

B

QUESTION BOOKLET
MECHANICAL ENGINEERING **667726**
PAPER - II (05)

Time Allowed : 2 Hours

Maximum Marks : 200

INSTRUCTIONS FOR CANDIDATES

1. Please do not open this Question Booklet until you are told to do so.
2. Candidate must fill up the necessary informations in the space provided on the OMR answer sheet before commencement of the examination.
3. Answer sheet will be processed by electronic device. Invalidation of answer sheet due to incomplete / incorrect filling of relevant circle of Roll No. and Question Booklet Series in the OMR answer sheet shall result in cancellation of candidature. Any deficiency in filling up OMR answer sheet will be the sole responsibility of the candidate.
4. An example is given below how to fill / mark (darken) Roll No. 41311706 and Question Booklet Series - B. Accordingly, you have to fill / mark (darken) the Roll No. and Question Booklet Series given to you in your OMR answer sheet.

EXAMPLE

Roll No.								Question Booklet Series
4	1	3	1	1	7	0	6	B
1	2	3	4	5	6	7	8	A ☐
2	2	2	2	2	2	2	2	B ☒
3	3	3	3	3	3	3	3	C ☐
4	4	4	4	4	4	4	4	D ☐
5	5	5	5	5	5	5	5	
6	6	6	6	6	6	6	6	
7	7	7	7	7	7	7	7	
8	8	8	8	8	8	8	8	
9	9	9	9	9	9	9	9	
0	0	0	0	0	0	0	0	

5. For marking the correct answer, darken one circle by **BLUE BALLPOINT PEN** only.
6. Please do not mark (darken) more than one circle. Darkening more than one circle against an answer will be treated as wrong answer.
7. Do not detach any leaf from this Question Booklet. After the examination, hand over the OMR answer sheet to the Room Invigilator. You are allowed to take the Question Booklet and carbon copy of the OMR answer sheet after examination is over.
8. Each question carries 2 marks. There is no negative marking for any wrong answer.
9. Possession and use of Calculator, Mobile Phone, Pager or any other electronic gadget is strictly prohibited in the Examination Hall.
10. Please abide by the instructions above and those given on the OMR answer sheet, failure to comply these instructions will be sole responsibility of the candidates.



05 - B



1. If d is shaft diameter, the diameter of hub of flywheel is usually
 - (A) d
 - (B) $2d$
 - (C) $3d$
 - (D) $4d$
2. The cross-section of flywheel arms is usually
 - (A) elliptical
 - (B) rectangular
 - (C) I-section
 - (D) L-section
3. When helical compression spring is cut into halves, the stiffness of the resulting spring will be
 - (A) same
 - (B) double
 - (C) one-half
 - (D) one-fourth
4. Which stress is induced in the arms of a flywheel ?
 - (A) Tensile
 - (B) Bending
 - (C) Shrinkage
 - (D) All above
5. Which of the following is antifriction bearing ?
 - (A) Journal bearing
 - (B) Pedestal bearing
 - (C) Collar bearing
 - (D) Needle bearing
6. Roller bearings are usually lubricated to
 - (A) reduce friction and wear
 - (B) prevent rusting and corrosion
 - (C) dissipate heat
 - (D) All above
7. Two close coiled helical springs with stiffness k_1 and k_2 respectively are connected in series. The stiffness of the equivalent spring is
 - (A) $\frac{k_1 k_2}{k_1 + k_2}$
 - (B) $\frac{k_1 - k_2}{k_1 + k_2}$
 - (C) $\frac{k_1 + k_2}{k_1 k_2}$
 - (D) $\frac{k_1 - k_2}{k_1 \cdot k_2}$

