

MIZORAM PUBLIC SERVICE COMMISSION
TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE
UNDER POWER & ELECTRICITY DEPARTMENT, NOVEMBER, 2015

MECHANICAL ENGINEERING
PAPER - III

Time Allowed : 3 hours

Full Marks : 200

Attempt all questions.

Part A - Objective Type Questions (100 Marks)

All questions carry equal marks of 2 each.

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

1. The locations of the atoms and their particular arrangement in a given crystal are described by means of
 - (a) intermolecular bond
 - (b) space lattice
 - (c) diffusion
 - (d) potential energy
2. Which of the following is a ceramic material?
 - (a) silicon carbide
 - (b) zinc
 - (c) iron
 - (d) wood
3. Which of the following tool materials is the hardest?
 - (a) ceramic tool
 - (b) high speed tool
 - (c) carbide tool
 - (d) diamond tools
4. Which of the following processes are heat treatment processes?
 - (a) normalizing
 - (b) annealing
 - (c) quenching
 - (d) all of these
5. Silicon, when added to copper increases
 - (a) strength
 - (b) hardness
 - (c) strength and hardness
 - (d) strength and ductility
6. The process of introducing carbon into low carbon steel in order to produce a hard surface is known as
 - (a) carbonitriding
 - (b) carboaddition
 - (c) cyaniding
 - (d) carburizing
7. The total number of atoms in body centred cubic (BCC) structure unit cell is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
8. Delta iron occurs at temperature of
 - (a) room temperature
 - (b) around melting point
 - (c) between 1400°C to 1539°C
 - (d) between 910°C to 1400°C

9. Manganese in steel increases its
- (a) ductility
 - (b) hardness
 - (c) fluidity
 - (d) tensile strength
10. The purpose of annealing is to
- (a) induce stresses
 - (b) remove stresses
 - (c) harden surface
 - (d) none of these
11. Machining properties of steel are improved by adding
- (a) phosphorous, lead and sulphur
 - (b) silicon, aluminium and titanium
 - (c) vanadium and aluminium
 - (d) chromium and nickel
12. Corrosion resistance of steel is increased by adding
- (a) chromium and nickel
 - (b) nickel and molybdenum
 - (c) aluminium and zinc
 - (d) tungsten and sulphur
13. German Silver is an alloy of
- (a) silver and some impurities
 - (b) nickel, copper and zinc
 - (c) refined silver
 - (d) silver and gold
14. Hardness of steel depends on
- (a) amount of carbon it contains
 - (b) the shape and distribution of the carbide in iron
 - (c) contents of alloying elements
 - (d) none of these
15. Which of the following is preferred for welding of non-ferrous metals by arc welding?
- (a) A.C. low frequency
 - (b) A.C. high frequency
 - (c) D.C.
 - (d) all of these
16. In four high rolling mill the bigger rollers are called
- (a) guide rolls
 - (b) back up rolls
 - (c) main rolls
 - (d) support rolls
17. Gears are best mass produced by
- (a) milling
 - (b) hobbing
 - (c) shaping
 - (d) casting
18. Wax pattern is used in
- (a) die casting
 - (b) investment casting
 - (c) shell moulding
 - (d) plaster moulds
19. Usually no cutting fluid is needed in turning
- (a) low carbon steel
 - (b) alloy steel
 - (c) aluminium
 - (d) cast iron
20. Permeability of a moulding sand is increased with
- (a) increasing the moisture content
 - (b) coarse grain size
 - (c) increasing the compact factor
 - (d) fine grain size
21. The most economical furnace to melt cast iron in large volume is
- (a) reverberatory furnace
 - (b) cupola furnace
 - (c) induction furnace
 - (d) electric furnace

22. Which of the following is always a cold-working operation?
- (a) rolling (b) wire drawing
(c) forging (d) extrusion
23. The flame type that is normally used to weld copper base alloys in oxy-oxy-acetylene welding method is
- (a) carburising flame (b) neutral flame
(c) oxidising flame (d) reducing flame
24. The cutting edges of a standard twist drill are called
- (a) flutes (b) lips
(c) wedges (d) flanks
25. For grinding steels, the preferred abrasive is
- (a) silicon carbide (b) aluminium oxide
(c) diamond (d) cubic boron nitride
26. A 3-jaw chuck is used in a lathe to clamp
- (a) cylindrical work-piece to locate the axis of rotation
(b) eccentric work-piece to locate the axis of rotation
(c) square bar to locate the axis of rotation
(d) any type of work-piece to locate the axis of rotation
27. There is no electrode consumption for which of the following processes?
- (a) TIG welding (b) gas welding
(c) laser welding (d) arc welding
28. The depth of cut depends upon
- (a) tool life (b) power required
(c) type of cut required (d) all of these
29. Automobile bodies can be manufactured by employing
- (a) rod drawing (b) tube drawing
(c) wire drawing (d) deep drawing
30. Which process is used for fine hole drilling and contour machining?
- (a) EBM (b) LBM
(c) ECM (d) USM
31. The reason behind using non-traditional machining processes is to get
- (a) high accuracy (b) high strength
(c) good surface finish (d) all of these
32. NC machine tools are operated by
- (a) input-output module (b) series of coded instructions
(c) feedback system (d) close loop system
33. Which of the following is the basic tool in work study?
- (a) process chart (b) stop watch
(c) bar chart (d) activity chart
34. If normal time is N, idle time is I and allowance is A, then standard time is equal to
- (a) $N+I+A$ (b) $N+I-A$
(c) $N-A$ (d) $N+A$

