



Note: Answers Marked Red in Colour

MECHANICAL ENGINEERING Paper III

Time : 150 Minutes *All Power is with in you you can do anything & everything* Max. Marks : 150

INSTRUCTIONS

1. Please check the Test Booklet and ensure that it contains all the questions. If you find any defect in the Test Booklet or Answer Sheet, please get it replaced immediately.
2. The Test Booklet contains 150 questions. Each question carries **one** mark.
3. The Test Booklet is printed in four (4) Series, viz. **A B C D**. The Series, **A** or **B** or **C** or **D** is printed on the right-hand corner of the cover page of the Test Booklet. Mark your Test Booklet Series **A** or **B** or **C** or **D** in Part C on side 1 of the Answer Sheet by darkening the appropriate circle with Blue/Black Ball point pen.

Example to fill up the Booklet Series

If your Test Booklet Series is A, please fill as shown below :



If you have not marked the Test Booklet Series at Part C of side 1 of the Answer Sheet or marked in a way that it leads to discrepancy in determining the exact Test Booklet Series, then, in all such cases, your Answer Sheet will be invalidated without any further notice. No correspondence will be entertained in the matter.

4. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer Sheet by darkening the appropriate circle for the question. If more than one circle is darkened, the answer will not be valued at all. Use Blue/Black Ball point pen to make heavy black marks to fill the circle completely. Make **no** other stray marks.

e.g. : If the answer for Question No. 1 is Answer choice (2), it should be marked as follows :



1. Heat transfer takes place according to
- (1) Zeroth Law of Thermodynamics
 - (2) First Law of Thermodynamics
 - (3) Second Law of Thermodynamics
 - (4) Third Law of Thermodynamics
2. It is desired to increase the heat dissipation rate over the surface of an electronic device of spherical shape of 5 mm radius exposed to convection with $h = 10 \text{ W/m}^2 \text{ K}$ by encasing it in a spherical sheath of conductivity 0.04 W/mK . For maximum heat flow, the diameter of the sheath should be
- (1) 18 mm
 - (2) 16 mm
 - (3) 12 mm
 - (4) 8 mm
3. A counterflow heat exchanger is used to heat water from 20 deg C to 80 deg C by using hot exhaust gas entering at 140 deg C and leaving at 80 deg C. The log mean temperature difference for the heat exchanger is
- (1) 80° C
 - (2) 60° C
 - (3) 110° C
 - (4) Not determinable
4. Addition of fin to the surface increases the heat transfer if $\sqrt{hA/KP}$ is
- (1) equal to one
 - (2) greater than one
 - (3) less than one
 - (4) greater than one but less than two
5. In a vapour compression refrigeration system, a throttle valve is used in place of an expander because
- (1) It considerably reduces the system weight
 - (2) It improves the COP as the condenser is small
 - (3) The positive work in isentropic expansion of liquid is very small
 - (4) It leads to significant cost reduction
6. The refrigerant used for absorption refrigerator working on solar heat is a mixture of water and
- (1) Carbon dioxide
 - (2) Freon 12
 - (3) Lithium bromide
 - (4) Sulphur dioxide
7. During the adiabatic cooling of moist air
- (1) DBT remains constant
 - (2) WBT remains constant
 - (3) Dew point temperature remains constant
 - (4) Relative humidity remains constant
8. In a cooling tower, "approach" is the temperature difference between the
- (1) hot inlet water and cold outlet water
 - (2) hot inlet water and WBT
 - (3) cold outlet water and WBT
 - (4) DBT and WBT
9. Which of the following statements is true for two-dimensional flow of ideal fluids ?
- (1) Potential function exists if stream function exists
 - (2) Stream function may or may not exist
 - (3) Both potential function and stream function must exist
 - (4) Stream function will exist but potential function may not exist

