MPPSC AE

SECTION – A

1. Malanjkhand is famous for which of the following mineral ?

   (A) Bauxite

   (B) Copper

   (C) Dolomite

   (D) Limestone

2. Bansagar Project is situated on which of the following river ?

   (A) Ken

   (B) Betwa

   (C) Son

   (D) Dhasan

3. In Madhya Pradesh, which of the following resources has the highest established capacity among the non-conventional sources of energy ?

   (A) Wind energy

   (B) Solar energy   Doubt

   (C) Biomass energy

   (D) Energy from garbage

4. Which of the following sources has highest proportion of irrigation in Madhya Pradesh ?

   (A) Canals

   (B) Tanks

   (C) Wells-tubewells

   (D) Other sources

5. Vindhyachal Super Thermal Power Station is established in which of the following district ?

   (A) Shahdol

   (B) Betul

   (C) Umaria

   (D) Singrauli

6. Number of moveable joints in robot is called

   (A) Degree of independence

   (B) Degree of joints

   (C) Degree of freedom

   (D) Degree of movement

7. Technique to verify message integrity is known as

   (A) Message encrypt

   (B) Message checksum

   (C) Message digest

   (D) None of the above

8. _____ is a software program that filters all the data coming through the internet.

   (A) Antivirus

   (B) Cookies

   (C) Malware

   (D) Firewall

9. Infrastructure aspects provided by Government in formation of National e-Governance Plan for application and data hosting and connectivity are

   (A) SDC, SWAN and ESDG

   (B) SWAN, SDC and NIC

   (C) SWAN, SDLC and NISG

   (D) None of these

10. The scope of cyber security is

   (A) Vulnerability reduction

   (B) Incident response

   (C) Recovery policy

   (D) All of the above

11. Which of the following folk-dance is **not** associated to Nimari folk-dance ?

   (A) Gangour

   (B) Rai

   (C) Kathi

   (D) Fefariya

12. Which of the following is a famous folk-drama of Malwa ?

   (A) Hingola

   (B) Chhahur

   (C) Mansukha

   (D) Maach

13. What was the ancient name of Baghelkhand ?

   (A) Karush

   (B) Mahishmati

   (C) Teerbhukti

   (D) Shuktimati

14. The famous Chandela Generals Alha and Udal lost their lives while fighting against which ruler ?

   (A) Ajayraj

   (B) Arnoraj

   (C) Sindhuraj

   (D) Prithviraj Chauhan

15. Which of the following is **not** a composition of Pandit Makhanlal Chaturvedi ?

   (A) Himkiritani

   (B) Bijuri

   (C) Himtarangini

   (D) Rasikpriya

16. On what dates were the Olympic Games held in Tokyo ?

(A) 21 July to 5 August 2021

(B) 22 July to 10 August 2021

(C) 22 July to 11 August 2021

(D) 23 July to 8 August 2021

17. Where is the 2024 Olympic Games Scheduled to be held ?

(A) Paris

(B) London

(C) Johannesburg

(D) Budapest

18. On which date the Arogya Setu App was launched by the Government of India ?

(A) 17 June 2021

(B) 17 January 2021

(C) 2 April 2020

(D) 14 March 2020

19. On which date the National Education Policy 2020 was launched by the Government of Madhya Pradesh ?

(A) 16 August 2021

(B) 26 August 2021

(C) 28 August 2021

(D) 30 August 2021

20. How many gold medals did the Indian team win in the Paralympics held in 2021 ?

(A) 5

(B) 6

(C) 7

(D) 19

21. Rain occurs in the month of August in Madhya Pradesh is mainly receives from which of the following ?

(A) North-Eastern Monsoon

(B) South-Western Monsoon

(C) Winter Monsoon

(D) Cyclonic Rain

22. According to the Government of Madhya Pradesh, what percentage of the following area is under protected forests out of the total forest area ?

