

Sl. No. : 20009341

MPE08

Register
Number

2014

MECHANICAL AND PRODUCTION ENGINEERING
(Degree Standard)

Time Allowed : 3 Hours]

[Maximum Marks : 300

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Booklet has a cover (this page) which should not be opened till the invigilator gives signal to open it at the commencement of the examination. As soon as the signal is received you should tear the right side of the booklet cover carefully to open the booklet. Then proceed to answer the questions.
2. This Question Booklet contains 200 questions. Prior to attempting to answer the candidates are requested to check whether all the questions are there and ensure there are no blank pages in the question booklet. In case any defect in the Question Paper is noticed it shall be reported to the Invigilator within first 10 minutes.
3. Answer all questions. All questions carry equal marks.
4. You must write your Register Number in the space provided on the top right side of this page. Do not write anything else on the Question Booklet.
5. You will also encode your Register Number, Subject Code, Question Booklet No. etc. with Blue or Black ink Ball point pen in the space provided on the side 2 of the Answer Sheet. If you do not encode properly or fail to encode the above information, your Answer Sheet will not be evaluated.
6. Each question comprises four responses (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
7. In the Answer Sheet there are four circles (A), (B), (C) and (D) against each question. To answer the questions you are to mark with Ball point pen ONLY ONE circle of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong..e.g. If for any item, (B) is the correct answer, you have to mark as follows :

(A) ● (C) (D)
8. You should not remove or tear off any sheet from this Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. After the examination is concluded, you must hand over your Answer Sheet to the Invigilator. You are allowed to take the Question Booklet with you only after the Examination is over.
9. The sheet before the last page of the Question Booklet can be used for Rough Work.
10. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
11. Do not tick-mark or mark the answers in the Question booklet.

SEAL

[Turn over

1. A beam of uniform strength is a beam in which
 - (A) the bending moment is the same throughout the beam
 - (B) the shear stress is the same throughout the beam
 - (C) the deflection is the same throughout the beam
 - ☒ (D) the bending stress is the same along the length of the beam

2. The strain energy stored in a body of volume V and subjected to a gradually applied load which induces a stress σ is given by
 - (A) $\frac{\sigma E}{V}$
 - (B) $\frac{\sigma E^2}{V}$
 - (C) $\frac{\sigma^2}{E} V$
 - ☒ (D) $\frac{1}{2} \frac{\sigma^2}{E} V$

3. For ductile materials, the most appropriate failure theory is
 - ☒ (A) maximum shear stress theory
 - (B) maximum principal stress theory
 - (C) maximum principal strain theory
 - (D) shear strain energy theory

4. In an n -link mechanism maximum, possible number of elements on any of the n links, for odd value of n is
 - (A) $n/2$
 - (B) $(n-1)/2$
 - ☒ (C) $(n+1)/2$
 - (D) $n(n+1)/2$

5. In an offset slider-crank mechanism with length of connecting rod l , crank radius r and offset e , the crank will revolve only when
 - ☒ (A) $l \geq (r + e)$
 - (B) $l \leq (r - e)$
 - (C) $l > (r - e)$
 - (D) $l < (r + e)$

6. Kliens construction can be used when
 - (A) crank has uniform angular velocity
 - (B) crank has non-uniform velocity
 - (C) crank has uniform angular acceleration
 - ☒ (D) crank has a uniform angular velocity and angular acceleration

7. For a slider crank mechanism, the velocity and acceleration of the piston at inner dead centre will be
 - (A) 0 and 0
 - (B) 0 and $w^2 r$
 - (C) 0 and $< w^2 r$
 - ☒ (D) 0 and $> w^2 r$

