

# MIZORAM PUBLIC SERVICE COMMISSION

## TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE, P&E CADRE (ELECTRICAL WING) UNDER POWER & ELECTRICITY DEPARTMENT, GOVERNMENT OF MIZORAM, JULY-2023

### MECHANICAL ENGINEERING PAPER-III

Time Allowed : 3 hours

FM : 200

#### **SECTION - A (Multiple Choice questions) (100 Marks)**

*All questions carry equal mark of 2 each. Attempt all questions.*

*This Section should be answered only on the **OMR Response Sheet** provided.*

- Which of the following sand is applied directly next to the surface of the pattern?  
(a) Parting sand (b) Facing sand  
(c) Loam sand (d) Backing sand
- The shape factor for a casting in the form of an annular cylinder of outside diameter 30cm, inside diameter 20cm and height 30cm will be  
(a) 20 (b) 20.5  
(c) 21.7 (d) 22
- In a drilling operation under a given condition, the tool life was found to decrease from 20 min to 5 min due to increase in drill speed from 200 rpm to 400 rpm. What will be the tool life of that drill under same condition if the drill speed is 300 rpm?  
(a) 10.15 min (b) 8.88 min  
(c) 5.67 min (d) 9.25 min
- The front rake required to machine brass by HSS tool is  
(a)  $15^{\circ}$  (b)  $5^{\circ}$   
(c)  $0^{\circ}$  (d)  $-5^{\circ}$
- In metal cutting heat distribution between chip, work and tool is  
(a) 20%, 75%, 5% respectively (b) 75%, 20%, 5% respectively  
(c) 5%, 20%, 75% respectively (d) 5%, 75%, 20% respectively
- The following nonconventional method of machining essentially requires electrolyte  
(a) EDM (b) ECM  
(c) LBM (d) UTM
- In orthogonal turning of medium carbon steel the specific machining energy is 2 J/mm<sup>3</sup>. The cutting velocity, feed rate and depth of cut are 120 m/min, 0.2 mm/rev and 2 mm respectively. The main cutting force in Newton is  
(a) 40 (b) 400  
(c) 800 (d) 1000

8. The advantage of positive rake angle on cutters is that
  - (a) Have less cutting pressure
  - (b) Generates less heat
  - (c) Work well on soft and ductile materials
  - (d) All of the above
9. The following is true for a Robot and NC Machine
  - (a) Similar power drive technology is used in both
  - (b) Different feedback systems are used in both
  - (c) All of the above
  - (d) None of the above
10. Ceramic tools are made from
  - (a) Tungsten oxide
  - (b) Silicon carbide
  - (c) Aluminium oxide
  - (d) Diamond sand
11. A configuration for a robot is
  - (a) Octagonal
  - (b) Rectangular
  - (c) Square
  - (d) Spherical
12. The most commonly used criteria for measuring forecast error is
  - (a) Mean absolute deviation
  - (b) Mean absolute percentage error
  - (c) Mean standard error
  - (d) Mean square error
13. When using a simple moving average to forecast demand, one would
  - (a) Give equal weight to all demand data
  - (b) Assign more weight to recent demand data
  - (c) Include new demand data in the average without discarding the earlier data
  - (d) Include new demand data in the average after discarding some of the earlier demand data
14. Which of the following 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 smoothing method
15. For a product, the forecast and the actual sales for December 2002 were 25 and 20 respectively. If the exponential smoothing constant ( $\alpha$ ) is taken as 0.2, the forecast sales for January 2003 would be
  - (a) 21
  - (b) 23
  - (c) 24
  - (d) 27
16. In an ideal inventory control system, the economic lot size for a part is 1000. If the annual demand for the part is doubled, the new economic lot size required will be
  - (a) 500
  - (b) 2000
  - (c)  $1000/\sqrt{2}$
  - (d)  $1000\sqrt{2}$
17. A company uses 2555 units of an item annually. Delivery lead time is 8 days. The reorder point (in number of units) to achieve optimum inventory is
  - (a) 7
  - (b) 8
  - (c) 56
  - (d) 60
18. In an assembly line for assembling toys, five workers are assigned tasks which take time of 10,8,6,9 and 10 minutes respectively. The balance delay for the line is
  - (a) 43.3%
  - (b) 14.8%
  - (c) 14%
  - (d) 16.3%

