

# MIZORAM PUBLIC SERVICE COMMISSION

## TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC HEALTH DEPARTMENT, GOVERNMENT OF MIZORAM, MARCH, 2019.

### 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.*

1. Composite materials are
  - (a) made mainly to improve temperature resistance.
  - (b) used for improved optical properties.
  - (c) made with strong fibers embedded in weaker and softer matrix to obtain strength better than strength of matrix.
  - (d) made with strong fibers embedded in weaker and softer matrix to obtain strength better than strength of both matrix and filler.
2. Ceramic materials are
  - (a) good conductors of electricity
  - (b) basically, crystalline oxides or metals
  - (c) inorganic compounds of metallic and non-metallic elements
  - (d) none of these
3. Sharing of electrons between neighboring atoms results in
  - (a) metallic bond
  - (b) ionic bond
  - (c) covalent bond
  - (d) none of these
4. Metallic bond is not characterized by
  - (a) opacity
  - (b) ductility
  - (c) high conductivity
  - (d) directionality
5. 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
6. The pearlite content in plain carbon steel
  - (a) increases with carbon content upto 8% and then decreases
  - (b) increases with increasing carbon content upto 1.2%
  - (c) decreases as carbon content increases
  - (d) none of these

7. Heat treatment that requires heating a part below  $A1$  temperature, i.e. between  $550^{\circ}\text{C}$  and  $650^{\circ}$  is called as
- (a) hardening
  - (b) normalizing
  - (c) process annealing
  - (d) full annealing
8. Annealing temperature is
- (a) same as normalizing temperature
  - (b) greater than normalizing temperature
  - (c) less than normalizing temperature
  - (d) sometimes greater and sometimes lesser than normalizing temperature
9. Which one of the following metals crystallizes in FCC structure
- (a) zinc
  - (b) sodium
  - (c) aluminium
  - (d) caesium chloride
10. The space lattices with two lattice parameters does not belong to the crystal system
- (a) triclinic
  - (b) rhombohedral
  - (c) hexagonal
  - (d) tetragonal
11. The aim of value engineering is to
- (a) find the depreciation value of a machine
  - (b) determine the selling price of a product
  - (c) minimize the cost without change in quality of the product
  - (d) all of the above
12. In value engineering, the term value refers to
- (a) manufacturing cost of the product
  - (b) selling price of the product
  - (c) total cost of the product
  - (d) utility of the product
13. In inventory control theory, the economic order quantity is
- (a) average level of inventory
  - (b) optimum lot size
  - (c) capacity of a warehouse
  - (d) lot size corresponding to break-even analysis
14. Production cost refers to prime cost plus
- (a) factory overheads
  - (b) factory and administration overheads
  - (c) factory, administration and sales overheads
  - (d) factory, administration, sales overheads and profit
15. A-B-C analysis is used in
- (a) CPM
  - (b) PERT
  - (c) Inventory control
  - (d) All of these
16. PERT analysis is based upon
- (a) optimistic time
  - (b) pessimistic time
  - (c) most likely time
  - (d) all of these
17. In A-B-C analysis, which class of items are generally large in number?
- (a) A
  - (b) B
  - (c) C
  - (d) none of these

18. Simplex method is the method used for  
(a) value analysis (b) network analysis  
(c) linear programming (d) queuing theory
19. PERT requires  
(a) single time estimate (b) double time estimate  
(c) triple time estimate (d) none of these
20. In breakeven analysis, total cost consists of  
(a) fixed cost + sales revenue (b) variable cost + sales revenue  
(c) fixed cost + variable cost (d) fixed cost + variable cost + profit
21. Only two perpendicular components of cutting force act on the tool in case of  
(a) Oblique cutting (b) Orthogonal cutting  
(c) 3D cutting (d) Inclined cutting
22. On increasing the value of rake angle, the strength of tool  
(a) increases (b) decreases  
(c) remains constant (d) is unpredictable
23. The portion of the cutting part enclosed between the face and the flank is called  
(a) wedge (b) shank  
(c) base (d) rake face
24. The tool life increases with  
(a) increase in side cutting edge angle (b) decrease in side rake angle  
(c) decrease in nose angle (d) decrease in back rake angle
25. In Electrical discharge machining, the temperature developed is of the order of  
(a) 2,000°C (b) 6,000°C  
(c) 10,000°C (d) 14,000°C
26. Which of the following is not true in case of Electrical discharge machining (EDM)?  
(a) Erosion takes place both on Work piece and the tool.  
(b) Gap between tool and work piece is controlled by servo mechanism.  
(c) The electrode (tool) is made of graphite or copper.  
(d) The size of impression on work piece is exactly the same as that on electrode (tool).
27. In Electron beam machining, workpiece is held in  
(a) vacuum chamber (b) dielectric medium  
(c) electrolyte (d) none of these
28. The vacuum in case of Electron Beam machining is of the order of  
(a)  $10^{-2}$  mm of mercury (b)  $10^{-5}$  mm of mercury  
(c)  $10^{-7}$  mm of mercury (d)  $10^{-9}$  mm of mercury
29. Non-Traditional machining can also be called as  
(a) Contact Machining (b) Non-contact machining  
(c) Partial contact machining (d) Half contact machining
30. Which of the following process comes under mechanical machining?  
(a) USM (b) EDM  
(c) LBM (d) PAM