10. At the point of boundary layer separation
- (1) shear stress is maximum
 - (2) shear stress is zero
 - (3) velocity is negative
 - (4) density variation is maximum
11. The specific speed of a hydraulic turbine is defined as the speed of a member of the same homologous series of such a size that it
- (1) delivers unit discharge at unit load
 - (2) delivers unit discharge at unit power
 - (3) delivers unit power at unit discharge
 - (4) produces unit power under a unit head
12. In reaction turbines, draft tube is used
- (1) for the safety of the turbine
 - (2) to destroy the undesirable eddy currents
 - (3) to convert the kinetic energy of flow by a gradual expansion of the flow cross-section
 - (4) None of the above purposes
13. The heat transfer, the work done and the change in internal energy are all zero in case of
- (1) a rigid vessel containing steam at 150°C left in the atmosphere which is at 25°C
 - (2) 1 kg gas contained in an insulated cylinder expanding as the piston moves slowly outwards
 - (3) 1 kg of air flowing adiabatically from atmosphere into a previously evacuated bottle
 - (4) a rigid vessel containing ammonia gas connected through a valve to an evacuated rigid vessel, the vessel, the valve and the connecting pipes being well insulated and the valve being opened slowly
14. The velocity of steam in impulse turbine as it flows through the blades
- (1) increases gradually
 - (2) increases rapidly
 - (3) drops gradually
 - (4) remains constant
15. Irrotational flow is characterised as the one in which
- (1) the fluid flows along a straight line
 - (2) the fluid does not rotate as it moves along
 - (3) the net rotation of fluid particles about their mass centres remains zero
 - (4) the streamlines of flow are curved and closely spaced
16. The Buckingham's theorem is widely used in the dimensional analysis and expresses the resulting equation in terms of
- (1) geometric, kinematic and dynamic variables
 - (2) n dimensionless factors
 - (3) (n-m) dimensionless factors
 - (4) independent and dependent variables
17. The work done in the expansion of a gas from volume V_1 to V_2 under constant pressure P is equal to
- (1) Zero
 - (2) $P(V_2 - V_1)$
 - (3) $P(V_2 + V_1)$
 - (4) $P/(V_2 - V_1)$
18. According to first law of thermodynamics
- (1) Heat and work are mutually convertible
 - (2) Carnot engine is the most efficient
 - (3) The entropy of universe is ever increasing
 - (4) Heat flows from hot substance to cold substance

19. Engine misfiring is likely to result from
(1) spark plug gap too small
(2) spark plug gap too wide
(3) vapour lock in the fuel line
(4) stoichiometric fuel air mixture
20. Tractive effort in an automobile is maximum in
(1) first gear
(2) second gear
(3) third gear
(4) top gear
21. Tilting of the front wheels of an automobile away from the vertical is called
(1) castor
(2) camber
(3) toe-in
(4) toe-out
22. A hot body will radiate heat most rapidly if its surface is
(1) white and polished
(2) grey
(3) black and rough
(4) black and polished
23. A steam pipe is to be insulated by two layers of insulations of different conductivities. For least heat loss, the better insulation should be placed
(1) above the inferior insulation
(2) below the inferior insulation
(3) above or below depending on temperature of steam
(4) anywhere above or below the inferior insulation
24. Spent fuel from the nuclear thermal reactor contains
(1) plutonium
(2) unused fuel
(3) fission products
(4) All of the above
25. By advancing the spark timing in an S.I. engine, the possibility of knock will
(1) increase
(2) decrease
(3) not change
(4) be eliminated
26. In petrol engine using fuel having fixed octane rating, increase in compression ratio will
(1) increase the knocking tendency
(2) decrease the knocking tendency
(3) not effect the knocking tendency
(4) increase or decrease the knocking depending on other parameters like strength and time of spark
27. The accumulation of carbon in a cylinder results in increase of
(1) clearance volume
(2) ignition delay
(3) effective compression ratio
(4) volumetric efficiency
28. In a cycle, the spark lasts roughly for
(1) 1 sec
(2) 0.1 sec
(3) 0.01 sec
(4) 0.001 sec
29. The firing order in a six cylinder S.I. engine is
(1) 1-5-3-4-2-6
(2) 1-3-6-5-2-4
(3) 1-6-2-5-4-3
(4) 1-5-2-6-3-4
30. For low load operation, most economical engine is
(1) an S.I. engine
(2) a C.I. engine
(3) a two-stroke engine
(4) both S.I. and C.I. engines are equally good