8. If ϵ_1 & ϵ_2 are two principal strains then maximum shear strain will be
- (A) $\epsilon_1 - \epsilon_2$
 (B) $\epsilon_1 + \epsilon_2$
 (C) $\frac{\epsilon_1 \cdot \epsilon_2}{\epsilon_1 - \epsilon_2}$
 (D) $\frac{\epsilon_1 - \epsilon_2}{\epsilon_1 \cdot \epsilon_2}$
9. If a solid shaft can resist a bending moment of M and twisting moment of T , then maximum torque that can be applied on it is
- (A) $\sqrt{M^2 + T^2}$
 (B) $\sqrt{M^2 - T^2}$
 (C) $\frac{M}{M^2 + T^2}$
 (D) $\frac{T}{M^2 - T^2}$
10. When a rod is elongated to double its initial length, its true strain is
- (A) 0.5
 (B) 0.693
 (C) 1.0
 (D) 1.386
11. A hollow circular shaft having outside diameter D and inside diameter d is subjected to a constant twisting moment ' T ' along its length. If T_s is maximum shear stress produced in the shaft, then T is _____ times $T_s \left(\frac{D^4 - d^4}{D} \right)$
- (A) $\frac{\pi}{8}$
 (B) $\frac{\pi}{16}$
 (C) $\frac{\pi}{32}$
 (D) $\frac{\pi}{64}$
12. A simply supported beam of span l is subjected to a uniformly varying load having zero intensity at the left support and w N/m at the right support. The reaction force at the right support is
- (A) $\frac{wl}{2}$
 (B) $\frac{wl}{5}$
 (C) $\frac{wl}{4}$
 (D) $\frac{wl}{3}$
13. In simple tension test, Hooke's law is valid upto
- (A) elastic limit
 (B) proportionality limit
 (C) ultimate stress
 (D) breaking point

14. Gas turbine blades are manufactured by which of the following process ?
- Forging
 - Rolling
 - Investment casting
 - Sand casting
15. Break even analysis deals with which costs ?
- fixed cost and direct cost
 - fixed cost and indirect cost
 - fixed cost and variable cost
 - direct cost and indirect cost
16. Ductility of a material can be defined as
- resistance to indentation
 - ratio of elongation at fracture during tensile test to the original length
 - resistance to impact force
 - resistance to external load
17. Two shafts having the same length and material are joined in series. If the ratio of the diameter of first shaft to that of the second shaft is 2, then the ratio of the angle of twist of the second shaft to that of the first shaft is
- 16
 - 8
 - 4
 - 2
18. Austenite is
- BCC form of iron
 - FCC form of iron
 - Pure iron without any carbon
 - inter-metallic compound iron-carbide
19. Chromium as an alloying element in alloy steel is used to improve
- hardenability
 - mechanical properties
 - corrosion and oxidation resistance
 - machinability
20. Tempering is used in steels to achieve
- lower hardness by transforming austenite to pearlite
 - lower hardness by transforming martensite to pearlite
 - higher hardness by transforming austenite to martensite
 - higher hardness by transforming martensite to pearlite
21. Maximum carbon content in steel is upto
- 0.2%
 - 1.2%
 - 2%
 - 6.67%

22. Riser is used in a sand casting to reduce
- (A) slag inclusion
 - (B) defects due to air aspiration
 - (C) mould erosion
 - (D) shrinkage cavities
23. Which of the following is always a cold working operation ?
- (A) Rolling
 - (B) Wire drawing
 - (C) Forging
 - (D) Extrusion
24. Straight polarity in arc welding is obtained with
- (A) alternating current & +ve electrode
 - (B) direct current & +ve electrode
 - (C) alternating current & -ve electrode
 - (D) direct current & -ve electrode
25. Shrinkage allowance is added to pattern dimensions to take care of
- (A) liquid shrinkage
 - (B) liquid or solid shrinkage
 - (C) solid shrinkage
 - (D) liquid shrinkage and solid shrinkage
26. To improve the mechanical properties of a powder-metallurgy part, which of the following finishing operations is usually used
- (A) repressing
 - (B) sizing
 - (C) coining
 - (D) impregnation
27. The amount of rake angle to be given in a cutting tool depends on
- (A) types of work material
 - (B) types of cutting tool material
 - (C) depth of cut
 - (D) All of above
28. The number of holes required to be moved to mill a hexagonal bolt by direct indexing in case of rapid index plate having 24 holes is
- (A) 1
 - (B) 2
 - (C) 4
 - (D) 6
29. Fuel that has the highest flame temperature in gas welding is
- (A) propylene
 - (B) propane
 - (C) acetylene
 - (D) hydrogen

