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12PT-02

TEACHERS RECRUITMENT BOARD, CHENNAI – 6
WRITTEN COMPETITIVE EXAMINATION FOR DIRECT RECRUITMENT OF
LECTURERS IN GOVERNMENT POLYTECHNIC COLLEGES – 2012

MECHANICAL ENGINEERING

Time Allowed : 3 Hours]   [Total Marks : 190

Each question carries four options namely A, B, C and D.
Choose one correct option and mark in appropriate
place in the OMR answer sheet.

SECTION - A
[1 mark each]

1. Auto collimator is used to check

   A) roughness   B) flatness

   C) angles   D) automobile balance.

2. Clinometer is related with

   A) Engineer's parallels   B) Angle gauges

   C) Spirit level   D) Bevel profractor.

3. Material having highest cutting speed is

   A) cast iron   B) bronze

   C) aluminium   D) high carbon steel.

4. Cutting tool used on lathe, shaper and planer is

   A) single point   B) multi-point

   C) two-point   D) three-point.

[Turn over

F-007

5. Tool life equation is

A) $VT^n = C$

B) $VT^{\frac{1}{n}} = C$

C) $VT = nC$

D) $V^n T^n = C$.

6. Break-even analysis chart is drawn between

A) overhead cost and fixed cost

B) volume of production and income

C) material cost and labour cost

D) none of these.

7. In ABC analysis the C items are those which represent

A) small percentage of total annual consumption value

B) high percentage of total annual consumption value

C) small percentage of closing inventory value

D) high percentage of closing inventory value.

8. Scarce items are

A) mostly available in local market

B) of short supply

C) semifinished items

D) none of these

9. Which of the following is not a forecasting technique ?

A) Trend line estimate

B) Delphi method

C) Hungarian technique

D) Judgemental technique

10. Inventory is in the form of

A) raw materials

B) finished goods

C) in-process goods

D) all of these.

11. The material that has poor machinability is

A) aluminium

B) copper

C) white cast iron

D) gray cast iron.

12. The packing fraction for FCC structure is

A) 0·68

B) 0·72

C) 0·74

D) 0·78.

13. Which one of the following metals is not of face centered cubic structure ?

A) Aluminium

B) Chromium

C) Copper

D) Nickel.

14. Which one of the following is not a strengthening mechanism ?

A) Alloying

B) Heat treatment

C) Strain hardening

D) Metallizing

15. The solidification time in castings is proportional to

A) $\left\{\dfrac{volume}{surface\ area}\right\}^2$

B) $\left\{\dfrac{volume}{surface\ area}\right\}^{3\cdot 2}$

C) $\left\{\dfrac{volume}{surface\ area}\right\}^3$

D) $\left\{\dfrac{volume}{surface\ area}\right\}^{1\cdot 2}$

16. Metal supports used to keep the cores from shifting are called

A) core prints

B) chaplets

C) chills

D) sprue

D

[Turn

7. An example for amorphous material is

A) glass

B) silver

C) lead

D) zinc.

18. Which of the following alloys of aluminium is often used for aeroplane and automobile parts ?

A) Duralumin

B) Magnalium

C) RR-53

D) Aluminium bronze.

19. Chills are used in moulds to

A) reduce possibility of blow holes

B) reduce freezing time

C) achieve directional solidification

D) smoothen metal flow for reducing splatter.

20. In deep drawing of sheets the limiting draw ratio depends on

A) percentage of elongation of sheet metal

B) yield strength of sheet metal

C) types of press used

D) thickness of sheet metal.

21. Heat transfer takes place as per

A) Zeroth law of thermodynamics

B) First law of thermodynamics

C) Second law of thermodynamics

D) Kirchhoff's law

[D]

22. Heat transfer in liquids and gases takes place by

A) conduction

B) convection

C) radiation

D) conduction and radiation.

23. In heat exchangers, degree of approach is defined as the difference between temperatures of

A) cold water inlet and outlet

B) hot medium inlet and outlet

C) hot medium outlet and cold water inlet

D) hot medium outlet and cold water outlet.