31. Thermal efficiency of an S.I. engine operating on lean mixture is
- (1) higher
 - (2) lower
 - (3) independent of mixture ratio
 - (4) higher or lower depending on engine rating
32. The concentration of oxides of nitrogen in the exhaust of an S.I. engine will be maximum when
- (1) the fuel air mixture is 10% lean
 - (2) the fuel air mixture is stoichiometric
 - (3) the fuel air mixture is 10% rich
 - (4) the fuel air mixture is 20% rich
33. A dimensionless heat transfer coefficient which gives a measure of the ratio of the heat transfer to the rate at which heat would be conducted within the fluid under temperature gradient is known as
- (1) Reynolds number
 - (2) Grashoff's number
 - (3) Nusselt number
 - (4) Stanton number
34. Three metal walls of the same cross-sectional area having thermal conductivities in the ratio of 1 : 2 : 4 transfer heat at the rate of 6000 kJ/hr. For the same wall thickness, the temperature drop will be in the ratio
- (1) 1 : 2 : 4
 - (2) 1 : 1/2 : 1/4
 - (3) 1/4 : 1/2 : 1
 - (4) 1 : 1 : 1
35. Oil separator in a refrigeration system is installed
- (1) before compressor
 - (2) between compressor and condenser
 - (3) between condenser and expansion valve
 - (4) before evaporator
36. The coefficient of performance of a refrigerator working on reversed Carnot cycle is 4. The ratio of highest temperature to the lowest temperature of the cycle would be
- (1) 1.25
 - (2) 1.4
 - (3) 0.80
 - (4) 1.0
37. Brine is used as a secondary refrigerant in
- (1) Cold storage plants
 - (2) Milk chilling plants
 - (3) Ice plant
 - (4) Cinema hall air-conditioning plant
38. A coal containing high amount of volatile matter will have
- (1) high ignition temperature
 - (2) low ignition temperature
 - (3) high ash fusion temperature
 - (4) very low ash content
39. Foot valves are provided in the suction line of a centrifugal pump to
- (1) avoid cavitation
 - (2) remove the contaminants present in the liquid
 - (3) avoid priming every time the pump is started
 - (4) control the liquid discharge
40. In gas turbine jet propulsion units, when the velocity of discharged jet equals the flight speed, then the propulsion efficiency and thrust become
- (1) 100%, zero
 - (2) 100%, maximum
 - (3) 50%, maximum
 - (4) 0%, maximum

41. Super heating of steam for steam engine results in
- (1) reducing misting quantity
 - (2) more balanced engine
 - (3) less work output
 - (4) increase in efficiency of Rankine cycle
42. Joule Thomson coefficient for an ideal gas following $pV = mRT$ is
- (1) unity
 - (2) infinite
 - (3) zero
 - (4) 0.5
43. Which of the following is conserved across a normal shock wave ?
- (1) Temperature
 - (2) Pressure
 - (3) Momentum
 - (4) All of the above
44. The capacity of a compressor is specified as 50 cubic metre per minute. It implies that
- (1) it is capable of supplying 50 cu. m of compressed air per min
 - (2) compressor is capable of compressing 50 cu. m of free air per min
 - (3) compressor has storage tank capable of storing 50 cu. m of air
 - (4) one kg of compressed air as delivered by the compressor would expand to 50 cu.m under NTP conditions
45. In multistage compressor, the isothermal compression is achieved by
- (1) constantly cooling the cylinder
 - (2) running compressor at very low speed
 - (3) employing inter cooler
 - (4) insulating the cylinders
46. According to fan laws, for fans having constant wheel diameter, the air of gas capacity varies directly as
- (1) fan speed
 - (2) square of fan speed
 - (3) cube of fan speed
 - (4) square root of fan speed
47. HUCR is the highest compression ratio at which the
- (1) engine can be run
 - (2) engine gives maximum power output
 - (3) engine is most efficient
 - (4) fuel can be used in a test engine without knocking
48. Propulsive efficiency is defined as the ratio of
- (1) Thrust power and fuel energy
 - (2) Engine output propulsive power
 - (3) Thrust power and propulsive power
 - (4) Propulsive power and fuel input
49. The usual assumption in elementary compressor cascade theory is that
- (1) axial velocity through the cascade changes
 - (2) pressure rise across the cascade is given by equation of state
 - (3) axial velocity through the cascade does not change
 - (4) None of the above
50. A grinding wheel of 150 mm diameter is rotating at 3000 rpm. The grinding speed is
- (1) 7.5π m/s
 - (2) 15π m/s
 - (3) 45π m/s
 - (4) 450π m/s