30. To maximize the objective function Z , the entering basic variable in simplex method is the non-basic variable that
- (A) increases Z at the fastest rate
 - (B) increases Z at the slowest rate
 - (C) decreases Z at the fastest rate
 - (D) decreases Z at the slowest rate
31. Which of the following statements is correct in linear programming ?
- (A) Dual of primal is primal
 - (B) Dual of primal is dual
 - (C) Dual of dual is primal
 - (D) Dual of dual is dual
32. Degeneracy in linear programming problem is associated with
- (A) tie for key row
 - (B) tie for key column
 - (C) infeasible solution
 - (D) multiple optional solution
33. Which of the following is one type of motion control of cutting tools in NC machine ?
- (A) Point-to-point
 - (B) Straight cut
 - (C) Contouring
 - (D) All above
34. Total number of basic variables in a transportation problem with ' m ' sources and ' n ' destinations is
- (A) $m + n$
 - (B) $m - n$
 - (C) $m + n + 1$
 - (D) $m + n - 1$
35. A fictitious factory is required to be added in a transportation problem with total demand ' D ' of ' n ' warehouses and total supply ' S ' of ' m ' sources if
- (A) $S > D$
 - (B) $D > S$
 - (C) $m > n$
 - (D) $n > m$
36. The solution of linear programming problem would be unbounded if there is
- (A) tie for entering basic variable
 - (B) tie for leaving basic variable
 - (C) no choice for entering basic variable
 - (D) no choice for leaving basic variable

37. Which of the following methods provide optional solution to a transportation problem ?

- (A) North-West corner method
- (B) Least cost method
- (C) Modified distribution method
- (D) All above

38. The probability distribution of activity times in PERT is

- (A) normal
- (B) poisson
- (C) beta
- (D) exponential

39. Assignment problem is a spectral type of transportation problem where supply 'S' of each source and demand 'D' of each destination are

- (A) $S > 1, D > 1$
- (B) $S < 1, D < 1$
- (C) $S = D = 1$
- (D) $S > 1, D < 1$

40. The activity that should be crashed first to reduce project duration in CPM must be _____ and with _____ cost slope.

- (A) critical, maximum
- (B) critical, minimum
- (C) non-critical, maximum
- (D) non-critical, minimum

41. Johnson rule for sequencing of jobs minimizes

- (A) average flow time
- (B) make span
- (C) maximum tardiness
- (D) number of tardy jobs

42. Which is the correct relationship among total float TF, free float FF and independent float IF in CPM ?

- (A) $TF \geq FF \geq IF$
- (B) $TF \leq FF \leq IF$
- (C) $FF \geq IF \geq TF$
- (D) $TF \geq IF \geq FF$

43. For a queueing system with Kendall's notation (a/b/c) : (d/e/f), d represents

- (A) system size
- (B) source size
- (C) arrival distribution
- (D) queue discipline

44. For a queueing system (M/μ/1) : (GD/∞/∞) with arrival rate λ and departure rate μ, the average number of busy servers is

- (A) $\frac{1}{\lambda}$
- (B) $\frac{1}{\mu}$
- (C) $\frac{\lambda}{\mu}$
- (D) $\frac{\mu}{\lambda}$

45. If a customer stands for some time in a queue and then leaves the queue before receiving the service, his behaviour is termed as

- (A) jockeying
- (B) balking
- (C) reneging
- (D) pure death

46. In exponential smoothing method of forecasting without any trend and seasonality, if previous base is 20, current demand is 18 and smoothing constant is 0.1, then forecast for next period will be 0

- (A) 16.4
- (B) 19.8
- (C) 18.2
- (D) 20.2

47. Let W_s and W_q are expected waiting time for customer in the system and queue respectively. If λ and μ are rates of arrival and departure respectively, then w_s is equal to

- (A) $W_q + \frac{1}{\mu}$
- (B) $W_q + \frac{1}{\lambda}$
- (C) $W_q + \frac{\lambda}{\mu}$
- (D) $W_q + \frac{\mu}{\lambda}$

48. The time series method of forecasting in which only a few most recent sales data are considered is

- (A) moving average
- (B) exponential smoothing
- (C) regression analysis
- (D) econometric method

49. Which is a component of demand ?

- (A) base
- (B) trend
- (C) seasonality
- (D) All above

50. Materials requirement planning

- (A) is pull type of planning
- (B) ensures no material stock out
- (C) is done for dependent demand items
- (D) All above

51. The final solution of linear programming must be

- (A) basic
- (B) feasible
- (C) optimal
- (D) All above

52. If D is annual consumption and C is cost of each item, then in ABC classification, of inventory, the items are classified on the basis of

- (A) D
- (B) C
- (C) $D \times C$
- (D) $D + C$

53. In inventory control, the economic order quantity minimizes

- (A) annual ordering cost T_O
- (B) annual inventory holding cost T_H
- (C) lead time of ordering
- (D) $T_O + T_H$