(A) 45.6%

(B) 44.6%

(C) 32.8%

(D) 70.2%

23. Which of the following mountain range is situated between Narmada-Tapti rivers and South of the Son river ?

(A) Kaimur range

(B) Bhander range

(C) Vindhyachal range

(D) Satpura-Maikal range

24. Which is the origin of the West direction flowing river Tapti (Tapi) ?

(A) Shahpur

(B) Chicholi

(C) Bhainsdehi

(D) Multai

25. Which of the following is the share of Madhya Pradesh in the total manganese production of the country ?

(A) 18.84%

(B) 15.02%

(C) 12.50%

(D) 4.56%

26. Who among the following is **not** a Bundeli writer ?

(A) Jagnik

(B) Maharaj Vishwanath Singh

(C) Isuri

(D) Gangadhar Vyas

27. In which district of Madhya Pradesh, Jageshwari fair is organized ?

(A) Satna

(B) Ashok-nagar

(C) Balaghat

(D) Badwani

28. Which revolutionary was hanged by the British Government during the Bundela rebellion ?

(A) Madhukar Shah of Narhot

(B) Bandeshah of Bhanpur

(C) Jujhar Singh of Herapur

(D) None of these

29. According to the Baiga tradition, who was the creater of the Universe ?

(A) Thakurdev

(B) Indradev

(C) Agnidev

(D) Somdev

30. The famous artist Annasaheb Raghunath K. Phadke is associated with which of the following art ?

(A) Sculpture

(B) Dance

(C) Music

(D) Painting

31. Which of these is **not** an open source Operating System ?

(A) UNIX

(B) ANDROID

(C) WINDOWS

(D) None of these

32. $(1101\ 0001)_2$ binary number is same as ( )$_8$ octal number.

(A) $(321)_8$

(B) $(123)_8$

(C) $(641)_8$

(D) $(146)_8$

33. Which of these is used as CPU in computer ?

(A) Microprocessor

(B) Microcontroller

(C) Microcomputer

(D) Microprogrammer

34. How many megabytes represent one gigabyte (in binary) ?

(A) 2048

(B) 1024

(C) 1024×1024

(D) 1048

35. The space in which a robot operates is called

(A) Environment

(B) Spatial space

(C) Work space

(D) Work envelope

36. In which Article of the Constitution, the function of the Council of Ministers is said to "Assistance and Advise" the Governor ?

(A) Article – 162

(B) Article – 163

(C) Article – 164

(D) Article – 165

37. What is the level of Panchayati Raj System in Madhya Pradesh ?
    (A) Two tier
    (B) Three tier
    (C) Four tier
    (D) None of these

38. The scheme One Stop Center (Sakhi) is related with
    (A) Providing facilities to women victims of violence
    (B) Providing ration
    (C) Self employment
    (D) Skill and training

39. The lowest population density district of Madhya Pradesh is
    (A) Jhabua
    (B) Mandla
    (C) Dindori
    (D) Sidhi

40. Arrange the following district of Madhya Pradesh in descending order of sex ratio and select the correct answer from below codes.
    1. Mandla
    2. Dindori
    3. Alirajpur
    4. Balaghat
    Codes :
    (A) 1, 2, 3, 4
    (B) 4, 3, 1, 2
    (C) 2, 1, 4, 3
    (D) 3, 4, 2, 1

41. In which year the Sports Authority of India was established ?
    (A) 1976
    (B) 1981
    (C) 1984
    (D) 1991

42. When was the 'Ladli Lakshmi Yojna' started by the Government of Madhya Pradesh ?
    (A) 1 April 2006
    (B) 1 April 2007
    (C) 1 April 2008
    (D) 1 July 2006

43. When was the Chief Minister's Women Empowerment Scheme started in Madhya Pradesh ?
    (A) April 2012
    (B) July 2012
    (C) September 2013
    (D) November 2013

44. From which date the present Governor of Madhya Pradesh Shri Mangu Bhai Ch. Patel has taken over ?

(A) 03 July 2021

(B) 13 July 2021

(C) 08 July 2021

(D) 28 July 2021

Doubt 20

45. In which famous place Jyotirling Mamleshvar is situated ?

(A) Mandsour

(B) Omkareshvar

(C) Kapil Dhara

(D) Ujjain

46. When was Chief Minister Krishak Udhyami Yojana launched ?

(A) Year 2016 – 2017

(B) Year 2017 – 2018

(C) Year 2018 – 2019

(D) Year 2019 – 2020

47. In a year 2005 – 06, average size of agricultural holding in Madhya Pradesh is

(A) 1.28 Hectare

(B) 2.22 Hectare

(C) 1.8 Hectare

(D) 2.25 Hectare

48. Which district irrigated by "BenGanga" Canal in Madhya Pradesh ?

(A) Jabalpur

(B) Mandla

(C) Sidhi

(D) Balaghat

49. Soil Health Card is related with

(A) Use of balanced fertilizer

(B) High yields

(C) Soil test

(D) All of the above

50. Lowest female literacy rate district in Madhya Pradesh is

(A) Jhabua

(B) Alirajpur

(C) Sheopur

(D) Barwani

खंड – ब/SECTION – B

51. An oil of specific gravity 0.9 is flowing inside a pipe at a velocity of 3 m/s at pipe diameter of 25 mm. The mass flow rate at another location where diameter is reduced to 20 cm will be

(A) 125.25 Kg/s

(B) 132.23 Kg/s

(C) 118.20 Kg/s

(D) 112.18 Kg/s

52. The three-dimensions continuity equation in Cartesian co-ordinate system for incompressible fluid is

(A) $\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial y}(\rho v) + \frac{\partial}{\partial z}(\rho w) = 0$