19. Simplex method of solving linear programming problem uses
- (a) All the points in the feasible region
  - (b) Only the corner points of the feasible region
  - (c) Intermediate points within the infeasible region
  - (d) Only the interior points in the feasible region
20. Which of the following point defects is non-stoichiometric in nature?
- (a) Schottky defect
  - (b) Metal excess defect
  - (c) Interstitial defect
  - (d) Impurity defect
21. Convert  $[2\bar{1}\bar{1}\bar{1}]$  from four-index system to three-index system.
- (a)  $[2\ 1\ 0]$
  - (b)  $[3\ 0\ 1]$
  - (c)  $[\bar{1}\ \bar{1}\ \bar{1}]$
  - (d)  $[\bar{1}\ \bar{2}\ 1]$
22. Which of the following is a property of Miller indices?
- (a) They uniquely identify a plane
  - (b) They are always positive
  - (c) They are not fractions
  - (d) They are always negative
23. Brass is an alloy of
- (a) Copper and zinc
  - (b) Tin and zinc
  - (c) Copper and tin
  - (d) Copper and Al
24. On heating, one solid phase results in another solid phase and a liquid phase during \_\_\_\_\_ reaction.
- (a) Eutectoid
  - (b) Peritectic
  - (c) Eutectic
  - (d) Peritectoid
25. What is % of carbon by weight in hypo-eutectoid steels?
- (a) 0.5%
  - (b) 0.7%
  - (c) 0.8%
  - (d) 1.2%
26. Arc stability is better with
- (a) AC welding
  - (b) DC welding
  - (c) Both AC and DC welding
  - (d) Specially designed wave forms
27. Which flame is suitable for welding of ferrous metals, Cu and Al alloys?
- (a) Oxidizing flame
  - (b) Carburizing flame
  - (c) Neutral flame
  - (d) Blue flame
28. Pearlite phase in steel is made up of
- (a) alternate layers of martensite and cementite
  - (b) alternate layers of ferrite and cementite
  - (c) alternate layers of ferrite and martensite
  - (d) alternate layers of bainite and cementite
29. Which one of the following is not equilibrium heat treatment
- (a) Austenitising
  - (b) Annealing
  - (c) Normalizing
  - (d) Precipitation
30. 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
31. Eutectic reaction for iron-carbon system occurs at
- (a) 600°C
  - (b) 723°C
  - (c) 1147°C
  - (d) 1493°C

32. 18/8 stainless steel contains
- (a) 18% Ni, 8% Cr
  - (b) 18% Cr, 8% Ni
  - (c) 18% Cr, 8% W
  - (d) 18% W, 8% Cr
33. Hardness is the property of material due to which it
- (a) can be drawn into wires
  - (b) will break with little permanent distortion
  - (c) can cut another metal
  - (d) can be rolled or hammered into thin sheets
34. In the austempering heat treatment process austenite changes to
- (a) Martensite
  - (b) Troosite
  - (c) Sorbite
  - (d) Bainite
35. Delta iron occurs in this temperature range
- (a) 1400°C to 1530°C
  - (b) 723 to 910°C
  - (c) 910 to 1400°C
  - (d) 400 to 723°C
36. In a green-sand moulding process, uniform ramming leads to
- (a) less change of gas porosity
  - (b) uniform flow of molten metal into the mould cavity
  - (c) greater dimensional stability of the casting
  - (d) less sand expansion type of casting defect
37. Shrinkage allowance on pattern is provided to compensate for shrinkage when
- (a) the temperature of liquid metal drops from pouring to freezing temperature
  - (b) the metal changes from liquid to solid state at freezing temperature
  - (c) the temperature of solid phase drops from freezing to room temperature
  - (d) the temperature of metal drops from pouring to room temperature
38. In sheet metal work, the cutting force on the tool can be reduced by
- (a) grinding the cutting edges sharp
  - (b) increasing the hardness of tool
  - (c) providing shear angle on tool
  - (d) increasing the hardness of die
39. In hot working of metals, the working temperature is
- (a) below the recrystallisation temperature
  - (b) above the recrystallisation temperature
  - (c) equal to the melting point of the metal
  - (d) 150°
40. Which one of the following welding processes uses non-consumable electrodes?
- (a) TIG welding
  - (b) MIG welding
  - (c) Manual arc welding
  - (d) Submerged arc welding
41. 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
42. In drop forging, forging is done by dropping
- (a) the work piece at high velocity
  - (b) the hammer at high velocity
  - (c) the die with hammer at high velocity
  - (d) a weight on hammer to produce the requisite impact

