methods agrees with Taylor's series solution upto term in h^4 ?

   (A) Modified Euler's method

   (B) Fourth order Runge-kutta method

   (C) Picard's method

   (D) Milne's method

86. Which one of the following is a copying mechanism ?

   (A) Hart mechanism

   (B) Pantograph

   (C) Scott Russel mechanism

   (D) Watt mechanism

87. In an underdamped vibration system, logarithmic decrement is given by :

   (A) $\delta = \dfrac{2\pi\xi}{\sqrt{1-\xi^2}}$

   (B) $\delta = \dfrac{2\pi\xi^2}{\sqrt{1-\xi}}$

   (C) $\delta = \dfrac{2\pi\xi}{\sqrt{1+\xi^2}}$

   (D) $\delta = \dfrac{2\pi\xi^2}{\sqrt{1+\xi}}$

88. The ratio of the amplitude of the steady - state response to the static deflection under the action of a force is known as :

   (A) Damping factor

   (B) Magnification factor

   (C) Frequency ratio

   (D) Damping co-efficient

89. In a simply supported shaft carrying a uniformly distributed mass, the maximum deflection at the midspan is :

   (A) $\Delta = \dfrac{5mgl^2}{384EI}$

   (B) $\Delta = \dfrac{5mgl^4}{384EI}$

   (C) $\Delta = \dfrac{mgl^4}{384EI}$

   (D) $\Delta = \dfrac{3mgl^2}{384EI}$

90. In applications like power presses, and rolling mills, where synchronous operation is required, the most preferred type of clutch is :

   (A) Electromagnetic clutch

   (B) Positive contact clutch

   (C) Friction clutch

   (D) Fluid clutch

91. Heat is lost steadily through a 0.5 cm thick 2m × 3m window glass whose thermal conductivity is 0.7 w/m°c. The inner and outer surface temperatures of the glass are measured to be 12°C to 9°C. The rate of heat loss by conduction through the glass is :

(A) 420 w
(B) 5040 w
(C) 1256 w
(D) 2520 w

92. Heat is generated uniformly in a 4 cm diameter, 16 cm long solid bar [k = 24 w/m°c]. The temperatures at the center and the surface of the bar are measured to be 210°C and 45°C respectively. The rate of heat generation within the bar is,

(A) 240 w
(B) 1013 w
(C) 79,620 w
(D) 3.96×10^6 w

93. A 3 cm long, 2 mm × 2mm rectangular cross-section aluminum fin [k= 237 w / m°c] is attached to a surface. If the fin efficiency is 65%, the effectiveness of this single fin is :

(A) 30%
(B) 24%
(C) 8%
(D) 39%

94. In turbulant flow, one can estimate the Nusselt number using the analogy between heat and momentum transfer. (colburn analogy). This analogy relates the Nusselt number to the co-efficent of friction, C_f as.

(A) $(Nu) = 0.5 C_f (Re)(Pr)^{1/3}$

(B) $(Nu) = 0.5 C_f (Re)(Pr)^{2/3}$

(C) $(Nu) = C_f . Re.(Pr)^{1/3}$

(D) $(Nu) = C_f .(Re)^{1/2}(Pr)^{1/3}$

95. Water $[\mu = 9 \times 10^{-4}$ kg/m.s, $e = 1000$ kg/m$^3]$ enters a 2 cm diameter, and 3-m long tube whose walls are maintained at 100°C. The water enters this tube with a bulk temperature of 25°C and a volume flow rate of 3m^3/h. The Reynolds number for this internal flow is,

(A) 1,05,000
(B) 1,78,000
(C) 2,36,000
(D) 59,000

96. The molten metal is not introduced directly into the mould Cavity as it will cause :

(A) Erosion of the mould cavity

(B) Corrosion of the mould cavity

(C) Crack in the bottom surface

(D) Breakage of the mould

97. Which one **does not** form a part of the gating system for a casting :

    (A) Pouring Basin   (B) Sprue   (C) Choke   (D) Pattern

98. Which of the following **does not** form a part of metal working process :

    (A) Shearing   (B) Extrusion   (C) Stretch forming (D) Welding

99. In hammer forging, the hammer **does not** consist of :

    (A) Falling Weight   (B) Anvil

    (C) DIE   (D) Lifting mechanism for the ram

100. In powder metallurgy, the metal powder particle size is reduced during automization by :

    (A) Decreasing gas velocity   (B) Increasing gas velocity

    (C) Decreasing gas pressure   (D) Decreasing metal volume

101. A turbine develops 9000 kW when running at 100 rpm. Head on turbine is 30 m. If the head on the turbine is reduced to 18 m, speed of turbine under 18m is :