24. The concept of overall heat transfer coefficient is used in case of heat transfer by

A) conduction

B) convection

C) radiation

D) conduction and convection.

25. A perfect black body is one which

A) reflects all heat

B) is black in colour

C) absorbs all heat radiations of all wavelengths falling on it

D) is fully opaque.

26. Consider the following statements pertaining to large heat transfer rate using fins :

I. Fins should be used on the side where heat transfer coefficient is small

II. Long and thick fins should be used

III. Short and thin fins should be used

IV. Thermal conductivity of fin material should be large.

Of these

A) I, II & III are correct

B) I, II & IV are correct

C) II, III & IV are correct

D) I, III & IV are correct.

[D]

[Turn over

27. Two spheres A and B of the same material have radii 1 m and 4 m and temperature 2000 K and 1000 K respectively. The energy radiated by sphere A is

     A)   greater than that of sphere B B)   less than that of sphere B

     C)   equal to that of sphere B D)   equal to double that of sphere B.

28. A metal plate has a surface area of 2 m^2, thickness 10 mm and a thermal conductivity of 200 W/mK. What is the thermal resistance of the plate ?

     A) 4×10^1 K/W   B) $2 \cdot 5 \times 10^{-3}$ K/W

     C) $1 \cdot 5 \times 10^{-4}$ K/W   D) $2 \cdot 5 \times 10^{-5}$ K/W.

29. If the temperature of a solid surface changes from 27°C to 627°C, then its emissive power changes in which ratio ?

     A)   6 : 1   B)   9 : 1

     C)   27 : 1   D)   81 : 1.

30. Air can be best heated by steam in a heat exchanger of

     A)   plate type

     B)   double pipe type with fins on steam side

     C)   double pipe type with fins on air side

     D)   shell and tube type.

31. Quick return mechanism is an inversion of

     A)   four-bar chain   B)   single slider crank chain

     C)   double slider crank chain   D)   crossed slider crank chain.

32. The shock absorbing capacity of bolt is increased by

     A)   proper tightening

     B)   use of a spring washer

     C)   making shank diameter equal to core diameter

     D)   preventing stress concentration in the bolt.

D

33. A 2 kW motor is running at 1440 rpm. It is to be connected to a stirrer running at 36 rpm. The gearing arrangement suitable for this application is

     A)   differential gear   B)   helical gear

     C)   spur gear   D)   worm gear.

34. A test specimen is stressed slightly beyond the yield point and then unloaded. Its yield strength will

     A)   decrease

     B)   increase

     C)   remain same

     D)   become equal to ultimate tensile strength.

35. The tooth profile most commonly used in gear drives for power transmission is

     A)   a cycloid   B)   an involute

     C)   a hyperbola   D)   a spiral.

36. Whirling speed of a shaft coincides with the natural frequency of its

     A)   longitudinal vibration

     B)   transverse vibration

     C)   torsional vibration

     D)   coupled bending torsional vibration.

37. The life of a ball bearing is inversely proportional to

     A) $(\text{Load})^{1/3}$ B) $(\text{Load})^3$

     C) $(\text{Load})^{3\cdot3}$ D) $(\text{Load})^2$.

D   [Turn over

38. The fatigue life of a part can be improved by

A) electroplating   B) pickling

C) coating   D) shot peening.

39. Which of the following theories is applied to brittle materials ?

A) Maximum principal stress theory

B) Maximum principal strain theory

C) Maximum strain energy theory

D) Maximum shear stress theory.

40. The bolts in a rigid flanged coupling connecting two shafts transmitting power are subjected to

A) shear force and bending moment

B) axial force

C) torsion

D) torsion and bending moment.

41. The trigonometrical substitution to be used to differentiate $\tan^{-1}\frac{1-x}{1+x}$ with respect to x is

A) $x = \sin\theta$ B) $x = \cos\theta$

C) $x = \tan\theta$ D) $x = \sec\theta$.