43. The type of information that we get from the scheduling chart is
- (a) when the work will be completed
  - (b) to what extent the machines are utilised
  - (c) when does the work start and how much will be completed at a particular time
  - (d) to what extent can the idling time be eliminated
44. Delphi method of forecasting is applicable
- (a) when previous data from the market are available
  - (b) when a study about a product already in the market is required
  - (c) when a new product is launched in the market
  - (d) the market is highly competitive
45. Gantt chart gives the information about
- (a) the utilisation of man power
  - (b) the number of jobs to be completed
  - (c) the quantity of material flow into the process
  - (d) the production schedule
46. 'Shadow price' is the term used in linear programming to denote
- (a) Optimum cost assigned to the variable
  - (b) Value assigned to one unit of capacity
  - (c) Maximum cost/unit
  - (d) Minimum cost/unit
47. In simplex method of solution of linear programming problem, at the optimum level of solution, the values of the slack variables are
- (a) Infinitely large
  - (b) Positive or negative
  - (c) Zeros
  - (d) Can take any value
48. PERT network is
- (a) an activity oriented network
  - (b) an event oriented network
  - (c) an activity and event oriented network
  - (d) it is a review network
49. Dummy activity
- (a) is one which consumes time and resources and indicates precedence
  - (b) is one which does not consume time or resources and indicates precedence
  - (c) is an event only
  - (d) can replace a real activity
50. Consider the following statements with respect to PERT :
1. It consists of activities with uncertain time phases.
  2. This is evolved from Gantt Chart.
  3. Total slack along the critical path is not zero.
  4. There can be more than one critical path in PERT network.
  5. It is similar to electrical network.

Which of the statement given above are correct?

- (a) 1, 2 and 5
- (b) 1, 3, and 5
- (c) 2, 4, and 5
- (d) 1, 2 and 4

**SECTION - B (Short answer type question) (100 Marks)**

*All questions carry equal marks of 5 each.*

*This Section should be answered only on the Answer Sheet provided.*

1. State the difference between steel and cast iron with respect to their compositions.
2. Explain briefly your understanding about the TTT curves.
3. Explain the phenomenon of creep in metals. How is it controlled?
4. What are the advantages and limitations of upset forging?
5. What is the significant advantage of using a Robot in a computer integrated manufacturing system?
6. What are different methods of sales forecasting? Discuss the merits and limitations of sales forecasting method.
7. What is a critical path? What is its importance?
8. Bring out the difference between PERT and CPM.
9. What are inventories? Why does it is essential to keep inventories?
10. Define Value Engineering. Discuss the various fields of application of Value Engineering.
11. Define CNC system? How it is different from NC system?
12. What is the importance of surface roughness? Mention the geometrical characteristics of a surface.
13. What is composite material? How are composite materials classified?
14. Define crystal, space lattice and unit cell.
15. Write Short notes on: Statistical Quality Control and Statistical Process Control.
16. State the working principle of Laser Beam Machining. What are the characteristics of laser used in laser machining?
17. Describe some common defects of: (a) Wire drawing and (b) Extrusion.
18. Derive Economic Order Quantity for purchase model with instantaneous replenishment.
19. Deduce the material removal rate formula for ultrasound machining process.
20. An industry estimates that it will sell 12000 units of its product for the forthcoming year. The ordering cost is Rs 100 per order and the carrying cost per unit per year is 20 percent of the purchase price per unit. The purchase price per unit is Rs 50. Find
  - (a) Economic order quantity
  - (b) No. of orders per year
  - (c) Time between successive orders

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