    (A) 77 rpm   (B) 18 rpm   (C) 180 rpm   (D) 30 rpm

102. A 2 kW resistance heater wire whose thermal conductivity is K=15 W/m. K has a diameter of D=4 mm and a length of L = 0.5 m, and is used to boil water. If the outer surface temperature of the resistance wire is T_s = 105°C, determine the temperature at the centre of the wire.

    (A) 126°C   (B) 110°C   (C) 118°C   (D) 130°C

103. The efficiency of a pin fin with insulated tip is :

    (A) $\dfrac{\tan h\, mL}{\sqrt{hA/KP}}$ (B) $\dfrac{\tan h\, mL}{mL}$ (C) $\dfrac{mL}{\tan h\, mL}$ (D) $\dfrac{\sqrt{hA/KP}}{\tan h\, mL}$

104. Two long parallel plates of same emissivity 0.5 are maintained at different temperatures and have radiation heat exchange between them. The radiation shield of emissivity 0.25 placed in the middle will reduce radiation heat exchange to :

(A) $\dfrac{1}{2}$

(B) $\dfrac{1}{4}$

(C) $\dfrac{3}{10}$

(D) $\dfrac{3}{5}$

105. Air at 20°C blows over a hot plate of 50×60 cm² made of carbon steel maintained at 220°C. The convective heat transfer co-efficient is 25 W/m²k. What will be the heat loss from the plate ?

(A) 1500 W

(B) 2500 W

(C) 3000 W

(D) 4000 W

106. From the consideration of the erosion of blades in the later stages of a steam turbine, the maximum moisture content at the turbine exhaust is limited to :

(A) 20 %

(B) 12%

(C) 88%

(D) 5%

107. Sensible Heat Factor (SHF) is defined as :

(A) $\text{SHF} = \dfrac{LH}{SH+LH}$

(B) $\text{SHF} = \dfrac{LH}{SH-LH}$

(C) $\text{SHF} = \dfrac{SH}{SH+LH}$

(D) $\text{SHF} = \dfrac{SH}{LH-SH}$

Where   SH → Sensible Heat

LH → Latent Heat

108. A system is composed of a gas contained in a cylinder fitted with a piston. The gas expands from the state 1 for which $E_1 = 75$ kJ to a state 2 for which $E_2 = -25$kJ. During the expansion, the gas does 60 kJ of work on surroundings. The heat transferred to or from the systems during process is :

(A) −30 kJ

(B) −40 kJ

(C) 30 kJ

(D) 40 kJ

109. An ideal air standard cycle is shown in figure.
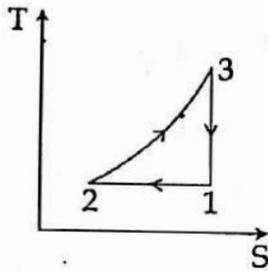
The same cycle, when represented on the pressure-volume co-ordinate, takes the form,

(A)

(B)

(C)

(D)
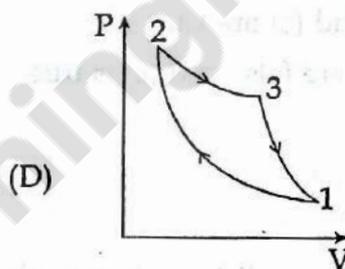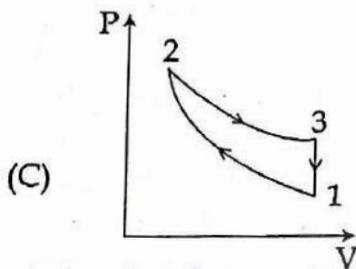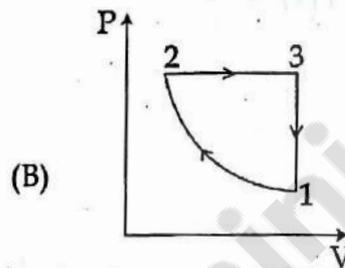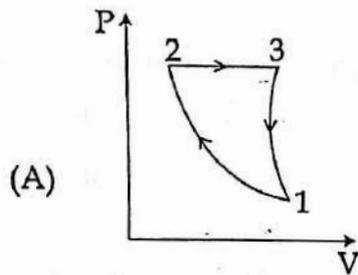
110. For copper, the yield stress σ_y and the brittle fracture stress σ_f are related as :