42. The semivertical angle of a right circular cone of given slant height and maximum volume is

A) $\tan^{-1} 2$ B) $\tan^{-1}\frac{1}{2}$

C) $\tan^{-1}\sqrt{2}$ D) $\tan^{-1}\frac{1}{\sqrt{2}}$.

$\boxed{D}$

43. $\int_0^{\pi/2} \log\sin x\, dx$ equals

A) $-\frac{\pi}{2}\log 2$ B) $\frac{\pi}{2}\log 2$

C) $-\pi\log 2$ D) $\pi\log 2$.

44. The region of integration in $\int_0^1\int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}}\, dy\, dx$ is

A) $x = 0; x = y; x^2 + y^2 = 2$ B) $y = 0; y = x; x^2 + y^2 = 2$

C) $x = 0; y = 0; x^2 + y^2 = 0$ D) $x = 0; x + y = 0; x^2 + y^2 = 2$.

45. The integrating factor of the differential equation $(x^2 - 1)x\frac{dy}{dx} + 2(2x^2 - 1)y = -5x^3$ is

A) $x^2(x^2 - 1)$ B) $x^2(x^2 + 1)$

C) $x(x^2 - 1)$ D) $x(x^2 + 1)$.

46. Particular integral of $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{-2x} + \sin x$ is

A) $xe^{-2x} + \frac{1}{10}(\sin x + 3\cos x)$ B) $-xe^{-2x} + \frac{1}{10}(\sin x - 3\cos x)$

C) $-xe^{-2x} + \frac{1}{10}(\cos x - 3\sin x)$ D) $-xe^{-2x} + \frac{1}{10}(\sin x + 3\cos x)$.

47. If n_1, n_2 are the sizes, $\bar{x}_1, \bar{x}_2$ the means, σ_1, σ_2 the standard deviations, the standard deviation of the combined series is (where $d_1 = \bar{x}_1 - \bar{x}$ and $d_2 = \bar{x}_2 - \bar{x}$)

A) $\left(\frac{1}{n_1} + \frac{1}{n_2}\right)\left(n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)\right)$

B) $\frac{1}{n_1 + n_2}\left(n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)\right)$

C) $\left(\frac{1}{n_1} - \frac{1}{n_2}\right)\left(n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)\right)$

D) $\frac{1}{n_1 - n_2}\left(n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)\right)$.

$\boxed{D}$ [Turn over

48. The probability that a person stopping at a gas station will ask to have his tyres checked is 0·12, the probability that he will ask to have his oil checked is 0·29 and the probability that he will ask to have them both checked is 0·07. The probability that a person who has his tyres checked will also have oil checked is

A)   0·34

B)   0·58

C)   0·24

D)   0·41.

49. A continuous random variable X has the distribution function

$$F(x) = 0 \text{ if } x < 1$$

$$= k(x-1)^4 \text{ if } 1 < x < 3$$

$$= 1 \text{ if } x > 3.$$

The value of k is

A) $\dfrac{1}{16}$

B) $\dfrac{1}{8}$

C) $\dfrac{1}{4}$

D) $\dfrac{1}{2}$.

50. If Laplace transform $L(y) = \log \dfrac{s+a}{s+b}$, then y equals

A) $\dfrac{1}{t}\left(e^{-bt} - e^{-at}\right)$

B) $\dfrac{1}{t}\left(e^{bt} - e^{at}\right)$

C) $e^{-bt} - e^{-at}$

D) $e^{bt} - e^{at}$

51. Machinability

A)   tends to increase with increase in hardness

B)   tends to decrease with increase in hardness

C)   remains unaffected with hardness

D)   is not related to any of these.

D

52. In transportation problem the condition for optimality test is

A)   number of allocations to be $(m + n - 1)$

B)   allocations are to be independent

C)   both (A) & (B)

D)   none of these.

53. Assignment of work to manpower and machinery is known as

A)   scheduling

B)   loading

C)   reporting

D)   none of these.