8. The angular velocities of two pulleys connected either by an open belt or a cross belt drive are
- (A) directly proportional to their diameters
 - ☒ (B) inversely proportional to their diameters
 - (C) proportional to square of diameters
 - (D) proportional to square root of their diameters
9. Creep in belt drive is due to
- (A) weak material of the belt
 - (B) weak material of the pulley
 - ☒ (C) uneven extensions and contractions of the belt when it passes from tight side to slack side
 - (D) friction between belt and pulley
10. Proell Governor as compared to porter governor
- (A) is more sensitive
 - (B) is less sensitive
 - (C) requires weights of smaller size
 - ☒ (D) is more sensitive and requires weights of smaller size
11. Sensitiveness of a governor is defined as the ratio of
- (A) mean speed to range of speed
 - ☒ (B) range of speed to mean speed
 - (C) maximum equilibrium speed to mean speed
 - (D) minimum equilibrium speed to mean speed
12. The frequency of the secondary forces as compared to primary force is
- (A) one half
 - ☒ (B) double
 - (C) one fourth
 - (D) one third
13. Natural frequency of a system is due to
- ☒ (A) free vibration
 - (B) forced vibration
 - (C) resonance
 - (D) damping
14. When a shaft is rotating at a speed which is less than critical speed, the phase difference between displacement and centrifugal force is
- (A) 180°
 - (B) 90°
 - (C) 45°
 - ☒ (D) 0°
15. A shaft with two rotors at its ends will have
- ☒ (A) three nodes
 - (B) two nodes
 - (C) one node
 - (D) zero node

16. While calculating the stress induced in a closed helical spring, Wahl's factor is considered to account for
- ☒ (A) the curvature and stress concentrated effect
 - (B) shock loading
 - (C) fatigue loading
 - (D) poor service conditions
17. A flat spiral spring made of strip of breadth 5 mm, thickness 1 mm and length 1.5 m has been subjected to a winding couple which induces a maximum stress of 150 N/mm^2 . The magnitude of winding couple is nearest to
- ☒ (A) 20.8 Nmm
 - (B) 41.6 Nmm
 - (C) 62.5 Nmm
 - (D) 83.3 Nmm
18. While designing a screw in a screw jack against buckling failure, the end conditions for a screw are taken as
- (A) both ends fixed
 - (B) both ends hinged
 - (C) one end fixed and other end hinged
 - ☒ (D) one end fixed and other end free
19. If the size of the flywheel in a punching machine is increased, then
- (A) fluctuation of speed as well as fluctuation of energy will decrease
 - ☒ (B) fluctuation of speed will decrease but the fluctuation of energy will increase
 - (C) fluctuation of speed will increase and the fluctuation of energy will decrease
 - (D) fluctuation of speed as well as fluctuation of energy will increase
20. When the pitch angle in Bevel gears is less than 90° it is referred to as an
- ☒ (A) external Bevel gear
 - (B) internal Bevel gear
 - (C) crown gear
 - (D) meter gear
21. In order to increase the angle of wrap it is preferable to go in for
- ☒ (A) Crossed belt drive
 - (B) Open belt drive
 - (C) Horizontal open belt drive
 - (D) Vertical open belt drive

22. One of the disadvantages of a hydraulic shaper compared to the mechanical shaper is
(A) ~~stopping point of the cutting stroke can vary depending upon the resistance offered to cutting~~
(B) less strokes per minute
(C) power available varies during the cutting stroke
(D) cutting speed remains constant throughout the cutting stroke
23. The lip angle used in a drill for drilling the Hard materials
(A) 128°
(B) ~~136°~~
(C) 90°
(D) 60°
24. Recirculating ball screws are used because
(A) they are easy to manufacture
(B) ~~power required for driving them is small due to small friction~~
(C) frictional resistance is more compared to ACME threads
(D) variable friction present due to the recirculating balls
25. The best machine tool to cut an internal spline in steel is
(A) milling machine
(B) ~~slotting machine~~
(C) lathe
(D) ~~grinding machine~~
26. The cutting tool in a milling m/c is held in position by
(A) ~~arbor~~
(B) spindle
(C) column
(D) knee
27. The cutting speed for reaming aluminium and its alloys is
(A) ~~45–70 m/min~~
(B) 15–20 m/min
(C) 10–12 m/min
(D) 5–20 m/min
28. Depth of cut for roughing operation normally varies from
(A) 5 mm to 10 mm
(B) ~~1 mm to 5 mm~~
(C) 0.2 mm to 1 mm
(D) 0.01 mm to 0.2 mm
29. The recommended average cutting speed in metres per minute for HSS tool for cutting mild steel is
(A) 15
(B) ~~30~~
(C) 60
(D) 90