51. Thrust force will increase with increase in
- (1) side cutting edge angle
 - (2) rake angle
 - (3) tool nose radius
 - (4) end cutting edge angle
52. In an orthogonal cutting, the depth of cut is halved and the feed is doubled. If the chip thickness ratio is unaffected with the changed cutting conditions, the actual chip thickness will be
- (1) unchanged
 - (2) halved
 - (3) doubled
 - (4) quadrupled
53. In blanking operation, the clearance provided is
- (1) 50% on punch and 50% on die
 - (2) on punch
 - (3) on die
 - (4) on die or punch depending on designer's choice
54. The blade of a power saw is made of
- (1) boron steel
 - (2) high speed steel
 - (3) stainless steel
 - (4) malleable cast iron
55. Quartz is a
- (1) ferromagnetic material
 - (2) ferroelectric material
 - (3) diamagnetic material
 - (4) piezoelectric material
56. Stroke of a shaping machine is 250 mm. It makes 30 double strokes per minute. Overall average speed of operation is
- (1) 3.75 m/min
 - (2) 5.0 m/min
 - (3) 7.5 m/min
 - (4) 15.0 m/min
57. In a blanking operation to produce steel washer, the maximum punch load used is 2×10^5 N. The thickness of the plate is 4 mm and the penetration is 25%. The work done during this shearing operation is
- (1) 200 J
 - (2) 400 J
 - (3) 600 J
 - (4) 800 J
58. Work study involves
- (1) only work measurement
 - (2) only method study
 - (3) method study and work measurement
 - (4) only motion study
59. Fixed investments for manufacturing a product in a particular year is ₹ 60,000. The estimated sales during the year is ₹ 2,00,000. The variable cost per unit for this product is ₹ 4. If each unit is sold at ₹ 14, then the break even point will be
- (1) 6000 units
 - (2) 15000 units
 - (3) 9000 units
 - (4) 10000 units
60. In a single point cutting tool operation with a cemented carbide and steel combination having Taylor exponent of 0.25, if the cutting speed is halved, then the tool life will become
- (1) half
 - (2) two times
 - (3) eight times
 - (4) sixteen times

61. The variable cost per unit associated with automated assembly line (V_a), cellular manufacturing (V_b), and job production (V_c) will be such that
- (1) $V_a > V_b > V_c$
 - (2) $V_b > V_a > V_c$
 - (3) $V_c > V_b > V_a$
 - (4) $V_c > V_a > V_b$
62. Which of the following is *not* a casting process?
- (1) Extrusion
 - (2) Semi-centrifuge method
 - (3) Shell moulding
 - (4) Slush process
63. Chills are used in casting moulds to
- (1) achieve directional solidification
 - (2) reduce possibility of blow holes
 - (3) reduce the freezing time
 - (4) increase the smoothness of cast surface
64. For a linearly elastic, isotropic and homogeneous material, the number of elastic constants required to relate stress and strain is
- (1) two
 - (2) three
 - (3) four
 - (4) six
65. If the cross-section of a member is subjected to a uniform shear stress of intensity 'q', then the strain energy stored per unit volume will be given by (C = modulus of rigidity)
- (1) $2q^2 / C$
 - (2) $2C / q^2$
 - (3) $q^2 / 2C$
 - (4) $C / 2q^2$
66. A Hartnell governor has its controlling force given by $F = p + qr$, where r is the radius of the balls and p and q are constants. The governor will be isochronous when
- (1) $p = 0$ and q is positive
 - (2) p is positive and $q = 0$
 - (3) p is negative and q is positive
 - (4) p is positive and q is also positive
67. If two shafts of the same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal
- (1) polar moment of inertia
 - (2) polar modulus of section
 - (3) diameter
 - (4) angle of twist
68. Young's modulus of elasticity and Poisson's ratio of a material are 1.25×10^5 MPa and 0.34 respectively. The modulus of rigidity of the material will be
- (1) 0.4025×10^5 MPa
 - (2) 0.4464×10^5 MPa
 - (3) 0.8375×10^5 MPa
 - (4) 0.9469×10^5 MPa
69. For a column, the buckling load will be maximum if
- (1) one end of the column is clamped and the other is free
 - (2) both ends of column are clamped
 - (3) both ends of column are hinged
 - (4) one end of column is hinged and the other end is free