(B) $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$

(C) $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial x} + \frac{\partial w}{\partial x} = 0$

(D) $\frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial x}(\rho v) + \frac{\partial}{\partial x}(\rho w) = 0$

53. A water is flowing at a velocity of 3 m/s through a pipe of diameter 30 cm and length 50 m. If kinematic viscosity is 0.01×10^{-4} m²/s, the head lost due to friction using Darcy formula is

(A) 78.28 cm

(B) 80.25 cm

(C) 69.25 cm

(D) 75.28 cm

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54. In case of turbulent flow through pipe, the loss of pressure head is approximately proportional to (velocity)^n, where n is

(A) 1

(B) 2

(C) 3

(D) 4

55. The square root of ratio of inertia force of a flowing fluid to the surface tension force is

(A) Froude's number

(B) Euler's number

(C) Weber's number

(D) Mach's number

56. Which of the following is not a programming language ?

(A) ADAPT

(B) EXAPT

(C) INAPT

(D) MINIAPT

57. In which of the following sector, Automated Guided Vehicles (AGVs) are used extensively to move parts and to orient them as required ?

(A) Flexible manufacturing system

(B) Group technology

(C) Cellular manufacturing

(D) Agile manufacturing

58. Which is a concept that seeks to take advantage of the design and processing similarities among the parts to be produced ?

(A) Flexible manufacturing system

(B) Group technology

(C) Cellular manufacturing

(D) Agile manufacturing

59. What is the basis of modern Computer-Aided Design System ?

(A) ICG

(B) GCI

(C) GIF

(D) IGC

60. Which of the following is **not** a part of Computer-Aided Design (CAD) hardware ?

(A) A graphics terminal

(B) Secondary storage

(C) Computer programmes

(D) Plotters

61. In linear programming problem, the term which is **not** involved is

(A) Objective function

(B) Linear scale

(C) Linear constraints

(D) Decision variables

62. In transportation model, if the number of row + the number of columns – 1 is not equal to the number of occupied squares, then it is the case of

(A) Dummy sources

(B) Dummy destinations

(C) Dummy activity

(D) Degeneracy

63. In forecasting, the mean absolute deviation expresses

(A) Gross error

(B) Direction and magnitude of the error

(C) Direction of the error

(D) Magnitude of the error

64. System efficiency is expressed as ratio of

(A) Actual measured output to the designed capacity

(B) Actual measured output to the installed capacity

(C) Actual measured output to the system capacity

(D) Actual measured output to the rated capacity

65. One of the characteristics of the queuing system is

(A) Customers feedback

(B) Hungarian mechanism

(C) Customer experience

(D) Service mechanism

66. A steel bar is subjected to an axial pull of 84 kN. Stress induced into the bar is 140 N/mm². If Young's modulus is 2×10^5 N/mm², then the longitudinal strain produced will be

(A) 0.0002

(B) 0.0003

(C) 0.0006

(D) 0.0007

$\in = \frac{\sigma}{E}$

$= \frac{140}{2 \times 10^5}$

67. Maximum flexural stress for a cast iron pipe having maximum bending moment 125000 N-mm and section modulus 17017 mm³ will be

(A) 17.23 N/mm²

(B) 7.34 N/mm²

(C) 9.21 N/mm²

(D) 14.32 N/mm²

$\frac{M}{I} = \frac{\sigma}{y}$

$\frac{M}{z}$

68. Steel column pinned at both ends has modulus of elasticity $E = 2 \times 10^5$ N/mm², moment of inertia I = 90000 mm⁴, l = 1.75 m, value of Euler's critical load will be

(A) 75000 N

(B) 72000 N

(C) 68000 N

(D) 58009 N

$\frac{125000}{17017}$

$= \frac{\pi^2 \times 2 \times 10^5 \times 90000}{(1.75)^2}$

69. An air vessel has circumferential stress of 267.75 N/mm²; longitudinal stress of 133.875 N/mm² ; value of Young's modulus E = 2.1 ×10⁵ N/mm², Poisson's ratio m = 0.3 ; value of the circumferential strain will be

(A) 0.0005090

(B) 0.001084

(C) 0.0002050

(D) 0.002040

70. Metal bar AB is subjected to a tensile load of 50 kN. It's length is 600 mm and cross-sectional area is 1000 mm². If value of Young's modulus E = 1.05 ×10⁵ N/mm²; then extension of that metal bar due to the tensile load is