31. In CNC machine tool, the part program entered into the computer memory
- (a) can be used only once
  - (b) can be used again and again
  - (c) can be used again but it has to be modified every time
  - (d) cannot say
32. Several machine tools can be controlled by a central computer in
- (a) NC (Numerical Control) machine tool
  - (b) CNC (Computer Numerical Control) machine tool
  - (c) DNC (Direct Numerical Control) machine tool
  - (d) CCNC (Central-Computer Numerical Control) machine tool
33. Part-programming mistakes can be avoided in
- (a) NC (Numerical Control) machine tool
  - (b) CNC (Computer Numerical Control) machine tool
  - (c) Both (a) & (b)
  - (d) None of these
34. The difference between the upper limit and lower limit of a dimension is known as
- (a) Basic size
  - (b) Nominal size
  - (c) Tolerance
  - (d) Actual size
35. Encoder is used in CNC machine tool, to sense and control
- (a) Spindle speed
  - (b) Spindle position
  - (c) Table position
  - (d) All of these
36. To accurately cut gears operating at velocities upto 20m/s, the velocity factor is equal to
- (a)  $3/(3+v)$
  - (b)  $6/(6+v)$
  - (c)  $9/(9+v)$
  - (d)  $4.58/(4.58+v)$
37. Internal gears can be cut by
- (a) hobbing
  - (b) gear shaping with rack cutter
  - (c) gear shaping with pinion cutter
  - (d) gang milling
38. Chills are used in casting moulds to
- (a) achieve directional solidification
  - (b) reduce possibility of blow hole
  - (c) reduce the freezing time
  - (d) increase the smoothness of cast surface
39. Size of shaper is given by
- (a) stroke length
  - (b) motor power
  - (c) weight of the machine
  - (d) rate size
40. Weld spatter refers to
- (a) Welding electrode
  - (b) Flux
  - (c) Filler Material
  - (d) Welding defect
41. Which of the following is not a specification of lathe machine tool?
- (a) chuck size
  - (b) swing over diameter
  - (c) distance between centres
  - (d) bed length

42. In oxidizing flame, the inner core attains a temperature of  
(a) 2100 °C (b) 2800 °C  
(c) 3150 °C (d) 3500 °C
43. Size of shaper is generally given by  
(a) stroke length (b) motor power  
(c) weight of the machine (d) rate size
44. For mild steel, the hot forging temperature range is  
(a) 400°C to 600°C (b) 700°C to 900°C  
(c) 1000°C to 1200°C (d) 1300°C to 1500°C
45. Which type of tapers can be produced by attachment method?  
(a) internal (b) external  
(c) both internal and external (d) none of the mentioned
46. Shaper can produce contours of  
(a) concave (b) convex  
(c) both concave and convex (d) none of these
47. Which of the following operation is used to enlarge the previously drilled hole?  
(a) reaming (b) tapping  
(c) boring (d) none of these
48. Which of the following motion does a milling machine has?  
(a) vertical motion (b) crosswise motion  
(c) longitudinal motion (d) all of the mentioned
49. Indexing is accomplished by using a special attachment known as  
(a) dividing head (b) index head  
(c) both dividing head and index head (d) none of the mentioned
50. Which of the following dividing head is also known as simple dividing head?  
(a) plain dividing head (b) universal dividing head  
(c) optical dividing head (d) all of the mentioned

**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. What is difference between crystalline and non-crystalline solids?
2. What are the solid-state analogue of the eutectic and peritectic reactions?
3. What are composites material? How are they different from alloy material?
4. What is the purpose of annealing and normalizing a metal?
5. Aluminium has FCC structure. Its density is 2700 kg/m<sup>3</sup>. Find the unit cell dimensions and atomic diameter. Given atomic weight of Al = 26.98.
6. Define CNC system? What are the different processes that can be performed using CNC system?
7. Explain the following terms used in surface finish measurement: (i) Roughness, (ii) Waviness, (iii) Effective profile, (iv) Sampling length, (v) Lay.
8. Derive Economic Order Quantity for purchase model with instantaneous replenishment and without shortages.
9. Explain with the help of a suitable figure the working principle of Laser Beam welding.
10. An industry estimates that it will sell 15000 units of its product for the forthcoming year. The ordering cost is Rs 200 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 100. Find (i) Economic order quantity (ii) No. of orders per year (iii) Time between successive orders.
11. Briefly describe the process of Carburizing and Nitriding.
12. Explain the need for heat treatment of steels. Describe the process of quenching.
13. Describe the operation of a cupola furnace for melting cast iron.
14. Describe the objective of gating system in any casting.
15. What are the functions served by the pouring basin in a sand casting?
16. What are the advantage and disadvantage of forging? How do you compare forge components with cast components?
17. Explain with sketches the difference between direct and indirect extrusion.
18. Describe the oxy-acetylene gas welding technique. Why is a neutral flame extensively used in oxy-acetylene gas welding?
19. How is an arc obtained in arc welding? What are the advantage of AC equipment over DC equipment in arc welding?
20. Explain with sketches the difference between orthogonal cutting and oblique cutting.