MIZORAM PUBLIC SERVICE COMMISSION

**COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF
INSPECTOR OF FACTORIES UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT &
ENTREPRENEURSHIP DEPARTMENT, GOVERNMENT OF MIZORAM, 2019**

MECHANICAL ENGINEERING
PAPER - III

Time Allowed : 2 hours   Full Marks : 200

All questions carry equal marks of 2 each.
Attempt all questions.

1. Which one of the following is the process to refine the grains of metal after it has been distorted by hammering or cold working?
   (a) Annealing
   (b) Softening
   (c) Re-crystallizing
   (d) Normalizing

2. In metals subjected to cold working, strain hardening effect is due to -
   (a) slip mechanism
   (b) twining mechanism
   (c) dislocation mechanism
   (d) fracture mechanism

3. Cold working of steel is defined as working -
   (a) at its recrystallisation temperature
   (b) above its recrystallisation temperature
   (c) below its recrystallisation temperature
   (d) at two thirds of the melting temperature of the metal

4. Hot rolling of mild steel is carried out -
   (a) at recrystallisation temperature
   (b) between 100°C to 150°C
   (c) below recrystallisation temperature
   (d) above recrystallisation temperature

5. The blank diameter used in thread rolling will be -
   (a) equal to minor diameter of the thread
   (b) equal to pitch diameter of the thread
   (c) a little large than the minor diameter of the thread
   (d) a little larger than the pitch diameter of the thread

6. An imaginary circle which by pure rolling action, gives the same motion as the actual gear, and is called -
   (a) addendum circle
   (b) pitch circle
   (c) dedendum circle
   (d) base circle

7. Thread rolling is restricted to -
   (a) ferrous materials
   (b) ductile materials
   (c) hard materials
   (d) none of these

8. Fabrication weldability test is used to determine -
   (a) mechanical properties required for satisfactory performance of welded joint
   (b) susceptibility of welded joint for cracking
   (c) suitability for joint design
   (d) appropriate machining process

9. Tip of the electrodes used in spot welding are made of:
   (a) Soft Iron
   (b) Mild steel
   (c) Copper
   (d) Aluminium

10. Welding is usually used to join the ends of two pipes of uniform cross section.
    (a) Upset welding
    (b) Flash welding
    (c) Spot
    (d) Projection

11. Neutral flame cannot be used for welding -
    (a) Cast iron
    (b) Mild steel
    (c) Copper and aluminium
    (d) none of these

12. Use of more acetylene with less volumes of oxygen in an oxyacetylene torch produces a
    _____flame.
    (a) Neutral
    (b) Oxidising
    (c) Carburising
    (d) None of these

13. The property of sand due to which it evolves a great amount of steam and other gases is called -
    (a) Permeability
    (b) Cohesiveness
    (c) Adhesiveness
    (d) None

14. Green sand is a mixture of -
    (a) 30% sand and 70% clay
    (b) 50% sand and 50% clay
    (c) 70% sand and 30% clay
    (d) 90% sand and 10% clay

15. A casting defect which occur near the ingates as rough lumps -
    (a) Shift
    (b) Sand wash
    (c) Swell
    (d) Scab

16. The operation of finishing a predrilled hole is known as -
    (a) Boring
    (b) Reaming
    (c) Counter boring
    (d) Spot facing

17. Which one of the following statements is correct in respect of unconventional machining processes?
    (a) The cutting tool is in direct contact with the job
    (b) The tool material needs to be harder than the job material
    (c) The tool is never in contact with the job
    (d) There has to be a relative motion between the tool and the job

18. Which of the following is/are used as low wearing tool material(s) in electric discharge machining?
    (a) Copper and brass
    (b) Aluminium and graphite
    (c) Silver tungsten and copper tungsten
    (d) Cast iron

19. In Electro-Discharge Machining (EDM), the tool is made of -
    (a) Copper
    (b) High Speed Steel
    (c) Cast Iron
    (d) Plain Carbon Steel