35. The network analysis mainly based on events falls under the category of
(a) CPM (b) PERT
(c) RAFT (d) CAD
36. The simplex method is the basic method for
(a) queuing theory (b) network analysis
(c) value analysis (d) linear programming
37. Which of the following is not an inventory control technique?
(a) ABC analysis (b) HML analysis
(c) VED analysis (d) PQ analysis
38. Under economic order quantity (EOQ), the sum of cost of carrying and cost of ordering is
(a) maximum (b) minimum
(c) constant (d) none of these
39. In a network analysis technique under project management, CPM is based on
(a) single time (b) two times
(c) three times (d) none of these
40. Which of the following are goals of JIT?
(a) increasing efficiency (b) reducing wastage
(c) reducing lead time (d) all of these
41. The performance of a specific task in CPM is known as
(a) dummy (b) event
(c) activity (d) contract
42. Queuing theory is associated with
(a) sales (b) inspection time
(c) waiting time (d) production time
43. The order in which different jobs are being taken up in a machine or process is called
(a) scheduling (b) sequencing
(c) routing (d) aggregate planning
44. Product layout is employed for
(a) batch production (b) continuous production
(c) effective utilisation of machine (d) all of these
45. Motion study involves analysis of
(a) actions of operator (b) layout of work place
(c) tooling and equipment (d) all of these
46. The micro-motion study was originated by
(a) F.W.Taylor (b) Henri Fayol
(c) F.B. and L.M.Gilberth (d) R.M.Barnes
47. The zone of feasible solution of an LPP is a
(a) rectangular set (b) set of finite number of points
(c) concave set (d) convex set
48. The stepping stone method in transportation problem is used to find
(a) a basic solution (b) a feasible solution
(c) the initial basic feasible solution (d) the optimal solution

49. Salvage value and service life of an equipment are
(a) based on first cost (b) estimated on the basis of past experience
(c) fictitious values (d) actual values
50. Depreciation of machines is considered as
(a) direct expense (b) indirect expense
(c) direct material cost (d) indirect material cost

Part B - Short Answer Questions (100 Marks)

All questions carry equal marks of 5 each.

*This Part should be answered only on the **Answer Booklet** provided.*

1. Mention two types of dislocations and explain briefly. (5)
2. What is the difference between alpha iron, delta iron and gamma iron? (5)
3. What are the effects of carbon on the properties of steel. (5)
4. Describe the types of flames obtained in an oxy-acetylene gas welding process giving the applications. (5)
5. What is Routing? Explain the routing procedure in brief. (2+3=5)
6. Define 'control chart' and state the objective of \bar{X} and R charts. (2+3=5)
7. What are the desirable properties of a cutting-tool material? Explain briefly. (2+3=5)
8. Draw a (110) and a $\bar{1}\bar{1}1$ plane inside the unit cell of a cubic crystal. Determine the Miller indices of the direction that is common to both these planes. (5)
9. What are ceramics? Give their important areas of applications. (2+3=5)
10. Explain the principle of arc welding. (5)
11. What is machinability? Give the factors on which machinability depend. (2+3=5)
12. Define 'quality of design' and state the factors which control the quality of design. (5)
13. What is the object of heat treatment? List the various heat treatment processes. (2+3=5)
14. Write the difference between the following (*any two*): (2×2½=5)
(i) Plastic and Resins (ii) Brasses and Bronzes (iii) Rubbers and Elastomers.
15. Name different methods of forging processes. Also write the advantages and defects in forging. (2+3=5)
16. Draw a single point right handed cutting tool and label its terminology. (5)
17. What is tool life? Name the physical factors which affect tool life. Also write the expression of Taylor's tool life equation. (1+2+2=5)
18. What are the effects of alloying elements on the behaviour and structure of steel? Give two examples. (3+2=5)
19. Discuss the working of Electro-Discharge Machining (EDM). Also state the advantages of such machining over conventional type of machining. (3+2=5)
20. A firm manufactures a product which is sold for Rs.10.50 per unit and the fixed cost of the assets is Rs.50000/- with a variable cost of Rs.6.50 per unit. How many units must be produced to earn a profit of Rs.1000/-? What would be the profit for sales volume of 20,000 units? (2×2½=5)