30. EDM stands for
- (A) Energy Discharge Method ~~(B) Electro-Discharge Machining~~
(C) Energy Direct Machining (D) Efficient Direct Method
31. In USM process, the cutting rate will be faster, if amplitude of vibration is
- (A) minimum ~~(B) maximum~~
(C) constant (D) normal
32. In ECM process, the MRR is given by
- (A) $\frac{F.I}{\rho.A.V}$ ~~(B) $\frac{I.At}{F.\rho.A.V}$~~
(C) $\frac{F.\rho.A.V}{I.At}$ (D) $\frac{F.I.At}{\rho.A.V}$
33. In ECG process, a continuous stream of non-corrosive salt solution is passed through work and tool. This solution acts as
- (A) an electrolyte (B) a coolant
~~(C) an electrolyte and coolant~~ (D) dielectric medium
34. The cutting rate in mm/min for LBM process is equal to
- (A) $\frac{C \times P \times t}{E \times A}$ (B) $\frac{P \times t}{C \times E \times A}$
(C) $\frac{E \times A \times t}{C \times P}$ ~~(D) $\frac{C \times P}{E \times A \times t}$~~
35. Operating characteristic curve in sampling plan is drawn between
- (A) defective items and total number of items
(B) no. of accepted items and total number of items
~~(C) probability of acceptance and percentage defective~~
(D) no. of rejections and percentage defective
36. The following surface roughness parameter is expressed in percentage
- (A) R_a (B) R_p
(C) R_q ~~(D) t_p~~

37. The allowance factor in a time study is to
 (A) adjusts normal time for errors and rework
 (B) adjusts standard time for lunch breaks
~~(C) adjusts normal time for personal needs, unavoidable delays and fatigue~~
 (D) allows workers to rest every 20 minutes
38. The time study of a work operation at a restaurant yielded an average observed time of 9 minutes. The analyst rated the observed worker at 90%. The normal time of this operation is
 (A) 9 minutes (B) 81 minutes
~~(C) 8.1 minutes~~ (D) 90 minutes
39. Aggregate planning is concerned with quantity and timing of production in the
 (A) short term (B) intermediate term
~~(C) long term~~ (D) medium term
40. Five jobs are to be processed through two work centres. The time for processing each job is given below. Select the sequence in order to minimize the total processing time

Job	Work centre I	Work centre II
A	5	2
B	3	6
C	8	4
D	10	7
E	7	12

- (A) A D B C E ~~(B) B E D C A~~
 (C) B A D C E (D) B D E C A
41. High volume production of assembled products is most closely associated with which one of the following layout types?
 (A) cellular layout (B) fixed position layout
 (C) process layout ~~(D) product layout~~
42. Cycle counting in inventory
 (A) provides a measure of inventory turnover
 (B) assumes that all inventory records must be verified with the same frequency
~~(C) is a process by which inventory records are periodically verified~~
 (D) provides annual demand
43. The purpose of the stepping store is to
 (A) develop the initial solution to a transport problem
 (B) identify the relevant costs in a transportation problem
~~(C) determine whether a given solution is a feasible or not~~
 (D) assist one in moving from an initial feasible solution to the optimal solution
44. A feasible solution to a linear programming problem
~~(A) must satisfy all of the problem's constraints simultaneously~~
 (B) need not satisfy all of the constraints, only some of them
 (C) must not be a corner point of the feasible region
 (D) must give the maximum possible profit