$$\begin{array}{r} 1 \\ 34 \\ \hline 34 \\ 156 \\ \hline 250 \end{array}$$

70. A metal pipe of 1 m diameter contains a fluid having a pressure of 1 N/mm^2 . If the permissible stress in the metal is 20 N/mm^2 , then the thickness of the metal required for making the pipe would be
- 5 mm
 - 20 mm
 - 10 mm
 - 25 mm
71. A length of 10 mm diameter steel wire is coiled to a close coiled helical spring having 8 coils of 75 mm mean diameter and the spring has a stiffness K. If the same length of steel wire is coiled to 10 coils of 60 mm mean diameter, then the spring stiffness will be
- K
 - 1.95 K
 - 1.56 K
 - 1.25 K
72. The casting method adopted for making ornaments and toys from non-ferrous alloys is
- Investment casting
 - Slush casting
 - Die casting
 - Centrifugal casting
73. The magnitude of cutting power consumption depends mainly on the cutting tool's
- Rake angle
 - Cutting angle
 - Clearance angle
 - Lip angle
74. The process of restoring the cutting ability of a grinding wheel is known as
- Truing
 - Dressing
 - Facing
 - Cleaning
75. Dielectric fluid is used in
- Electrochemical machining
 - Ultrasonic machining
 - Electrodischarge machining
 - Laser machining
76. Lump of granular flux is separately used in
- Carbon Arc Welding
 - Submerged Arc Welding
 - TIG Welding
 - MIG Welding
77. Carburising flame is used to weld metals like
- Stainless steel
 - Low carbon steel
 - Copper and Brass
 - High carbon steel
78. When the dimension is expressed as $20^{+0.035}_{-0.025}$ mm then the tolerance is
- 0.035 mm
 - 0.025 mm
 - 0.01 mm
 - 0.06 mm
79. Simple cast iron with no major alloying additions
- is the product of blast furnace
 - has a carbon content in the range of 0.2 to 2.0 wt%
 - has a carbon content in the range of 2.0 to 5.0 wt%
 - always contains martensite

80. Martensite in steel is
- (1) Hard and body centered cubic
 - (2) Soft and body centered cubic
 - ~~(3)~~ Hard and body centered tetragonal
 - (4) Soft and body centered tetragonal
81. White Cast Iron has carbon in the form of
- ~~(1)~~ Cementite
 - (2) Free form
 - (3) Graphite
 - (4) Nodules of free carbon
82. For a second order system with natural frequency 2 rad/sec and damping ratio $\zeta = 0.3$, the value of peak time t_p without derivative feedback control is
- (1) $2 \pi \text{ secs}$
 - (2) $5 \pi \text{ secs}$ correct Ans: $0.5 \pi \text{ secs}$
 - (3) $0.2 \pi \text{ secs}$
 - ~~(4)~~ $0.25 \pi \text{ secs}$
83. In lathe, the carriage and tail stock are guided on
- (1) Different guideways
 - (2) Same guideways
 - ~~(3)~~ Any one of the two
 - (4) None of the above
84. Ultrasonic machining method is best suited for
- (1) Brittle materials
 - ~~(2)~~ Stainless steel
 - (3) Plastics
 - (4) Lead
85. In metal cutting at speed above 20 m/min , maximum heat is carried away by
- ~~(1)~~ Work piece
 - (2) Tool
 - (3) Chip
 - (4) Equally by all
86. A standard ground drill has a point angle of
- (1) 90°
 - (2) 100°
 - (3) 118°
 - (4) 122°
87. Mild steel belongs to which of the following categories?
- (1) Low carbon steel
 - ~~(2)~~ Medium carbon steel
 - (3) High carbon steel
 - (4) Alloy steel
88. In grey cast iron, carbon is present in the form of
- ~~(1)~~ Cementite
 - (2) Flakes
 - (3) Free carbon
 - (4) Nodular aggregates of graphite
89. Corrosion resistance of steel is increased by adding
- (1) Zinc
 - (2) Tungsten and Molybdenum
 - (3) Chromium and Nickel
 - (4) Vanadium and Sulphur
90. Brass is an alloy of
- (1) Copper and Tin
 - (2) Copper and Zinc
 - (3) Copper and Aluminium
 - (4) Copper and Silver

91. Manganese in steel increases its

- (1) tensile strength
- (2) hardness
- (3) ductility
- (4) malleability

92. Presence of sulphur makes steel brittle. Its effect can be reduced by adding

- (1) Copper
- (2) Silicon
- (3) Vanadium
- (4) Magnesium

93. Low carbon steel can be hardened by

- (1) heating and quenching in oil
- (2) heating and quenching in water
- (3) carburizing and cyaniding
- (4) Any of the above

94. Which one of the following statements is correct in the context of balancing of engines ?

- (1) Magnitude of primary unbalancing force is less than the secondary unbalancing force
- (2) The primary unbalancing force attains its maximum value twice in one revolution of the crank
- (3) The unbalanced force due to reciprocating masses varies in magnitude and direction
- (4) The hammer blow in the engine occurs due to unbalanced force along the line of stroke of the piston

95. A company has four work centers A, B, C and D with per day capacities of 450 units, 390 units, 360 units and 400 units respectively. The machines are laid in order A, B, C, D and the product has to be operated on all these machines for getting converted into finished product. The actual output turns out to be 306 units. What is the system efficiency ?