54. In the problem $Z = 3x_1 + 2x_2$

subject to $2x_1 + x_2 \leq 20$ .... (i)

$x_1 \leq 10$ .... (ii)

$x_1, x_2 \geq 0$ .... (iii)

constraint (iii) is known as

A)   availability constraint

B)   non-negativity constraint

C)   objective constraint

D)   none of these.

55. PERT stands for

A)   Project Evaluation and Review Technique

B)   Program Evaluation and Review Technique

C)   Project Estimation and Review Technique

D)   Program Estimation and Review Technique.

D | Turn over

5. As the ratio of mean arrival to mean service rate is increased, it is likely that

   A) customer moves faster in the system

   B) customer moves slowly in the system

   C) utilization is decreased because of added strain on the system

   D) the average number in the system decreases.

7. Vogel's approximation method is connected with

   A) Assignment problem
   B) Inventory problem
   C) Transportation problem
   D) PERT.

8. Traffic intensity in a queuing system is indicated by

   A) arrival rate / service rate

   B) service rate / arrival rate

   C) (arrival rate) / (service rate – arrival rate)

   D) arrival rate × service rate.

9. Crashing is to be applied on

   A) critical activities

   B) non-critical activities

   C) both critical and non-critical activities

   D) critical activities with positive slack.

10. Multiple solutions in LPPs indicate that

   A) more than one solution is available for different objective functions values

   B) two solutions are available satisfying all constraints

   C) more than one solution is available for the same objective function value

   D) no solution is available satisfying all the constraints.

61. One angstrom unit is equal to

   A) 10^{-6} cm
   B) 10^{-8} cm
   C) 10^{-4} cm
   D) 10^{-10} cm.

62. In hole basis system fit is obtained by

   A) varying the tolerance on the shaft

   B) varying the tolerance on the hole

   C) varying the tolerance on both the hole and shaft

   D) keeping the shaft size fixed.

63. Go gauges are meant to check

   A) one feature
   B) multiple features
   C) wear
   D) none of these.

64. Angle dekkor is a type of

   A) clinometer
   B) auto-collimator
   C) sine bar
   D) interferometer.

65. Comparators are used to

   A) measure dimensions
   B) measure dimensional differences
   C) zero errors
   D) composite errors.

66. Interference occurs when light rays are

   A) obtained from two different sources and their travel path lengths differ by odd number of half wavelengths

   B) obtained from a single source and their travel path lengths differ by odd number of half wavelengths

   C) obtained from a single source and their travel path lengths differ by even number of half wavelengths

   D) obtained from two different sources and their travel path lengths differ by even number of half wavelengths.

[D]

| Turn over

67. Which of the following is not connected with surface finish ?

A) R_a

B) R_z

C) R_{max}

D) R_n

68. The APT (Automatically Programmed Tools) language is used with

A) Drafting systems

B) NC machines

C) Programmable controllers

D) Large automation systems.

69. Two major categories of software are application software and

A) System software

B) Unix software

C) CAD software

D) High-level languages.

70. In a point-to-point control type of NC system

A) control of position and velocity of tool is essential

B) control of only position of the tool is essential

C) control of only velocity of the tool is sufficient

D) neither position nor velocity need be controlled.

71. Balanced draught system uses

A) steam jet draught

B) induced draught

C) forced draught

D) both induced and force draught.

72. Steam has a specific saturation temperature at

A) each volume

B) each pressure

C) each enthalpy

D) each entropy.

73. Mollier chart is drawn between

A) temperature and pressure

B) temperature and entropy

C) enthalpy and entropy

D) pressure and enthalpy.

74. For the same heat input and compression ratio the most efficient cycle is

A) Otto cycle

B) Diesel cycle

C) Dual cycle

D) None of these.

75. The dry bulb, wet bulb and dew point temperatures will all be same when the air is

A) completely dry

B) fully saturated

C) partially wet

D) at atmospheric pressure.

76. Figure below shows thermodynamic expansion processes A, B, C and D. Which line is closest to the isentropic process ?