20. In ECM, the material removal is due to -

    (a) corrosion   (b) erosion

    (c) fusion   (d) ion displacement

21. Which one of the following processes does not cause tool wear?

    (a) Ultrasonic machining   (b) Electrochemical machining

    (c) Electric discharge machining   (d) Anode mechanical machining

22. During ultrasonic machining, the metal removal is achieved by -

    (a) high frequency eddy currents   (b) high frequency sound waves

    (c) hammering action of abrasive particles   (d) rubbing action between tool and workpiece

23. Chip equivalent is increased by -

    (a) an increases in side-cutting edge angle of tool

    (b) an increase in nose radius and side cutting edge angle of tool

    (c) increasing the plant area of cut

    (d) increasing the depth of cut

24. Which of the following is a single point cutting tool?

    (a) Hacksaw blade   (b) Milling cutter

    (c) Grinding wheel   (d) Parting tool

25. For cutting of brass with single-point cutting tool on a lathe, tool should have -

    (a) negative rake angle   (b) positive rake angle

    (c) zero rake angle   (d) zero side relief angle

26. Single point thread cutting tool should ideally have -

    (a) zero rake   (b) positive rake

    (c) negative rake   (d) normal rake

27. In ASA System, if the tool nomenclature is 8-6-5-5-10-15-2-mm, then the side rake angle will be -

    (a) $5°$ (b) $6°$

    (c) $8°$ (d) $10°$

28. A built-up-edge is formed while machining -

    (a) ductile materials at high speed   (b) ductile materials at low speed

    (c) brittle materials at high speed   (d) brittle materials at low speed

29. In orthogonal cutting, shear angle is the angle between -

    (a) shear plane and the cutting velocity

    (b) shear plane and the rake plane

    (c) shear plane and the vertical direction

    (d) shear plane and the direction of elongation of crystals in the chip

30. Thrust force will increase with the increase in -

    (a) side cutting edge angle   (b) tool nose radius

    (c) rake angle   (d) end cutting edge angle

31. As the cutting speed increases -

    (a) more heat is transmitted to the workpiece and less heat is transmitted to the tool

    (b) more heat is carried away by the chip and less heat is transmitted to the tool

    (c) more heat is transmitted to both the chip and the tool

    (d) more heat is transmitted to both the workpiece and the tool

32. The front rake required to machine brass by HSS tool is
    (a) 15°   (b) 5°
    (c) 0°   (d) -5°

33. Flank wear occurs mainly on which of the following?
    (a) Nose part and top face
    (b) Cutting edge only
    (c) Nose part, front relief face, and side relief face of the cutting tool
    (d) Face of the cutting tool at a short distance from the cutting edge

34. Crater wear on tools always starts at some distance from the tool tip because at that point -
    (a) cutting fluid does not penetrate   (b) normal stress on rake face is maximum
    (c) temperature is maximum   (d) tool strength is minimum

35. Tool/life is generally better when -
    (a) grain size of the metal is large
    (b) grain size of the metal is small
    (c) hard constituents arc present in the microstructure of the tool material
    (d) none of these

36. The iron ore mostly used for the production of pig iron is_____.
    (a) Magnetite   (b) Hematite
    (c) Limonite   (d) Pyrite

37. Fe_3C is known as _____.
    (a) Cementite   (b) Ferrite
    (c) Austenite   (d) None

38. The melting point of wrought iron is about_____.
    (a) 1530°C   (b) 530°C
    (c) 1539°C   (d) None

39. The Cupola is used to manufacture _____.
    (a) Pig iron   (b) Cast iron
    (c) Steel   (d) None

40. 18/8 steel contains_____.
    (a) 18%Ni, 8%Cr   (b) 18% Cr, 8% Ni
    (c) 18%Ni, 18%Cr   (d) None

41. Composite materials are -
    (a) made mainly to improve temperature resistance
    (b) used for improved optical properties
    (c) made with strong fibres embedded in weaker and softer matrix to obtain strength better than strength of matrix
    (d) made with strong fibres embedded in weaker and softer matrix to obtain strength better than strength of both matrix and filler

42. Ceramic materials are -
    (a) inorganic compounds of metallic and non-metallic elements
    (b) basically crystalline oxides or metals
    (c) good conductors of electricity
    (d) none of these