(A) $\sigma_f > \sigma_y$ (B) $\sigma_y > \sigma_f$ (C) $\sigma_y = \sigma_f$ (D) $\sigma_f << \sigma_y$

111. The fatique strength of mild steel is :

(A) Lower than the yield strength   (B) More than the yield strength

(C) More than its tensile strength   (D) Lower than its tensile strength

112. A casting $200 \times 200 \times 70$ mm^3 Size solidifies in 10 mins. Solidification time for $200 \times 100 \times 10$ mm^3 under similar conditions is given below find it :

(A) 0.748 min   (B) 0.648 min   (C) 0.848 min   (D) 0.948 min

113. One of the advantages given below of the forged parts is not correct, find it :

(A) High production rate   (B) Higher forging head

(C) Less die wear   (D) Lower forging temperature

114. Neat oils can be preferred while machining of :

    (A)   Grey Cast Iron   (B)   Copper alloys

    (C)   Aluminium alloys   (D)   Alloy Steels

'115. A bore of 14.46 mm diameter on a job can be measured by :

    (A)   Steel rule   (B)   Vernier caliper

    (C)   Plug gauge   (D)   Micrometer

116. Consider the function $f(x) = \dfrac{|x|}{x}$:

    (a) $\lim\limits_{x \to 0^+} f(x) = 1$

    (b) $\lim\limits_{x \to 0^-1} f(x) = -1$

    (c) $\lim\limits_{x \to 0} f(x)$ does not exists

    (A)   All (a) and (b) and (c) are true

    (B)   Both (a) and (b) are false and (c) is true

    (C)   (c) alone true

    (D)   (a) and (c) are true

117. Three cities A, B, C and equidistance from each other. A car travels from A to B at 60 km/hr, from B to C at 40 km/hr from C to A 50 km/hr determine the Average speed :

    (A) $\dfrac{1}{\frac{1}{3}\left(\frac{1}{60}+\frac{1}{40}+\frac{1}{50}\right)}$ (B) $\dfrac{1}{\frac{1}{3}(60+40+50)}$ (C) $\dfrac{1}{3}\left(\dfrac{1}{60}+\dfrac{1}{40}+\dfrac{1}{50}\right)$ (D) $\dfrac{3}{60+40+50}$

118. The normalized modal matrix for diagonalizing $M = \begin{pmatrix} 5 & 3 \\ 3 & 5 \end{pmatrix}$ is :

    (A) $\begin{pmatrix} 1 & -1 \\ 1 & -\frac{1}{2} \end{pmatrix}$ (B) $\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}$

    (C) $\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} \frac{1}{\sqrt{3}} & \frac{2}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{3}} \end{pmatrix}$

119. A single step method for the differential equation $y' = f(t, y)$, where $y(t) = a + be^{-t}$, which produces exact result is :

(A) $y_{j+1} = y_j + \left(1 + e^{-h}\right) y_j'$

(B) $y_{j+1} = y_j + \left(1 - e^{-h}\right) y_j'$

(C) $y_{j+1} = y_j + \left(1 - e^{-h}\right)\left(y_j + y_{j+1}'\right)$

(D) $y_{j+1} = y_j + \left(\dfrac{1 - \cos h}{\sin h}\right)\left(y_j'\right)$

120. The Lami's theorem is applicable only for :
(A) Coplanar forces
(B) Concurrent forces
(C) Coplanar and Concurrent forces
(D) Any type of the forces

121. Match List - I and List - II and select the **correct** answer :

	List - I		List - II
(a)	Flatness	(i)	$\bigoplus$
(b)	Profile of a surface	(ii)	$/\!/$
(c)	Position	(iii)	$\frown$
(d)	Parallelism	(iv)	$\square$