54. Which of the following machine tool does not utilize quick return mechanism ?

- (A) Shaper
- (B) Slotter
- (C) Milling machine
- (D) Planer

55. If the time study man gives a rating factor of 120%, it means that the operator is working at

- (A) normal pace
- (B) faster than normal pace
- (C) slower than normal pace
- (D) None of the above

56. In valve engineering, the term 'value' refers to

- (A) cost of production
- (B) selling price
- (C) utility
- (D) None of the above

57. Job evaluation is the method of determining

- (A) relative values of a job
- (B) worker's performance on a job
- (C) worth of a machine
- (D) value of overall production

58. Gantt chart is used for

- (A) inventory control
- (B) material handling
- (C) operation schedule
- (D) machine repair

59. The number of side milling cutters mounted on the arbour of the milling machine in straddle milling is

- (A) one
- (B) two
- (C) three
- (D) four

60. In the following 'C' program, what value will be stored in variable d.

```
int a, b, c; double d;
```

```
a = 2; b = 3; c = 5;
```

```
d = (b * c) % 2
```

- (A) 7.5
- (B) 1
- (C) 15
- (D) 30

61. Quality is defined as

- (A) customer satisfaction
- (B) fitness for use
- (C) conformance to requirements
- (D) All above

62. If F is fixed cost, V is variable cost per unit and P is selling price per unit, then break even quantity is equal to

(A) $\frac{F.V}{P}$

(B) $\frac{F.P}{V}$

(C) $\frac{F}{1 + \frac{V}{P}}$

(D) $\frac{F}{1 - \frac{V}{P}}$

63. Oldham's coupling is used to connect two shafts which are

- (A) intersecting
- (B) parallel
- (C) perpendicular
- (D) co-axial

64. Total number of instantaneous centres of a mechanism having 'n' links is

- (A) $\frac{n(n-1)}{2}$
- (B) $\frac{n-1}{2}$
- (C) $\frac{n(n+1)}{2}$
- (D) $\frac{n+1}{2}$

65. Coriolis acceleration component

- (A) lags the sliding velocity by 90°
- (B) leads the sliding velocity by 90°
- (C) lags the sliding velocity by 180°
- (D) leads the sliding velocity by 180°

66. The lead screw of a lathe with nut is a

- (A) rolling pair
- (B) screw pair
- (C) turning pair
- (D) sliding pair

67. The efficiency of screw jack is maximum when angle of inclination is

- (A) $45^\circ - \frac{\phi}{4}$
- (B) $45^\circ + \frac{\phi}{2}$
- (C) $45^\circ + \frac{\phi}{4}$
- (D) $45^\circ - \frac{\phi}{2}$

Where ϕ = angle of limiting friction

68. In a multiple fraction clutch, the number of active fraction surfaces is

- (A) $2n$
- (B) n
- (C) $2(n-1)$
- (D) $n-1$

Where n is total number of plates.

69. The circle drawn to the cam profile with minimum radius is called

- (A) prime circle
- (B) cam circle
- (C) pitch circle
- (D) base circle

70. Contact ratio of gears is always

- (A) more than one
- (B) one
- (C) less than one
- (D) zero

71. The ratio of circular pitch to module is

- (A) π
- (B) $\frac{1}{\pi}$
- (C) π^2
- (D) $\frac{1}{\pi^2}$

72. A differential uses _____ gear train.

- (A) simple
- (B) epicyclic
- (C) reverted
- (D) compound

73. Crowning of pulleys is done to

- (A) increase tightness of belt on pulley
- (B) prevent belt running off the pulley
- (C) increase the torque transmitted
- (D) improve the shape and strength of pulley

74. For complete dynamic balance, at least _____ mass/masses are necessary.

- (A) one
- (B) two
- (C) three
- (D) four

75. The height of a Watt governor is

- (A) g/w^3
- (B) w^2/g
- (C) w^2g
- (D) g/w^2

76. The frictional resistance at the sleeve _____ the sensitivity of governor.

- (A) does not affect
- (B) increase
- (C) decreases
- (D) may increase or decrease

77. Static balancing involves balancing of

- (A) forces
- (B) couples
- (C) masses
- (D) forces and couples

78. Resonance is a phenomenon in which the frequency of the exciting force is _____ to the natural frequency of the system.