43. Which one are inorganic materials -
  (a) biological materials
  (b) minerals and ceramics
  (c) plastics
  (d) wood

44. Using cutting material which can sustain high temperature -
  (a) cerment
  (b) high carbon steel alloy
  (c) composite of two metals
  (d) none of these

45. In which of the following phases of steel cementite is in particle form?
  (a) Martensite
  (b) Ferrite
  (c) Pearlite
  (d) Bainite

46. When FCC iron and BCC iron coexist in equilibrium, the degrees of freedom are -
  (a) 1
  (b) 2
  (c) 3
  (d) 0

47. On heating, if one solid phase splits into two solid phases, the reaction is -
  (a) eutectoid
  (b) peritectoid
  (c) peritectic
  (d) eutectic

48. If the rate of cooling of a liquid metal is rapid, the temperature of freezing/crystallization will -
  (a) decrease
  (b) increase
  (c) remain constant
  (d) none of these

49. Sharing of electrons between neighbouring atoms results in -
  (a) metallic bond
  (b) ionic bond
  (c) covalent bond
  (d) none of these

50. The atomic number of an atom is equal to -
  (a) atomic weight
  (b) atomic mass
  (c) number of protons
  (d) mass number

51. The space lattices with two lattice parameters does not belong to the crystal system -
  (a) triclinic
  (b) rhombohedral
  (c) hexagonal
  (d) tetragonal

52. Decreasing grain size in a polycrystalline material -
  (a) Increases yield strength and corrosion resistance
  (b) Decreases yield strength and corrosion resistance
  (c) Decreases yield strength but increases corrosion resistance
  (d) Increases yield strength but decreases corrosion resistance

53. When the temperature of a solid metal increases,
  (a) Strength of the metal decreases but ductility increases
  (b) Both strength and ductility of the metal decrease
  (c) Both strength and ductility of the metal increase
  (d) Strength of the metal increases but ductility decreases

54. Which of the following statement is true about brittle fracture?
  (a) High temperature and low strain rates favour brittle fracture
  (b) Many metal with HCP crystal structure commonly show brittle fracture
  (c) Brittle fracture is always preceded by noise
  (d) Cup and cone formation is characteristic for brittle materials

55. Magnesium is extruded and not rolled because -

(a) It has a low melting point

(b) It has a low density

(c) Its reactivity with roll material is high

(d) It has a dose-packed hexagonal structure

56. Match the items in Column I and Column II.

Column I		Column II
P.	Charpy test	1. Fluidity
Q.	Knoop test	2. Micro hardness
R.	Spiral test	3. Formability
S.	Cupping test	4. Toughness
		5. Permeability

(a) P - 4, Q - 5, R - 3, S – 2

(b) P - 3, Q - 5, R - 1, S - 4

(c) P - 2, Q - 4, R - 3, S – 5

(d) P- 4, Q - 2, R - 1, S – 3

57. With the increase of percentage of carbon in the steel, which one of the following properties does increase?

(a) Modulus of elasticity

(b) Ductility

(c) Toughness

(d) Hardness

58. A measure of Rockwell hardness is the -

(a) Depth of penetration of indenter

(b) Surface area of indentation

(c) Projected area of indentation

(d) Height of rebound

59. The material property which depends only on the basic crystal structure is -

(a) Fatigue strength

(b) Work hardening

(c) Fracture strength

(d) Elastic constant

60. Match List-I (Crystal Structure) with List-II (Example) and select the correct answer using the codes given below the Lists:

List-I	List-II
(Crystal Structure)	(Example)
A. Simple Cubic	1. Zinc
B. Body-centered Cubic	2. Copper
C. Face-centered Cubic	3. Alpha iron at room temperature
D. Hexagonal Close Packed	4. Manganese

Codes:	A	B	C	D
(a)	4	3	1	2
(b)	4	3	2	1
(c)	3	4	2	1
(d)	3	4	1	2

61. The microstructure composition of pearlite for a Fe_3C diagram consists of -

(a) Carbon dissolved in alpha iron having a body cantered cubic structure

(b) Carbon dissolved in gama iron having a face cantered cubic structure

(c) A mixture of body-cantered alpha iron and face-entered gamma iron

(d) Carbon dissolved in body-cantered alpha iron and an Fe, Fe_3C

62. The coordination number for FCC crystal structure is -
    (a) 4   (b) 8
    (c) 12   (d) 16

63. Which one of the following is the correct ascending order of packing density for the given crystal structures of metals?
    (a) Simple cubic – Face centred cubic – Body centred cubic
    (b) Body centred cubic - Simple cubic - Face centred cubic
    (c) Simple cubic - Body centred cubic - Face centred cubic
    (d) Body centred cubic - Face centred cubic - Simple cubic