A) A

B) B

C) C

D) D.

77. For a given set of operating pressure limits of a Rankine cycle, the highest efficiency occurs for

A) saturated cycle

B) superheated cycle

C) reheat cycle

D) regenerative cycle.

[D]

[Turn over

78. The specific heat of an ideal gas depends on its

A) temperature

B) pressure

C) volume

D) molecular weight and structure.

79. Global warming is caused by

A) ozone

B) carbon dioxide

C) nitrogen

D) carbon monoxide.

80. On psychrometric chart, relative humidity lines are

A) horizontal

B) vertical

C) straight line inclined downward

D) curved.

81. Air vessel in a reciprocating pump is used to

A) obtain continuous supply of water at uniform rate

B) increase delivery

C) reduce suction head

D) remove any entrapped air from water.

82. A hydraulic coupling belongs to the category of

A) power absorbing machines

B) power developing machines

C) energy generating machines

D) energy transfer machines.

83. In a reaction turbine the draft tube is used to

A) transport water to downstream without eddies

B) reconvert kinetic energy to flow energy by a gradual expansion of the flow cross-section

C) increase the effective head

D) prevent air from entering.

D

84. The purpose of surge tank in a pipeline is to

A) smoothen the flow of water

B) minimize friction losses in pipe

C) prevent occurrence of hydraulic jump

D) relieve pressure due to water hammer.

85. In a flow field, the stream lines and equipotential lines

A) are parallel

B) are orthogonal

C) cut at any angle

D) cut orthogonally except at stagnation points.

86. In a static fluid

A) resistance to shear stress is small

B) fluid pressure is zero

C) linear deformation is small

D) only normal stresses can exist.

87. For measuring flow by a venturimeter, it should be installed in

A) vertical line

B) horizontal line

C) inclined line with flow downward

D) in any direction and in any location.

88. For pipes laminar flow occurs when Reynolds number is

A) less than 2000

B) between 2000 and 4000

C) more than 4000

D) none of these.

| Turn over

F-008   D

95. Distance of the centroid of a semicircle of radius r from its base is

 A) $\dfrac{4r}{3\pi}$ B) $\dfrac{3r}{4\pi}$

 C) $\dfrac{4\pi}{3r}$ D) $\dfrac{3\pi}{4r}$.

96. Ratio of a circular body's moment of inertia about its x-axis to that about y-axis is

 A)   0·5   B)   1·0

 C)   1·5   D)   2·0

97. Two shafts A and B are made of the same material. The diameter of shaft B is twice that of shaft A. The ratio of power which can be transmitted by shaft A to that of shaft B is

 A) $\dfrac{1}{2}$ B) $\dfrac{1}{4}$

 C) $\dfrac{1}{8}$ D) $\dfrac{1}{16}$.

98. A solid shaft can resist a bending moment of 3·0 kNm and a twisting moment of 4·0 kNm together. The maximum torque that can be applied is

 A)   7·0 kNm   B)   3·5 kNm

 C)   4·5 kNm   D)   5·0 kNm.

99. A Mohr's circle reduces to a point when the body is subjected to

 A)   pure shear

 B)   uniaxial stress only

 C)   equal and opposite axial stresses on two mutually perpendicular planes, the planes being free of shear

 D)   equal axial stresses on two mutually perpendicular planes, the planes being free of shear.

D   [Turn over

100. For maximum horizontal range, the angle of projection of a projectile should be

    A)   30°   B)   45°

    C)   60°   D)   90°.

101. In which district is Adichanallur which had been the habitat of human race during 1000-2000 BC located ?

    A)   Ariyalur   B)   Ramanathapuram

    C)   Tirunelveli   D)   Virudhunagar.

102. Which of the following is measured on the Richter scale ?

    A)   Density of liquids   B)   Intensity of earthquakes

    C)   Velocity of tornadoes   D)   Height of mountains.