(A) 0.4916 mm

(B) 3.2916 mm

(C) 0.2857 mm

(D) 4.3164 mm

$\delta = \frac{50 \times 10^3 \times 600}{1000 \times 1.05 \times 10^5}$

71. Unit of thermal diffusivity in SI units system

(A) m³/s

(B) m²/s

(C) m/s

(D) W/mK

$\alpha = \frac{K}{\rho C}$

72. Effectiveness of infinitely long fin is given by

(where, P = Fin parameter, K = Fin thermal conductivity, h = Convective heat transfer coefficient, A_c = Fin cross-section area)

(A) $\sqrt{\dfrac{Ph}{KA_c}}$

(B) $\sqrt{\dfrac{PK}{h.A_c}}$

(C) $\sqrt{\dfrac{P.A_c}{h.K}}$

(D) $\sqrt{\dfrac{P}{h.K.A_c}}$

73. _____ number is a connecting link between velocity and temperature field and its value strongly influences relative growth of velocity and thermal boundary layers.

(A) Reynolds

(B) Grashoff

(C) Prandtl

(D) Biot

74. In transient heat conduction, two significant dimensionless parameters are _____ number and _____ number.

(A) Biot; Reynolds

(B) Biot; Prandtl

(C) Reynolds; Grashoff

(D) Biot; Fourier

75. The role of _____ number is the same in free convection as that of Reynolds number in forced convection.

(A) Prandtl

(B) Grashoff

(C) Fourier

(D) Biot

76. For a cantilever beam of length l carrying a concentrated load W at free end, the shear force and bending moment diagram will be

(A) Triangular and Rectangular respectively

(B) Rectangular and Triangular respectively

(C) Triangular and Triangular respectively

(D) Rectangular and Rectangular respectively

77. Torque transmitted by a solid circular shaft of diameter d, subjected to shear stress fs is given by

(A) $\dfrac{\pi}{32}$ fs . d^2

(B) $\dfrac{\pi}{32}$ fs . d^3

(C) $\dfrac{\pi}{16}$ fs . d^2

(D) $\dfrac{\pi}{16}$ fs . d^3

78. When both ends of column are pinned or hinged, buckling load equation is given by

(A) $\dfrac{\pi^2 EI}{l^2}$

(B) $\dfrac{\pi^3 EI}{l^3}$

(C) $\dfrac{\pi^2 EI}{l^3}$

(D) $\dfrac{\pi^2 EI}{l^4}$

79. Maximum principal stress theory is proper choice for

(A) Brittle Materials

(B) Ductile Materials

(C) Fragile Materials

(D) Composite Materials

80. For 100 kN tensile test of mild steel bar of 30 mm diameter, stress induced in the bar is

(A) 103.81 N/mm²

(B) 252.61 N/mm²

(C) 141.47 N/mm²

(D) 365.37 N/mm²

81. In throttling device,

(A) Enthalpy of fluid before and after throttling are not equal

(B) Enthalpy of fluid before and after throttling are equal

(C) Work is converted into heat

(D) Heat is converted into work

82. In a cyclic heat engine, source temperature is 800°C and sink temperature is 30°C; its maximum efficiency will be

(A) 65.4%

(B) 68.5%

(C) 71.8%

(D) 54.5%

83. In a compression process, initial temperature is 308 K; if compression ratio is 8; temperature at the end of compression will be

(A) 823.5 K

(B) 691.3 K

(C) 910.3 K

(D) 708.4 K

84. Machine containing fluid system has a stirring device in the cylinder. Stirring device is turned 10,000 revolutions with an average torque against fluid of -1.275 N-m, then work done by stirring device on system will be

(A) 173 KJ

(B) 110 KJ

(C) 90 KJ

(D) 80 KJ

85. Certain gas has mass of 2 kg; Cp = 1.968 KJ/KgK. Initial temp. $t_1 = 5°C$; final temp. $t_2 = 100°C$; change in enthalpy of the gas will be

(A) 373.92 KJ

(B) 437.32 KJ

(C) 568.44 KJ

(D) 418.21 KJ

86. The natural frequency of free torsional vibrations of a shaft is equal to ____. (where q = Torsional stiffness of the shaft and I = Mass moment of inertia of the disc attached at the end of a shaft.)