64. Eutectic reaction for iron-carbon system occurs at -
    (a) $600°C$ (b) $723°C$
    (c) $1147°C$ (d) $1493°C$

65. Which one of the following sets of constituents is expected in equilibrium cooling of a hypereutectoid steel from austenitic state?
    (a) Ferrite and pearlite   (b) Cementite and pearlite
    (c) Ferrite and bainite   (d) Cementite and martensite

66. Martensite is a super-saturated solution of carbon in -
    (a) Alpha iron   (b) Beta iron
    (c) Gamma iron   (d) Delta iron

67. The straight grades of cemented carbide cutting tool materials contain -
    (a) Tungsten carbide only   (b) Tungsten carbide and titanium carbide
    (c) Tungsten carbide and cobalt   (d) Tungsten carbide and cobalt carbide

68. The iron-carbon diagram and the TTT curves are determined under -
    (a) Equilibrium and non-equilibrium conditions respectively
    (b) Non-equilibrium and equilibrium conditions respectively
    (c) Equilibrium conditions for both
    (d) Non-equilibrium conditions for both

69. TTT diagram indicates time and temperature transformation of -
    (a) Cementite   (b) Pearlite
    (c) Ferrite   (d) Austenite

70. The complete phase recrystallization and fine grain structure is obtained in casting, forging and rolled parts by:
    (a) Recrystallization annealing   (b) Normalizing
    (c) Spheroidizing   (d) Austenising

71. For sales forecasting, pooling of expert opinions is made use of in -
    (a) Statistical correlation   (b) Delphi technique
    (c) Moving average method   (d) Exponential smoothing

72. Which of the following is the measure of forecast error?
    (a) Mean absolute deviation   (b) Trend value
    (c) Moving average   (d) Price fluctuation

73. Which one of the following statements is not correct for the exponential smoothing method of demand forecasting?

    (a) Demand for the most recent data is given more weightage

    (b) This method requires only the current demand and forecast demand

    (c) This method assigns weight to all the previous data

    (d) This method gives equal weightage to all the periods

74. Which one of the following methods can be used for forecasting the sales potential of a new product?

    (a) Time series analysis   (b) Jury of executive opinion method

    (c) Sales force composite method   (d) Direct survey method

75. Which of the following forecasting methods takes a fraction of forecast error into account for the next period forecast?

    (a) Simple average method   (b) Moving average method

    (c) Weighted moving average method   (d) Exponential smoothening method

76. Routing in production planning and control refers to the

    (a) Balancing of load on machines   (b) Authorization of work to be performed

    (c) Progress of work performed   (d) Sequence of operations to be performed

77. Production scheduling is simpler, and high volume of output and high labour efficiency are achieved in the case of:

    (a) Fixed position layout   (b) Process layout

    (c) Product layout   (d) A combination of line and process layout

78. Which one of the following is true in respect of production control for continuous or assembly line production?

    (a) Control is achieved by PERT network

    (b) Johnson algorithm is used for sequencing

    (c) Control is on one work centre only

    (d) Control is on flow of identical components through several operations

79. A production line is said to be balanced when

    (a) There are equal number of machines at each work station

    (b) There are equal number of operators at each work station

    (c) The waiting time for service at each station is the same

    (d) The operation time at each station is the same

80. Last year, a manufacturer produced 15000 products which were sold for Rs. 300 each. At that volume, the fixed costs were Rs. 15.2 lacs and total variable costs were Rs. 21 lacs. The break even quantity of product would be:

    (a) 4000   (b) 7800

    (c) 8400   (d) 9500

81. In PERT analysis a critical activity has -

    (a) Maximum Float   (b) Zero Float

    (c) Maximum Cost   (d) Minimum Cost

82. A dummy activity is used in PERT network to describe -

    (a) Precedence relationship   (b) Necessary time delay

    (c) Resource restriction   (d) Resource idleness

83. In PERT, the distribution of activity times is assumed to be:

    (a) Normal   (b) Gamma

    (c) Beta   (d) Exponential

84. The project activities, precedence relationships and durations are described in the table. The critical path of the project is:

Activity	Precedence	Duration (in days)
P	–	3
Q	–	4
R	P	5
S	Q	5
T	R, S	7
U	R, S	5
V	T	2
W	U	10

    (a) P-R-T-V   (b) Q-S-T-V

    (c) P-R-U-W   (d) Q-S-U-W

85. Dummy activities are used in a network to:

    (a) Facilitate computation of slacks   (b) Satisfy precedence requirements

    (c) Determine project completion time   (d) Avoid use of resources

86. Earliest finish time can be regarded as -

    (a) EST + duration of activity   (b) EST – duration of activity

    (c) LFT + duration of activity   (d) LFT – duration of activity

87. There are two products P and Q with the following characteristics

Product	Demand (Units)	Order Cost (Rs/order)	Holding Cost (Rs./unit/year)
P	100	50	4
Q	400	50	1

The economic order quantity (EOQ) of products P and Q will be in the ratio -

    (a) 1: 1   (b) 1: 2

    (c) 1: 4   (d) 1: 8

88. Economic Order Quantity is the quantity at which the cost of carrying is:

    (a) Minimum   (b) Equal to the cost of ordering

    (c) Less than the cost or ordering   (d) Cost of over-stocking

89. In inventory control theory, the economic order quantity (E.O.Q.) is:

    (a) Average level of inventory   (b) Optimum lot size

    (c) Lot size corresponding to break-even analysis(d) Capacity of a warehouse

90. If orders are placed once a month to meet an annual demand of 6,000 units, then the average inventory would be:

    (a) 200   (b) 250

    (c) 300   (d) 500

91. The first algorithm for Linear Programming was given by:

    (a) Bellman   (b) Dantzig

    (c) Kulm   (d) Van Neumann

92. A feasible solution to the linear programming problem should -

    (a) Satisfy the problem constraints

    (b) Optimize the objective function

    (c) Satisfy the problem constraints and non-negativity restrictions

    (d) Satisfy the non-negativity restrictions

93. Which one of the following is true in case of simplex method of linear programming?

    (a) The constants of constraints equation may be positive or negative

    (b) Inequalities are not converted into equations

    (c) It cannot be used for two-variable problems

    (d) The simplex algorithm is an iterative procedure

94. The cost of providing service in a queuing system increases with -

    (a) Increased mean time in the queue   (b) Increased arrival rate

    (c) Decreased mean time in the queue   (d) Decreased arrival rate

95. Little's law is a relationship between:

    (a) Stock level and lead time in an inventory system

    (b) Waiting time and length of the queue in a queuing system

    (c) Number of machines and job due dates in a scheduling problem

    (d) Uncertainty in the activity time and project completion time

96. Service time in queuing theory is usually assumed to follow:

    (a) Normal distribution   (b) Poisson's distribution

    (c) Erlang distribution   (d) Exponential law

97. If the number of arrivals in a queue follows the Poisson distribution, then the inner arrival time obeys which one of the following distributions?

    (a) Poisson's distribution   (b) Negative exponential law

    (c) Normal distribution   (d) Binomial

98. In a queuing problem, if the arrivals are completely random, then the probability distribution of number of arrivals in a given time follows:

    (a) Poisson distribution   (b) Normal distribution

    (c) Binomial distribution   (d) Exponential distribution

99. Which one of the following conditions should be satisfied for the application of optimality test on an initial solution of transportation model?

    (a) Number of allocations should be less than $m + n - 1$

    (b) Number of allocations should be equal to $m + n - 1$

    (c) Number of allocations should be equal to $m + n$

    (d) Number of allocations should be more than $m + n$

100. In a transportation problem North-West corner rule would yield

    (a) An optimum solution   (b) An initial feasible solution

    (c) A Vogel's approximate solution   (d) A minimum cost solution

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