103. Who got the Nobel Prize for Peace in the year 2011 ?

    A)   Thomas Sargent

    B)   Christopher Sims

    C)   Ellen Johnson Sirleaf, Leymah Gbowee and Tawakkol Karman

    D)   Domas Transtroma.

104. Which country won the Kabaddi World Cup, 2011 ?

    A)   United Kingdom   B)   India

    C)   Canada   D)   Germany.

105. The Raman effect is used in the study of

    A)   X-rays

    B)   Cells

    C)   Chromosomes

    D)   Molecular energy.

D

106. Green India Programme is the National Action plan on

    A)   Pollution

    B)   Climate change

    C)   Rainfall

    D)   Environment.

107. What is zero hour ?

    A)   When matters of utmost importance are raised

    B)   When money bill is introduced in the Lok Sabha

    C)   When proposals of opposition are considered

    D)   Interval between morning and evening sessions.

108. Which of the following is a direct tax ?

    A)   Excise duty   B)   Sales tax

    C)   Income tax   D)   Both (B) & (C).

109. Which work is known as an encyclopaedia of social life in the Eleventh Century ?

    A)   Dasakumaracharita by Dandin

    B)   Kathasaritsagara by Somadeva

    C)   Karpuramanjari by Rajasekhara

    D)   Rajatarangini by Kalhana.

110. Who led the French forces during the battle of Waterloo ?

    A)   Duke of Wellington

    B)   Duke of Cornwall

    C)   Napoleon Bonaparte

    D)   Duke of Scotland.

[Turn over

D

SECTION - B

[2 marks each]

111. Two particles with masses in the ratio 1 : 4 are moving with equal kinetic energies. The magnitude of their linear momentum will conform to the ratio

A) 1 : 8

B) 1 : 2

C) $\sqrt{2}$: 1

D) $\sqrt{2}$.

112. A circular shaft subjected to torsion undergoes a twist of 1° in a length of 120 cm. If the maximum shear stress induced is limited to 1000 kg/cm^2 and if modulus of rigidity $G = 0.8 \times 10^6$ then the radius of the shaft should be

A) $\frac{\pi}{18}$

B) $\frac{\pi}{27}$

C) $\frac{18}{\pi}$

D) $\frac{27}{\pi}$

113. The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material and the same inside diameter is

A) $\frac{15}{16}$

B) $\frac{3}{4}$

C) $\frac{1}{2}$

D) $\frac{1}{16}$

114. The deflection of a spring with 20 active turns under a load of 1000 N is 10 mm. The spring is made into two pieces each of 10 active coils and placed in parallel under the same load. The deflection of this system is

A) 20 mm

B) 10 mm

C) 5 mm

D) 2·5 mm.

115. A solid shaft can resist a bending moment of 3·0 kNm and a twisting moment of 4·0 kNm together. Then the maximum torque that can be applied is

A) 7·0 kNm

B) 3·5 kNm

C) 4·5 kNm

D) 5·0 kNm.

116. An impulse turbine operating with a single nozzle has a specific speed of 5. What will be the approximate specific speed of the turbine if the turbine is operated with one more additional nozzle of the same size ?

A) 4

B) 6

C) 7

D) 10.

117. Which of the following would not increase the rate of heat transferred from a heater pipe ?

A) Insulation with materials whose thickness is below critical thickness

B) Blowing air over it

C) Providing fins

D) Putting heater pipe within another whose thermal conductivity is smaller in number and 2 inches thick.

118. A 10 kg solid at 373 K with a specific heat of 0·8 kJ/kg K is immersed in 40 kg of 293 K liquid with a specific heat of 4·0 kJ/kg K. The temperature after a long time, if the container is insulated is

A) 303 K

B) 301 K

C) 299 K

D) 297 K.

119. Dropwise condensation usually occurs on

A) glazed surface

B) smooth surface

C) oil surface

D) coated surface.

120. Up to the critical radius of insulation

A) added insulation will increase heat loss

B) added insulation will decrease heat loss

C) convection heat loss will be less than conduction heat loss

D) heat flux will decrease.