- (1) 70%
- (2) 85%
- (3) 78%
- (4) 80%

96. Consider the following statements


- A. C++ is object oriented programming like Java
- B. C++ uses the same set of programming concepts as those of C

Which of the statements given above is/are correct ?

- (1) A only
- (2) B only
- (3) Both A and B
- (4) Neither A nor B

97. Production scheduling is simpler and high volume of output and high labour efficiency is achieved in the case of

- (1) fixed position layout
- (2) product layout
- (3) process layout
- (4) a combination of line and process layout

98. Value engineering technique in which experts of the same rank assemble for product development is called
- (1) Delphi
 - (2) Brain storming
 - (3) Morphological analysis
 - (4) Direct expert consultation
99. Which one of the following can completely balance several masses revolving in different planes on a shaft ?
- (1) A single mass in one of the planes of the revolving masses
 - (2) Two equal masses in any two planes
 - (3) A single mass in a different plane
 - (4) Two masses in any two planes
100. The outside diameter of an involute gear is equal to pitch circle diameter plus
- (1) 2 addendum
 - (2) 2 dedendum
 - (3) addendum + dedendum
 - (4) 2.157 module
- 
101. A simple spring mass vibrating system has a natural frequency of N . If the spring stiffness is halved and the mass is doubled, then the natural frequency will become
- (1) 8 N
 - (2) 4 N
 - (3) 2 N
 - (4) $N/2$
102. Principal stresses at a point in plane stressed element are $\sigma_x = \sigma_y = 500 \text{ N/mm}^2$. Normal stress on the plane inclined at 45 deg angle to x-axis will be
- (1) 0 N/mm^2
 - (2) 700 N/mm^2
 - (3) 500 N/mm^2
 - (4) 1000 N/mm^2
103. A steel rod of 1 sq. cm cross-sectional area is 1 m long and has a Young's modulus of elasticity $2 \times 10^6 \text{ kg/cm}^2$. It is subjected to an axial pull of 2000 kgf. The elongation of the rod will be
- (1) 0.1 cm
 - (2) 0.05 cm
 - (3) 0.20 cm
 - (4) 0.15 cm
104. If a material has a modulus of elasticity of $2 \times 10^6 \text{ kg/cm}^2$ and a modulus of rigidity of $0.8 \times 10^6 \text{ kg/cm}^2$, then the approximate value of the Poisson's ratio of the material will be
- (1) 0.26
 - (2) 0.31
 - (3) 0.45
 - (4) 0.2
105. In the assembly of pulley, key and shaft
- (1) key is made the weakest
 - (2) pulley is made the weakest
 - (3) shaft is made the weakest
 - (4) all are designed for equal strength

106. A shaft was initially subjected to bending moment and then was subjected to torsion. If the magnitude of bending moment is found to be the same as that of the torque, then the ratio of maximum bending stress to shear stress would be
- (1) 0.25
 (2) 0.50
 (3) 1.0
 (4) 2.0
107. The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to internal hydrostatic pressure P is
- (1) $1/2$
 (2) 1
 (3) 2
 (4) 4
108. Static balancing is satisfactory for low speed rotors, but with increasing speeds, dynamic balancing becomes necessary. This is because, the
- (1) unbalanced couples are caused only at higher speeds
 (2) effect of unbalance is directly proportional to speed
 (3) effect of unbalance is directly proportional to square of speed
 (4) unbalanced forces are not significant at higher speeds
109. For effective vibration isolation, the natural frequency ω_n of the system must be (ω is the forcing frequency)
- (1) $\omega/4$
 (2) ω
 (3) 2ω
 (4) 4ω
110. A point on a connecting link (excluding end points) of a double slider crank mechanism traces a
- (1) straight line path
 (2) parabolic path
 (3) elliptical path
 (4) hyperbolic path
111. A fixed gear having 100 teeth meshes with another gear having 25 teeth. The centre lines of both the gears is joined by an arm so as to form an epicyclic gear train. The number of rotations made by the smaller gear for one revolution of the arm is
- (1) 2
 (2) 3
 (3) 4
 (4) 5
112. The number of strain readings (using strain gauges) needed on a plane surface to determine the principal strains and their directions is
- (1) 1
 (2) 2
 (3) 3
 (4) 4