Codes :

	(a)	(b)	(c)	(d)
(A)	(iv)	(iii)	(i)	(ii)
(B)	(iii)	(iv)	(ii)	(i)
(C)	(ii)	(i)	(iv)	(iii)
(D)	(ii)	(iv)	(i)	(iii)

122. Match the following :

(a)	Coincidence method of measurement	(i)	Measurement of a mass on equal arm balance
(b)	Deflection method of measurement	(ii)	Measurement of length by vernier caliper
(c)	Direct method of measurement	(iii)	Measurement of mass by spring balance
(d)	Differential method of measurement	(iv)	Measurement of length by a comparator

Codes :

	(a)	(b)	(c)	(d)
(A)	(ii)	(iii)	(i)	(iv)
(B)	(iv)	(i)	(ii)	(iii)
(C)	(ii)	(iv)	(iii)	(i)
(D)	(i)	(ii)	(iii)	(iv)

123. A product 'A' comprises of 2 units of B and 3 units of C. Each unit of B requires 2 unit of D and one unit of E. Each unit of C needs 2 units of E and one unit of F. How many number of end units of 'E' are required for producing two units of A ?

(A) 8   (B) 16   (C) 6   (D) 2

124. The time required for two operations cutting and binding for 5 jobs are as follows :

Job No.	1	2	3	4	5
Cutting (min)	8	6	2	5	7
Binding (min)	8	7	7	6	4

What is the optimal makespan sequence ?

(A) $2-4-1-3-5$ (B) $3-4-2-1-5$

(C) $1-2-3-4-5$ (D) $3-5-2-4-1$

125. Monthly consumption of an item is 500 units. The price per unit is ₹ 25. Inventory carrying costs is 16 percent and ordering cost is ₹ 50 per order. For an economic order quantity model, determine the Re-order quantity :

(A) 380 units   (B) 370 units   (C) 378 units   (D) 388 units

126. We can find the deflection of beam carrying :

(A) Uniformly distributed load   (B) Central point load

(C) Gradually variable load   (D) All of these loads

127. A ball is dropped from a height of 15 m above a metal platform. The ball strikes the platform and rebounds successively. The height of rebound after the first rebound is :

(A) 8.44 m   (B) 4.75 m   (C) 2.67 m   (D) 9.44 m

128. The principal stresses σ_1, σ_2 and σ_3 at a point respectively are 80 MPa, 30 MPa and -40 Mpa. The maximum shear stress is :

(A) 60 MPa   (B) 55 MPa   (C) 35 MPa   (D) 25 Mpa

129. In a slider crank mechanism if the crank rotates at uniform speed of 200 rpm and has a length of 0.2 m, its linear velocity is :

(A) 4.19 m/s   (B) 20.9 m/s   (C) 5.2 m/s   (D) 41.9 m/s

130. The distance between two parallel shafts is 18 mm and they are connected by an oldhams coupling, the driving shaft revolves at 160 rpm. The maximum speed of sliding of the tongue is :

(A) 0.302 m/s   (B) 0.6 m/s   (C) 3.2 m/s   (D) 6 m/s

131. What is the pay-back period, if a machine is to cost ₹ 1,00,000 and extra revenue is expected to amount to ₹ 20,000 the first year, ₹ 40,000 the second year and ₹ 40,000 in the third year ?

(A) One Year   (B) Two Year   (C) Three Year   (D) Four Year

132. Consider the following Linear Programming Problem (LPP).

Maximise $Z = x_1 + 2x_2$

Subject to :

$x_1 \leq 2$

$x_2 \leq 2$

$x_1 + x_2 \leq 2$

$x_1, x_2 \geq 0$ (i.e. +ve decision variables)

What is the optimal solution $\left(x_1^{opt}, x_2^{opt}\right)$ to the above LPP ?

(A) 2, 2   (B) 0, 2   (C) 2, 0   (D) 0, 0

133. Consider a project consisting of nine jobs (A to I). The standard deviation for the jobs are as given below :

Job	A	B	C	D	E	F	G	H	I
Standard deviation	1	4	0	1	0	1	2	1	1

The critical jobs are : A, D, H and I. What is the standard deviation of the project duration ?