45. The factors influencing job design is
 (A) individual differences
 (B) technology involved
 (C) organization structure and internal climate
 (D) individual difference, technology involved, organization structure, and internal climate
46. Choose the wrong statement
 The most commonly used tests in staffing can be
 (A) intelligence tests
 (B) proficiency and aptitude tests
 (C) personality tests
 (D) toughness test
47. The managerial function of controlling is
 (A) the process of predicting the demand
 (B) the measurement of satisfaction of workers
 (C) the measurement and correction of performance
 (D) process of making the work environment clean
48. A car of mass 150 kg is travelling on a horizontal track at 36 Km/hr. The time needed to stop the car is _____ (Take $\mu = 0.45$).
 (A) $t = 2.26$ sec
 (B) $t = 3.20$ sec
 (C) $t = 3.8$ sec
 (D) $t = 4.2$ sec
49. A motorist travelling at a speed of 18 Km/hr, suddenly applies the brakes and comes to rest after skidding 75 m. The time required for the car to stop is
 (A) $t = 30.25$ sec
 (B) $t = 29.84$ sec
 (C) $t = 28.84$ sec
 (D) $t = 26.22$ sec
50. A particle is projected with an initial velocity of 60 m/sec at an angle of 75° with horizontal. The maximum height attained by the particle is
 (A) 171.19 m
 (B) 185.22 m
 (C) 221.11 m
 (D) 198.20 m
51. Length to radius ratio $\frac{l}{r}$ of a solid cylinder is such that the moments of inertia about the longitudinal and transverse axes are equal is
 (A) 1
 (B) $\sqrt{3}$
 (C) $\sqrt{5}$
 (D) 2
52. Ratio of moment of Inertia of a circular body about its x axis to that about y axis is
 (A) 0.5
 (B) 1.0
 (C) 1.5
 (D) 2.0
53. The motion of a body moving on a curved path is given by a equation $x = 4\sin 3t$ and $y = 4\cos 3t$. The resultant velocity of the car is
 (A) 30 m/sec
 (B) 24 m/sec
 (C) 12 m/sec
 (D) 40 m/sec

54. The heating of wet steam at constant temperature till it becomes dry saturated is similar to that of heating at a
- (A) constant volume ~~(B) constant pressure~~
(C) constant entropy (D) constant enthalpy

55. The dryness fraction of steam is equal to

~~(A) $\frac{M_g}{M_g + M_f}$~~ (B) $\frac{M_f}{M_g + M_f}$
(C) $\frac{M_g}{M_f}$ (D) $\frac{M_f}{M_g}$

Where M_g = Mass of dry steam

M_f = Mass of wet steam

56. With the increase of pressure

- ~~(A) The boiling point of water decreases and enthalpy of evaporation increases~~
~~(B) The boiling point of water increases and enthalpy of evaporation decreases~~
(C) Both the boiling point of water and enthalpy of evaporation decreases
(D) Both the boiling point of water and enthalpy of evaporation increases

57. The air standard efficiency of an Otto cycle is given by

~~(A) $1 - \frac{1}{(r)^{\gamma-1}}$~~ (B) $1 + \frac{1}{(r)^{\gamma-1}}$
(C) $1 - (r)^{\gamma-1}$ (D) $1 + (r)^{\gamma-1}$

Where (r) = compression ratio

58. The entropy may be expressed as a function of

- ~~(A) Pressure and temperature~~ (B) Temperature and volume
(C) Heat and work (D) Internal energy

59. The heating of a gas at constant pressure is governed by

- (A) Boyle's law ~~(B) Charles' law~~
(C) Gay-Lussac law (D) Joule's law

60. Which of the following parameter is 100 CC in a 100 CC engine?

- ~~(A) Fuel tank capacity~~ (B) Lubricating oil capacity
(C) Swept volume (D) Cylinder volume