[Turn over

121. The sequencing of jobs in the ascending order of their processing time is known as

    A) shortest processing time
    B) earliest due date
    C) dispatching
    D) none of these.

122. Critical activities have

    A) maximum float
    B) minimum float
    C) zero float
    D) negative float.

123. In a transportation problem there are four supply and five demand centres. The total quantity of supply available is greater than total demand. The number of allocations without degeneracy during an iteration is

    A) 3
    B) 6
    C) 9
    D) 8.

124. A PERT activity has an optimistic time of 3 days, pessimistic time of 15 days and an expected time of 7 days. The most likely time of the activity is

    A) 5 days
    B) 6 days
    C) 7 days
    D) 9 days.

125. Dual of the dual is the

    A) primal
    B) dual
    C) either primal or dual
    D) none of these.

126. Centrifugally cast products have

    A) larger grain structure with high porosity
    B) fine grain structure with high density
    C) fine grain structure with low density
    D) segregation of slug towards the outer skin of the casting.

D

127. Match List I (Components) correctly with List II (Processes) and select your answer using the codes given below the lists :

List I (Components)	List II (Processes)
a) Car body (metal)	1. Machining
b) Clutch lining	2. Casting
c) Gears	3. Sheetmetal pressing
d) Engine block	4. Powder metallurgy

Codes :

	a	b	c	d
A)	3	4	2	1
B)	4	3	1	2
C)	4	3	2	1
D)	3	4	1	2.

128. In which one of the following techniques is vacuum environment required ?

    A) Ultrasonic welding
    B) Laser beam welding
    C) Plasma arc welding
    D) Electron beam welding.

129. Precision is

    A) the repeatability of a measuring process
    B) agreement of result with true value
    C) ability to provide judgement on error
    D) none of these.

[Turn over

D

130. A shaft (diameter $20^{+0.05}_{-0.15}$) and a hole (diameter $20^{+0.20}_{+0.10}$) when assembled would yield

    A) transition fit   B) interference fit

    C) clearance fit   D) none of these.

131. Numerical control

    A) applies only to milling machines

    B) is a method for producing exact number of parts per hour

    C) is a method for controlling by means of a set of instructions

    D) all of these.

132. A standard ground drill has a point angle of

    A) 90°   B) 100°

    C) 118°   D) 120°.

133. Sequencing is a subset of

    A) routing   B) scheduling

    C) expediting   D) none of these.

134. The most commonly used criteria for measuring forecast error is

    A) mean absolute error   B) mean absolute percentage error

    C) mean standard error   D) mean square error.

135. Production Flow Analysis (PFA) is a method of identifying part families that use data from

    A) part programmes   B) production schedule

    C) route sheets   D) bill of materials.

D

136. The rank of the matrix $\begin{pmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 4 & 6 \end{pmatrix}$ is

    A) 1   B) 2

    C) 3   D) 4.

137. Eigenvalues of $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ are

    A) 1, 2, 3   B) 1, 1, 2

    C) 1, 1, 5   D) 2, 2, 5.

138. Solution of the boundary value of the problem $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 x}{\partial t^2}$, $0 < x < l, t > 0$ subject to the conditions $y(0, t) = y(l, t) = 0$; $y(x, 0) = f(x) \frac{\partial y}{\partial x}(x, 0) = 0$ is

    A) $y(x, t) = \sum_{1}^{\infty} A_m \frac{\cos m\pi ct}{l} \frac{\sin m\pi x}{l}$; $A_m = \frac{2}{\pi} \int_{0}^{l} f(x) \frac{\sin m\pi x}{l} \, dx$

    B) $y(x, t) = \sum_{1}^{\infty} A_m \frac{\cos m\pi ct}{l} \frac{\sin m\pi x}{l}$; $A_m = \frac{2}{l} \int_{0}^{l} f(x) \frac{\sin m\pi x}{l} \, dx$

    C) $y(x, t) = \sum_{1}^{\infty} A_m \frac{\cos m\pi t}{l} \frac{\sin m\pi cx}{l}$; $A_m = \frac{2}{l} \int_{0}^{l} f(x) \frac{\sin m x}{l} \, dx$

    D) $y(x, t) = \sum_{1}^{\infty} A_m \frac{\cos m\pi ct}{l} \frac{\sin m\pi cx}{l}$; $A_m = \frac{2}{\pi} \int_{0}^{l} f(x) \frac{\sin m\pi x}{l} \, dx$.