(A) $2\pi\sqrt{\dfrac{q}{I}}$

(B) $2\pi qI$

(C) $\dfrac{1}{2\pi}\sqrt{\dfrac{q}{I}}$

(D) $\dfrac{1}{2\pi}$

87. Ackerman steering gear consists of
(A) Sliding pairs
(B) Turning pairs
(C) Rolling pairs
(D) All of the above

88. When the perfectly elastic belt is stationary, it is subjected to some tension known as initial tension. The value of this tension is equal to ____. (Neglecting centrifugal tension.)
(A) Tension in the tight side of the belt
(B) Tension in the slack side of the belt
(C) Sum of the tensions on the tight side and slack side of the belt
(D) Average of the tensions in the tight side and slack side of the belt

89. When the axes of the first and last wheels of compound gear coincide, then the train is known as
(A) Reverted gear train
(B) Simple train of wheels
(C) Planetary gear train
(D) Epicyclic gear train

90. What is Hammer blow ?
(A) It is the maximum horizontal unbalanced force caused by the mass provided to balance the reciprocating masses
(B) It is the maximum vertical unbalanced force caused by the mass added to balance the reciprocating masses
(C) It is the minimum horizontal unbalanced force caused by the mass provided to balance the reciprocating masses
(D) None of the above

91. Which of the following combustion chamber requires multiple hole injection nozzles for proper mixing of fuel ?
(A) Divided combustion chamber
(B) Open combustion chamber
(C) Precombustion chamber
(D) M-combustion chamber

92. In order to overcome problem of exhaust gas dilution and low charge density, spark advance must be increased at
(A) Full load operation
(B) No load operation
(C) Part load operation
(D) None of the above

93. Solar radiations received from sun without change of direction are called
(A) Diffused radiation
(B) Beam radiation
(C) Global radiation
(D) None of the above

21

$$= \frac{5.67 \times 10^{-8} \times \left[1000^4 - 700^4\right] \times 2\pi r^2}{\left(\frac{1-0.5}{0.5 \times 2\pi r^2}\right) + \left(\frac{1}{2\pi r^2 \times 0.5}\right) + \left(1-\frac{0.25}{0.25}\right) \times \frac{r^2}{\pi r^2}}$$

94. Gas produced by organic waste digester is known as

(A) Producer gas

(B) Biogas

(C) Hydrogen gas only

(D) Natural gas

95. In a reaction turbine, drum diameter is 1 m and blades are at 10 cm high. If speed of turbine is 250 rpm, then blade speed will be

(A) 21.3 m/s

(B) 14.4 m/s

(C) 38.4 m/s
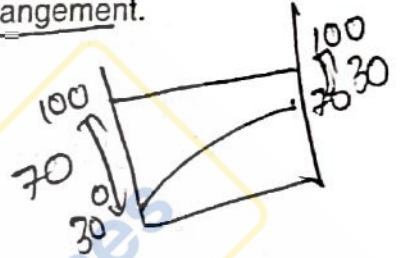
(D) 72.2 m/s

$$\frac{\pi \times 1 \times 250}{60}$$

96. Metals and gases respond rapidly to temperature changes as compared to non-metals and liquids due to

(A) High thermal conductivity

(B) Low thermal diffusivity

(C) High thermal diffusivity

(D) High heat capacity

97. The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 Kg/sec and 0.5 Kg/sec respectively. The inlet temperatures on hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. Calculate LMTD of heat exchanger.
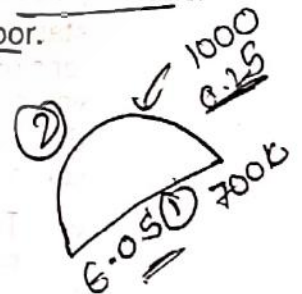
(A) 32°C

(B) 40.5°C

(C) 29.12°C

(D) 45.24°C

98. Saturated steam at 100°C is condensing on shell side of a shell and tube heat exchanger. The cooling water enters the tube at 30°C and leaves at 70°C. Calculate arithmetic mean temperature difference in counter flow arrangement.
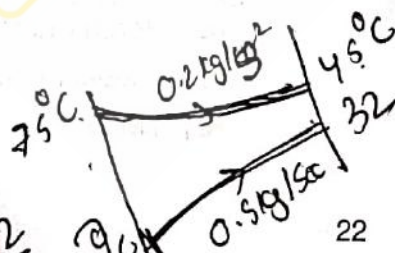
(A) 47.21°C

(B) 50°C

(C) 45.20°C

(D) 50.5°C

99. For a hemispherical furnace, the flat floor is at 700 K and has an emissivity of 0.5. The hemispherical roof is at 1000 K and has an emissivity of 0.25. Find the magnitude of net radiative heat transfer between the roof and floor.

(A) −12310.4 W/m²

(B) 12340.5 W/m²

(C) 12345.6 W/m²

(D) 12346.5 W/m²

100. Assuming the sun to be a black body emitting radiations with maximum intensity at $\lambda = 0.49$ μm. Calculate the heat flux at the surface of the sun.