113. Cracks in helical springs used in railway carriages usually start on the inner side of the coil because of the fact that
- (1) it has a lower curvature than the outer side
 - (2) it is subjected to higher stress than outer side
 - (3) it is subjected to higher cyclic loading than outer side
 - (4) it is more stretched than outer side during manufacturing
114. Static design of gears uses
- (1) Johnson equation
 - (2) Rankine equation
 - (3) Buckingham's equation
 - (4) Lewis equation
115. An electric lift is moving downwards with an acceleration of $g/3$. The vertical force between a passenger in the lift and its floor is equal to
- (1) $2/3$ of passenger's weight
 - (2) $4/3$ of the passenger's weight
 - (3) passenger's weight
 - (4) $1/3$ of passenger's weight
116. In the statement "an eccentric mass rotating at 3000 rpm will create X times more unbalanced force than 50% of the same mass rotating at 300 rpm", what is the value of X?
- (1) 59
 - (2) 100
 - (3) 200
 - (4) 10
117. A statically balanced rotor is supported on two bearings L m apart. At high speed of the rotor, dynamic reaction on left bearing is R. Now the right side bearing is shifted to a new position $2L$ m apart from the left bearing. What shall be the dynamic reaction on left bearing if the rotor speed is same?
- (1) R
 - (2) $2R$
 - (3) $R/2$
 - (4) $R/4$
118. In time study, the rating factor is applied to determine
- (1) standard time for a job
 - (2) fixation of incentive rates
 - (3) merit rating of the worker
 - (4) normal time of a job
119. Classifying items in A, B and C categories for selective control of inventory management is done by arranging items in the decreasing order of
- ~~(1)~~ total inventory costs
 - (2) value of item
 - (3) annual usage value
 - (4) demand of the item
120. In a computer application, where a direct dialogue is carried on between the computer and the user it is referred to as
- (1) interfacing
 - (2) decision application
 - (3) video conferencing
 - (4) real time application

correct Ans: 50

121. Determination of standard time in complex job system is best done through
- (1) stop watch time study
 - (2) group timing techniques
 - (3) analysis of micro motions
 - (4) analysis of standard data
122. The routing function in a production system design is concerned with
- (1) manpower utilization
 - (2) machine utilization
 - (3) zero defect manufacturing
 - (4) quality assurance
123. Which of the following subroutines does a computer implementation of linear programming by the simplex method use ?
- (1) Finding a root of polynomial
 - (2) Finding a determinant of a matrix
 - (3) Solving a system of linear equations
 - (4) Finding the eigen value of matrix
124. A production line is said to be balanced when
- (1) there are equal number of machines at each work station
 - (2) there are equal number of operations at each work station
 - (3) the waiting time for service at each station is same
 - (4) the operation time at each station is same
125. Process I requires 20 units of fixed cost and 3 units of variable cost per piece, while process II requires 50 units of fixed cost and 1 unit of variable cost per piece. For a company producing 10 pieces per day
- (1) process I should be chosen
 - (2) process II should be chosen
 - (3) either of the two processes could be chosen
 - (4) a combination of the two processes should be chosen
126. Consider two queuing disciplines in a single server queue. Case I has first come first served discipline and Case II has a last come first served discipline. If the average waiting times in the two cases are W_1 and W_2 respectively, then which one of the following inferences would be true ?
- (1) $W_1 > W_2$
 - (2) $W_1 < W_2$
 - (3) $W_1 = W_2$
 - (4) Data insufficient to draw any tangible inference
127. The degrees of freedom of a screw pair is
- (1) three
 - (2) six
 - (3) one
 - (4) two
128. A thin disc is balanced at speed 300 rpm by adding a balancing mass of 4 gms at a radius 30 mm on a particular radial line. The balancing mass at speed 600 rpm on the same radius as previous, would be
- (1) 4 gms
 - (2) 16 gms
 - (3) 8 gms
 - (4) 2 gms
129. In a thick cylinder pressurized from inside, the hoop stress is maximum at
- (1) the centre of the wall thickness
 - (2) the outer radius
 - (3) the inner radius
 - (4) same at both inner and outer radii
130. The time of completing a project in network analysis is given by following time of the critical activity meeting at the final node
- (1) early start
 - (2) early finish
 - (3) late start
 - (4) late finish

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131. RAM stands for

- (1) Network of computers
- (2) Software that makes the computer work
- (3) Memory used for processing
- (4) Memory in which user cannot write anything

132. The earliest occurrence time for event "1" is 8 weeks and the latest occurrence time for event "1" is 26 weeks. The earliest occurrence time for event "2" is 32 weeks and the latest occurrence time for event "2" is 37 weeks. If the activity time is 11 weeks, then the total float will be