(A) 2   (B) 1   (C) 4   (D) $\sqrt{11}$

134. If x is a decision variable of LPP and unrestricted in sign then this variable can be converted into $x = x' - x''$ so as to solve the LPP by simplex method, where :

(A) $x' \leq 0$ and $x'' \geq 0$

(B) $x' \geq 0$ and $x'' \leq 0$

(C) x' and $x'' \leq 0$

(D) x' and $x'' \geq 0$

135. While solving an LPP (defined by n variables and m equations, $m < n$) through simplex method, basic solutions are determined by setting $n - m$ variables equal to zero and solving m equations to obtain solution for remaining m variables, provided the resulting solutions are unique. This means that the maximum number of basic solutions is :

(A) $\dfrac{n!}{m!(n-m)!}$

(B) $\dfrac{m!}{n!(n-m)!}$

(C) $\dfrac{n!}{m!(n+m)!}$

(D) $\dfrac{m!}{n!(n+m)!}$

136. A link EF in a slider crank mechanism has a length of 0.4m. The velocity of end E with respect to F is 4.9 m/s. The angular velocity of the link is :

(A) 0.01225 rad/s

(B) 1.225 rad/s

(C) 12.25 rad/s

(D) 122.5 rad/s

137. The bottom clearance of a pair of spur gears with module 4 mm is :

(A) 4 mm

(B) 0.5 mm

(C) 1 mm

(D) 0.4 mm

138. The spillway for the dam is 20 m wide and is designed to carry 125 m^3/s at flood stage. A 1:15 model is constructed to study the flow characteristics through the spillway. The effects of surface tension and viscosity are to be neglected, determine the flow rate.

(A) 0.162 m^3/s

(B) 0.151 m^3/s

(C) 0.148 m^3/s

(D) 0.143 m^3/s

139. An odd shaped container weighs 2N when empty. If it is full of water it weighs 4907 N. Container's volume is _____. [take density of water as 1000 kg/m^3 and gravitational acceleration as 9.81 m/s^2] :

(A) 250 litres

(B) 500 litres

(C) 750 litres

(D) 1000 litres

140. A piece of ore weighing 1.5 N in air and 1.1 N in water. Its volume is :

(A) 40.8 m^3 (B) 40.8 cm^3 (C) 40.8 mm^3 (D) 4.08 mm^3

141. What temperature are Fahrenheit and Celsius equal ?

(A) −40°   (B) 574.59   (C) 40   (D) −574.59

142. In a class of 45 students, a boy is ranked 20th. When two boys joined, his rank was dropped by one. What is his new rank from the end ?

(A) 25th (B) 26th (C) 27th (D) 28th

143. Who wrote the novel - 'KavalKottam' ?

(A) Vannadasan   (B) S. Venkatesan   (C) Joe D Cruz   (D) Puviarasan

144. Article 21-A and the RTE Act came into effect :

(A) On 1st April 2010   (B) On 1st April 2009

(C) On 1st April 2017   (D) On 1st April 2005

145. Quit India Movement was launched in response to :

(A) Cabinet Mission plan   (B) Cripps proposals

(C) Simon Commission Report   (D) Wavell plan

146. First state to fix minimum education qualification for cooperative body poll :

(A) Rajasthan   (B) West Bengal   (C) Tamil Nadu   (D) Karnataka

147. Who won the gold both in the 5,000 and 10,000 metres event in 2017 Asian Athletics Championship ?

(A) Lakshmanan   (B) Gopi Thonkanal

(C) Jinson Johnson   (D) Neeraj Chopra

148. The parliament can make any law for whole or any part of India for implementing international treaties :

(A) with the consent of all the states

(B) with the consent of the majority of states

(C) with the consent of the states concerned

(D) without the consent of any state

149. In which of the following temple, the front Mandapam is in the form of a huge chariot drawn by horses ?

(A) Patteswaram temple

(B) Darasuram temple

(C) Thanjavur Brihadeeswarar temple

(D) Thiruvarur Thyagaraja temple

150. Consider the following rivers :

(a) Narmada   (b) Brahmaputra

(c) Godavari   (d) Tapti

Which of the above is/are flowing into the Bay of Bengal ?

(A) (a), (b) and (c) only   (B) (b) and (c) only

(C) (a) and (b) only   (D) (a) and (c) only

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