- (A) double
- (B) half
- (C) equal
- (D) thrice

79. At a certain speed, revolving shafts tend to vibrate violently in transverse directions. This speed is known as

- (A) Whirling Speed
- (B) Critical Speed
- (C) Whipping Speed
- (D) All of these

80. In free vibration, the velocity vector leads the displacement vector by

- (A) π
- (B) $\frac{\pi}{2}$
- (C) $\frac{\pi}{3}$
- (D) $\frac{2\pi}{3}$

81. Effort of a governor is the force exerted by the governor on the _____.

- (A) balls
- (B) sleeve
- (C) upper links
- (D) lower links

82. If T_c is centrifugal tension, for maximum power transmission by a belt drive, the maximum tension must be

- (A) $2 T_c$
- (B) $3 T_c$
- (C) $4 T_c$
- (D) $5 T_c$

83. The frictional torque for the same diameter in a conical bearing is _____ than in a flat bearing.

- (A) more
- (B) less
- (C) equal
- (D) may be more or less

84. The transfer function is the operational relationship of the output and _____.

- (A) command
- (B) response
- (C) input
- (D) error

85. The transverse fillet welded joints are designed for

- (A) tensile strength
- (B) compressive strength
- (C) bending strength
- (D) shear strength

86. When a nut is tightened by placing a washer below it, the bolt will be subjected to

- (A) tensile stress
- (B) compressive stress
- (C) shear stress
- (D) None of these

87. A locking device extensively used in automobile industry is a _____ nut.

- (A) jam
- (B) castle
- (C) screw
- (D) ring

88. For a parallel load on a fillet weld of equal legs, the plane of maximum shear occurs at

- (A) 22.5°
- (B) 30°
- (C) 45°
- (D) 60°

89. In a knuckle joint, the forked end of rod may fail in

- (A) tension
- (B) shear
- (C) crushing
- (D) All of these

90. The type of stress/stresses developed in a key is/are

- (A) shear stress
- (B) bearing stress
- (C) shear and bearing stresses
- (D) shearing, bearing and bending stresses

91. The maximum shear stress theory is used for

- (A) brittle materials
- (B) ductile materials
- (C) plastic materials
- (D) non-ferrous materials

92. If d is rod diameter, the length of cotter in a sleeve and cotter joint is taken as

- (A) $1.5 d$
- (B) $2.5 d$
- (C) $3 d$
- (D) $4 d$

93. A machined part is designed as a strut, when it is subjected to _____ force.

- (A) axial tensile
- (B) axial compressive
- (C) tangential
- (D) Any one of these

94. Screws used for power transmission should have

- (A) low efficiency
- (B) high efficiency
- (C) very fine thread
- (D) strong teeth

95. If α is lead angle and ϕ is angle of friction, then the efficiency of screw will be

- (A) $\frac{\tan(\alpha - \phi)}{\tan \alpha}$
- (B) $\frac{\tan \alpha}{\tan(\alpha - \phi)}$
- (C) $\frac{\tan(\alpha + \phi)}{\tan \alpha}$
- (D) $\frac{\tan \alpha}{\tan(\alpha + \phi)}$

96. Buckling will occur about Y-axis if

- (A) $I_{XX} = I_{YY}$
- (B) $I_{XX} = 4 I_{YY}$
- (C) $I_{XX} > 4 I_{YY}$
- (D) $I_{XX} < 4 I_{YY}$

97. The centrifugal tension in the belt

- (A) increases the power transmitted
- (B) decreases the power transmitted
- (C) has no effect on the power transmitted
- (D) is equal to maximum tension in the belt

98. Which of the following is a positive drive ?

- (A) Flat belt drive
- (B) Rope drive
- (C) V-belt drive
- (D) Chain drive

99. If D is diameter of pitch circle and T is number of teeth on the sprocket, then pitch of chain p can be related as

- (A) $p = D \sin \left(\frac{90^\circ}{T} \right)$
- (B) $p = D \sin \left(\frac{120^\circ}{T} \right)$
- (C) $p = D \sin \left(\frac{180^\circ}{T} \right)$
- (D) $p = D \sin \left(\frac{360^\circ}{T} \right)$

100. To ensure self-locking in a screw jack, the helix angle must be

- (A) larger than friction angle
- (B) smaller than friction angle
- (C) equal to friction angle
- (D) such as to give maximum efficiency in lifting