- (1) 11
- (2) 13
- (3) 18
- (4) 24

133. The type of layout suitable for use of the concept, principle and approach of group technology is

- (1) product layout
- (2) job-shop layout
- (3) fixed position layout
- (4) cellular layout

134. The instantaneous center of rotation of a rigid thin disc rolling on a plane rigid surface is located at

- (1) the centre of the disc
- (2) the point of contact
- (3) an infinite distance on the plane surface
- (4) the point on the circumference situated vertically opposite to the contact point

35. The gear train usually employed in clocks is a

- (1) simple gear train
- (2) sun and planet gear
- (3) reverted gear train
- (4) differential gear

136. Which one of the following loadings is considered for the design of axles ?

- (1) Bending moment only
- (2) Twisting moment only
- (3) Combined bending moment and torsion
- (4) Combined action of bending moment and axial thrust

137. The design calculations for members subject to fluctuating load with the same factor of safety yield the most conservative estimates when using

- (1) Soderberg relation
- (2) Goodman relation
- (3) Gerber relation
- (4) Maxwell relation

138. A cantilever beam having 5 m length is so loaded that it develops a shearing force of 20 T and a bending moment of 20 T-m at a section 2 m from the free end. Maximum shearing force and maximum bending moment developed in the beam under this load are respectively 50 T and 125 T-m. The load on the beam is

- (1) 25 T concentrated load at free end
- (2) 29 T concentrated load at free end
- (3) 5 T concentrated load at free end and 2 T/m uniformly distributed load over the entire length
- (4) 10 T/m uniformly distributed load over the entire length

139. Which one of the following is an open pair ?

- (1) Ball and socket joint
- (2) Cam and follower
- (3) Lead screw and nut
- (4) Journal bearing

140. When a shaking force is transmitted through the spring, damping becomes detrimental when the ratio of its frequency to the natural frequency is greater than

- (1) 0.25
- (2) 0.50
- (3) 1.00
- (4) 2.00

141. Two rigid plates are clamped by means of bolt and nut with an initial force N . After tightening, a separating force P ($P < N$) is applied to the lower plate which in turn acts on nut. The tension in the bolt after this will be
- (1) $(N + P)$
 - (2) $(N - P)$
 - (3) P
 - (4) N
142. Wire ropes are used for applications having
- (1) Low speed and low tension
 - (2) High speeds and high tension
 - (3) High speeds and low tension
 - (4) Low speeds and high tension
143. In flat belt drive, if the slip between the driver and the belt is 1% and that between belt and follower is 3% and driver and follower pulley diameters are equal, then the velocity ratio of the drive will be
- (1) 0.99
 - (2) 0.97
 - (3) 0.96
 - (4) 0.98
144. Tapered roller bearing can take
- (1) radial load only
 - (2) axial load only
 - (3) both radial and axial loads and the ratio of these being less than unity
 - (4) both radial and axial loads and the ratio of these being greater than unity
145. If the shear force acting at every section of a beam is of the same magnitude and of the same direction, then it represents a
- (1) simply supported beam with a concentrated load at the centre
 - (2) cantilever subjected to concentrated load at the free end
 - (3) simply supported beam having concentrated loads of equal magnitude and direction acting at equal distances from the support
 - (4) overhung beam having a concentrated load at the free end
146. A cantilever beam carries a load W uniformly distributed over its entire length. If the same load is placed at the free end of the same cantilever, then the ratio of maximum deflection in the first case to that in the second case will be
- (1) $3/8$
 - (2) $8/3$
 - (3) $5/8$
 - (4) $8/5$
147. During tensile testing of a specimen using Universal Testing Machine, the parameters actually measured include
- (1) true strain and true stress
 - (2) Young's modulus and Poisson's ratio
 - (3) engineering stress and engineering strain
 - (4) load and elongation
148. In simple harmonic motion, with respect to the displacement vector, the positions of velocity vector and acceleration vector will be respectively
- (1) 180 deg and 90 deg
 - (2) 90 deg and 180 deg
 - (3) 0 deg and 90 deg
 - (4) 90 deg and 0 deg
149. In the case of a flywheel, the maximum fluctuation of energy is the
- (1) sum of maximum and minimum energies
 - (2) difference between the maximum and minimum energies
 - (3) ratio of maximum and minimum energy
 - (4) ratio of minimum and maximum energy
150. In viscous damping, the damping force is proportional to
- (1) displacement of the vibrating body
 - (2) velocity of the vibrating body
 - (3) square of velocity of vibrating body
 - (4) None of the above