(A) 5.9×10^7 W/m²

(B) 6.93×10^7 W/m²

(C) 4.93×10^7 W/m²

(D) 7.93×10^3 W/m²

22

101. What is the relationship between CAD and CAM ?
    (A) Science and Technology
    (B) Manufacturing and Marketing
    (C) Design and Marketing
    (D) Design and Manufacturing

102. Which are the three basic types of motion control systems in numerical control ?
    (A) Point to point, straight cut and contouring
    (B) Point to point, edge to edge and straight cut
    (C) Point to point, edge to edge and contouring
    (D) Straight cut, edge to edge and contouring

103. What is the M-code for tool change in CNC ?
    (A) M05
    (B) M06
    (C) M10
    (D) M12

104. Which type of welding use industrial robots extensively to perform operations ?
    (A) Spot welding
    (B) MIG welding
    (C) TIG welding
    (D) Thermit welding

105. What type of solution is obtained by finite element analysis ?
    (A) Absolute
    (B) Approximate
    (C) Average
    (D) Discrete

SEE/ME/2020-A   23

106. If the cutting conditions in a turning operation are

    Cutting speed = 300 ft/min.
    Feed = 0.010 in/rev. and
    Depth of cut = 0.100 in,
    which one of the following is the material removal rate ?
    (A) 0.025 in³/min.
    (B) 0.3 in³/min.
    (C) 3.0 in³/min.
    (D) 3.6 in³/min.

107. A roughing operation generally involves which one of the following combinations of cutting conditions ?
    (where v = cutting speed, f = feed and d = depth.)
    (A) high v, f and d
    (B) high v, low f and d
    (C) low v, high f and d
    (D) low v, f and d

108. In a turning operation, the change in diameter of the work part is equal to which one of the following ?
    (A) 1 × depth of cut
    (B) 2 × depth of cut
    (C) 1 × feed
    (D) 2 × feed

[P.T.O.

Handwritten (top): $2 = (\omega_1 + \omega_2)(1 + \cos\theta)$, $V = (\omega_1 + \omega_2) r\omega(\sin$, $[R - R_1)](1 - \cos\theta)$, $R - R_1)]$

109. Which one of the following cutting tools **cannot** be used on a turret lathe ?

(A) Broach
(B) Reaming tool
(C) Drill bit
(D) Single-point turning tool

110. In ECM, metal removal rate

(A) depends on the hardness of the tool
(B) depends on the hardness of the job metal
(C) is independent of the hardness of the tool and work piece
(D) All of the above

111. For simple harmonic motion of the follower, a cosine curve represents

(A) Displacement Diagram
(B) Velocity Diagram
(C) Acceleration Diagram
(D) All of the above

Handwritten: $V = 3 S \ln \omega t$

112. Whirling speed of the shaft is the speed at which

(A) Shaft tends to vibrate in longitudinal direction
(B) Torsional vibrations occur
(C) Shaft tends to vibrate vigorously in transverse direction
(D) Combination of transverse and longitudinal vibration occurs

Handwritten (bottom): $x = r(1 - \cos\theta)$, $V = r\omega \sin\theta$, $r\omega^2 \cos\theta$, 24

113. The maximum retardation of a flat faced follower, when it has contact at the apex of the nose of a circular arc cam, is given by _____.
(where OQ = Distance between the centre of circular flank and centre of nose.)

(A) $\omega^2 \times OQ$
(B) $\omega^2 \times OQ \sin\theta$
(C) $\omega^2 \times OQ \cos\theta$
(D) $\omega^2 \times OQ \tan\theta$

Handwritten: Not done ; $(\omega_1 + \omega_2)\left|\frac{(1 + \cos\theta)}{R - R_1}\right|$, $R_1 + R_2$

114. The natural frequency of free transverse vibrations due to a point load acting over a simply supported shaft is _____.
(where δs is static deflection of simply supported shaft due to load.)

(A) $0.4985/\sqrt{\delta s}$
(B) $0.5615/\sqrt{\delta s}$
(C) $0.571/\sqrt{\delta s}$
(D) $0.6253/\sqrt{\delta s}$

Handwritten: $\delta = \frac{Pl^3}{48EI}$, $\frac{Pl^3}{48EI}$

115. In a band and block brake, the ratio of tensions on tight side and slack side of the band is _____.
(where μ = coefficient of friction between the block and drum, θ = Semi-angle of each block subtending at the centre of drum and n = Number of blocks.)