139. The following table gives the values of $f(x)$ at equal intervals of x. Find $\int_{0}^{2} f(x) \, dx$ by Simpon's rule :

x	0	0.5	1.0	1.5	2.0
$f(x)$	0.3999	0.352	0.242	0.129	0.054

    A) 0.375   B) 0.425

    C) 0.477   D) 0.498.

[Turn over

D

140. A motorbike starts from rest and accelerates at a rate of 4 m/sec^2 for 10 seconds and then decelerates at 8 m/sec^2 until it stops. The total distance travelled is

A) 100 m   B) 200 m

C) 300 m   D) 500 m

141. A refrigerator with its door open is left running in a closed room. If the fan is also on and heat transfer from the room is negligible, the room temperature will

A) fall for some time and then rise

B) keep on increasing

C) decrease continuously

D) remain unaffected

142. A system undergoes a change of rate during which 100 kJ of heat is transferred to it and it does 50 kJ of work. The system is brought back to its original state through a process during which 120 kJ of heat is transferred to it. The work done by the system is

A) 50 kJ   B) 70 kJ

C) 170 kJ   D) none of these

143. A refrigerating machine working on reversed Carnot cycle takes 2 kW/min of heat from system while working between temperatures of 300 K and 200 K. COP and power consumed by the cycle will be

A) 1, 1 kW   B) 1, 2 kW

C) 2, 1 kW   D) 2, 2 kW

144. Reduced pressure is

A) always less than atmospheric pressure

B) always unity

C) an index of molecular position of a gas

D) dimensionless.

145. Match List I correctly with List II and select your answer using the codes given below the lists :

List I		List II	
a)	Aluminium brake shoe	1.	Deep drawing
b)	Plastic water bottle	2.	Below moulding
c)	Stainless steel cups	3.	Sand casting
d)	Soft drink can (aluminium)	4.	Centrifugal casting
		5.	Impact extrusion
		6.	Upset forging.

Codes :

	a	b	c	d
A)	1	2	3	4
B)	4	3	2	1
C)	3	2	5	1
D)	3	6	5	4.

146. For a radial bearing the desired rated life is 10000 hours for a speed of 600 rpm and a radial load of 4 kN. The basic load rating for the bearing will be

A) 38·6   B) 40

C) 35·6   D) 38.

| Turn over

D

147. A shaft has two heavy rotors mounted on it. The transverse natural frequencies, considering each of the rotor separately are 100 cycles/sec and 200 cycles/sec respectively. The lowest critical speed is

A) 6000 rpm

B) 9360 rpm

C) 5397 rpm

D) 1259 rpm.

148. Pressure drop of water in a pipe is measured by a manometer using a liquid of density 2000 kg/m^3. The difference in height of liquid in the limbs is 10 cm. Then, the pressure drop is

A) 98·1 N/m^2

B) 981 N/m^2

C) 1692 N/m^2

D) 1620 N/m^2.

149. Two Pelton wheels A and B have the same specific speed and are working under the same head. Wheel A produces 400 kW at 1000 rpm. If B produces 100 kW, then its speed is

A) 4000 rpm

B) 2000 rpm

C) 1500 rpm

D) 1250 rpm.

150. Consider the following energies connected with a Pelton turbine :

   I.   Mechanical energy

   II.   Kinetic energy

   III. Potential energy.

The correct sequence of energy conversion from the entry of the fluid is

A) I, II, III

B) II, III, I

C) III, II, I

D) I, III, II.

D