(A) $\dfrac{T_n}{T_o} = \left[\dfrac{(1 + \mu\tan\theta)}{(1 - \mu\tan\theta)}\right]^n$

(B) $\dfrac{T_n}{T_o} = \mu.\theta.n$

(C) $\dfrac{T_n}{T_o} = \left[\dfrac{(1 - \mu\tan\theta)}{(1 + \mu\tan\theta)}\right]^n$

(D) $\dfrac{T_n}{T_o} = \left[\dfrac{(1 + \mu\tan\theta)}{(1 - \mu\tan\theta)}\right]^{1/n}$

Handwritten: $\sqrt{\dfrac{g}{\delta}}$, $\sqrt{\dfrac{9.8}{\delta}} = \sqrt{\dfrac{g}{\delta}}$

$$\frac{(w_1 + w_2) \times w \times (\sin \theta)}{w}$$

116. Gantt chart is used for
    (A) Resource management
    (B) Production scheduling
    (C) Large number of tasks
    (D) One time update

117. Dispatching is a part of
    (A) Planning phase
    (B) Action phase
    (C) Control phase
    (D) Development phase

118. The 4M's basically involved in production planning are
    (A) Material, Methods, Maintenance, Manpower
    (B) Material, Measurement, Machines, Manpower
    (C) Material, Methods, Machines, Manuals
    (D) Material, Methods, Machines, Manpower

119. The goods that do not vanish after a single act of consumption is
    (A) Non-durable consumer goods
    (B) Single use consumer goods
    (C) Perishable consumer goods
    (D) Fast moving consumer goods

120. Production Control involves
    (A) Inventory Management
    (B) Time Management
    (C) Vendor Management
    (D) Inspection

121. In EDM process, work piece is generally connected to _____
    (A) Positive terminal
    (B) Negative terminal
    (C) Earth terminal
    (D) Neutral terminal

122. Which one of the following is the chip thickness ratio ?
    (where, t_c = chip thickness after the cut, t_o = chip thickness before the cut, f = feed, d = depth and w = width of cut)
    (A) $r = \dfrac{t_c}{t_o}$
    (B) $r = \dfrac{t_o}{t_c}$
    (C) $r = \dfrac{f}{d}$
    (D) $r = \dfrac{t_o}{w}$

123. Of the following process, which one is noted for the excellent material removal rates ?
    (A) Electric discharge machining
    (B) Laser beam machining
    (C) Plasma arc cutting
    (D) Ultrasonic machining

124. _____ process is used for making a complicated contour in carbide piece.
   (A) Laser machining
   (B) Electro-chemical milling
   (C) Plasma arc machining
   (D) Electro-discharge machining

125. Which one of the following is closest to the temperatures used in plasma arc cutting ?
   (A) 2750°C (5000°F)
   (B) 5500°C (10000°F)
   (C) 8300°C (15000°F)
   (D) 11000°C (20000°F)

126. The displacement thickness (δ^*) for the velocity distribution in boundary layer is by $(u/U) = (y/\delta)$, where u = velocity at distance y from the plate and u = U at y = δ. If δ is boundary layer thickness, then δ^* is
   (A) $\delta/2$
   (B) $\delta/3$
   (C) $\delta/4$
   (D) $\delta/6$

127. The Bernoulli's equation for adiabatic process and compressible flow is
   (A) $\left(\dfrac{K}{K-1}\right)\dfrac{p}{\rho g} + \dfrac{v^2}{2g} + z = $ constant
   (B) $\left(\dfrac{K-1}{K}\right)\dfrac{p}{\rho g} + \dfrac{v^2}{2g} + z = $ constant
   (C) $(K-1)\dfrac{p}{\rho g} + \dfrac{v^2}{2g} + z = $ constant
   (D) $(K)\dfrac{p}{\rho g} + \dfrac{v^2}{2g} + z = $ constant

128. A gas is flowing through a horizontal pipe with mass flow rate of 0.5 Kg/s and Gas constant 292 N-m/Kg°K. The parameters at two different section of the pipe (1 and 2) are; At section 1, the cross section is 40×10^{-4} m², pressure is 50×10^4 N/m² and temperature is 15°C, At section 2, the cross section is 20×10^{-4} m² and pressure is 40×10^4 N/m². The velocity of gas at section 1 is
   (A) 21.02 m/s
   (B) 20.01 m/s
   (C) 21.09 m/s
   (D) 22.05 m/s

129. One of the observation made by O. Reynold in 1883 is
   (A) When the velocity of flow was low, the dye-filament in the glass tube was randomly distributed
   (B) With the increase of velocity of flow, the dye-filament was in the form of straight line
   (C) The straight line of dye filament parallel to the glass tube was the case of laminar flow
   (D) With further increase of velocity of flow, the dye-filament fails to produce shear stresses

130. The maximum hydraulic efficiency of a Pelton wheel for hydraulic efficiency = $2(V_{w_1} + V_{w_2}) \times u/V_1^2$ with conventional notations is
   (A) $(1 - \cos\phi)$
   (B) $(1 + \cos\phi)$
   (C) $(1 - \cos\phi)/2$
   (D) $(1 + \cos\phi)/2$

131. The stresses at a point on the circumference of a circular rod in tension and shear are 120 MPa and 60 MPa respectively. If the yield strength of the rod material is 340 MPa, the factor of safety in the rod material using maximum shear stress theory is nearly equal to

   (A) Factor of safety = 2.0
   (B) Factor of safety = 4.0
   (C) Factor of safety = 2.5
   (D) Factor of safety = 3.0

132. The shock absorbing capacity of a bolt is increased by

   (A) Preventing stress concentration anywhere in the bolt
   (B) Making shank diameter equal to the core diameter
   (C) Use a spring washer
   (D) Proper tightening

133. For the bracket bolted as shown with 4 bolts P, Q, R and S. Which of the bolts are heavily loaded ?

   (A) P and Q
   (B) P and S
   (C) S and Q
   (D) Q and R

134. The Bolts in a flange coupling are designed

   (A) Under tensile stresses
   (B) Under shearing stresses caused by torque transmitted
   (C) Under shearing stress which will develop force to cause torque to be transmitted
   (D) By empirical formula

135. Which of the following statements are correct ?
Consider the following statements :
A splined shaft is used for

   1. transmitting power
   2. holding a fly wheel rigidly in position
   3. moving axially the gears mounted on it
   4. mounting V-belt pulley on it

   (A) 2 and 4
   (B) 1 and 3
   (C) 1 and 4
   (D) 3 and 4

136. Chemically correct air fuel ratio for SI Engine is

   (A) 6 : 1
   (B) 15 : 1
   (C) 5 : 1
   (D) 4 : 1

137. Time lag between first ignition of fuel and the commencement of main phase of combustion is called as

   (A) After burning
   (B) Flame propogation
   (C) Pre-ignition
   (D) Ignition lag

138. In SI engine, increase in Intake temperature and pressure causes flame speed to

(A) Increases

(B) Decreases

(C) Both increases and decreases

(D) Can not be predicted

139. In SI engine, compression ratio increases causes to

(A) Decreases knocking tendency

(B) Increases knocking tendency

(C) May increase or decrease knocking

(D) None of the above

140. In CI engine, delay period increases

(A) With decrease in injection advance angle

(B) With increase in injection advance angle

(C) Maintaining zero injection advance angle

(D) None of the above

141. The properties which are independent of mass in the system are called

(A) Extensive properties

(B) Intensive properties

(C) Homogeneous properties

(D) None of these

142. The system in which both mass of matter and energy transfer takes place is called as

(A) Isolated system

(B) Closed system

(C) Open system

(D) All of these

143. Which of the following is an intensive property ?

(A) Volume

(B) Mass

(C) Energy

(D) Temperature

144. According to Kelvin – Plank statement

(A) It is impossible to construct a device which operates in a cycle and produces no effect other than transfer of heat from a cooler body to hotter body

(B) It is impossible for a heat engine to produce net work in a complete cycle if it exchanges heat only with bodies at a single fixed tap

(C) Heat can be converted into work

(D) Work can be converted into heat

145. Brayton cycle is an air standard cycle for

(A) Thermal power plant

(B) Diesel engines

(C) Otto (S.I.) engines

(D) Gas turbine power plant

146. A shaft is subjected to the combined bending load 'M' and torsional load 'T'. If the permissible shear stress is 'ζ', the diameter 'd' of the shaft will be calculated by the relation

(A) $d = 16T/\pi\zeta$

(B) $d = 32M/\pi d^3$

(C) $d = [16(M^2 + T^2)^{1/2}/\pi\zeta]^{1/3}$

(D) $d = [32(M^2 + T^2)^{1/2}/\pi\zeta]^{1/3}$

147. A shaft is subjected to combined bending and torsional moments of 6 kN-m and 10 kN-m respectively. The equivalent torque will be equal to

(A) $\sqrt{136}$ kN-m

(B) 16 kN-m

(C) $\sqrt{16}$ kN-m

(D) 8 kN-m

148. The ratio of inner and outer radii of the friction lining of a plate clutch for maximum power transmission condition is

(A) 0.58

(B) 0.50

(C) 0.75

(D) 0.65

149. A single plate clutch has outer and inner radii 50 mm and 20 mm respectively. An axial clamping force required to engage the clutch is 2 kN and coefficient of friction between liner material is 0.4, the torque carrying capacity of the clutch using uniform wear theory is

(A) 56 Nm

(B) 28 Nm

(C) 0.056 Nm

(D) 0.028 Nm

150. Match List-I with List – II and select the correct answer using the codes given below the lists.

List – I	List – II
J. Single-plate clutch	1. Scooters
K. Multi-plate clutch	2. Rolling mills
L. Centrifugal clutch	3. Trucks
M. Jaw clutch	4. Mopeds

Codes :

	J	K	L	M
(A)	1	3	4	2
(B)	1	3	2	4
(C)	3	1	4	2
(D)	3	1	2	4