61. A 2-stroke cycle internal combustion engine has a mean effective pressure of 6 bar. The speed of the engine is 1000 r.p.m. If the diameter of the piston and stroke are 110 mm and 140 mm respectively, then the Indicated power developed by the engine is
 (A) 6.7 KW (B) 13.3 KW
 (C) 26.6 KW (D) 39.9 KW
62. The knocking tendency in C.I. engine increases with
 (A) Decrease of compression ratio (B) Increase of compression ratio
 (C) Increase of Inlet air temperature (D) Increase of cooling water temperature
63. An aircraft cannot be designed without the part of
 (A) Turbine (B) Compressor
 (C) Combustion chamber (D) Propeller
64. Shock effect in a CD nozzle is felt in
 (A) Divergent portion (B) Inlet portion
 (C) Convergent portion (D) Throat portion
65. The thrust coefficient in rocket propulsion is computed by using the following values
 (A) Combustion pressure and throat area of nozzle
 (B) Combustion pressure and exhaust gas velocity
 (C) Combustion pressure, thrust and nozzle throat area
 (D) Thrust, effective exhaust velocity and exit area of nozzle
66. Fuel oxidizer combination for hybrid propellant rockets is
 (A) Liquid hydrogen – Liquid oxygen
 (B) Lithium hydride (LiH) – Chlorine trifluoride (ClF₃)
 (C) Hydrazine – Liquid Fluorine
 (D) Alcohol – WFNA
67. This engine is preferable in the lower range of speed
 (A) Ram Jet engine (B) Turboprop engine
 (C) Turbofan engine (D) Turbo Jet engine
68. If the flight speed is 140 m/sec and Jet velocity is 140 m/sec, then the maximum propulsive efficiency is
 (A) 10 % (B) 100 %
 (C) 50 % (D) 75 %
69. The total temperature and pressure in an isentropic flow of gases
 (A) Increases then decrease (B) Decreases then increase
 (C) Increases continuously (D) Constant

70. Dry bulb and Wet bulb temperature will be equal when
(A) DPT is 20°
~~(B) Relative humidity is 100%~~
(C) Specific humidity is 100 gm/kg of dry air
(D) These can never be equal
71. One ton of refrigeration is equivalent to SI units of
(A) 1 KW
~~(C) 3.5 KW~~
(B) 2.5 KW
(D) 5.0 KW
72. In Refrigeration system, expansion device is incorporated between
(A) Compressor and condenser
~~(C) Condenser and evaporator~~
(B) Compressor and evaporator
(D) Condenser and filter
73. The COP value of refrigerant ammonia
(A) 2.56
~~(C) 4.76~~
(B) 4.49
(D) 5.09
74. In which section of the vapour compression cycle there is abrupt changes in pressure and temperature?
(A) Evaporator
(B) Expansion valve
(C) Condenser outlet
(D) Drier
75. The condition of refrigerant before and after the expansion in a vapour compression system is
(A) Wet vapour, very wet vapour
(B) Wet vapour, dry saturated vapour
(C) Very wet vapour, high pressure saturated liquid
~~(D) High pressure saturated liquid, very wet vapour~~
76. Find the sonic velocity (C) for the crude oil of specific gravity 0.8 and bulk modulus 153036 N/cm^2
(A) $C = 1500 \text{ m/sec}$
~~(B) $C = 1383 \text{ m/sec}$~~
(C) $C = 980 \text{ m/sec}$
(D) $C = 1291 \text{ m/sec}$

77. The Bernoulli's equation can take the form

- (A) $\frac{P_1}{\rho_1 g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho_2 g} + \frac{V_2^2}{2g} + Z_2$ (B) $\frac{P_1}{\rho_1 g} + \frac{V_1^2}{2} + Z_1 = \frac{P_2}{\rho_2 g} + \frac{V_2^2}{2} + Z_2$
(C) $\frac{P_1}{\rho_1 g} + \frac{V_1^2}{2g} + Z_1 g = \frac{P_2}{\rho_2 g} + \frac{V_2^2}{2g} + Z_2 g$ (D) $\frac{P_1}{\rho_1 g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho_2 g} + \frac{V_2^2}{2g} + Z_2$

78. Hydraulic jump is used for

- (A) Increasing the flow rate (B) Reducing the flow rate
(C) Reducing the velocity of flow (D) Reducing the energy of flow

79. Which of the following fluid is heaviest?

- (A) Air (B) Castor oil
(C) Glycerine (D) Carbon tetra chloride

80. Dynamic viscosity (μ) has the dimensions as

- (A) MLT^{-2} (B) $ML^{-1}T^{-1}$
(C) $MLT^{-1}T^{-2}$ (D) $M^{-1}L^{-1}T^{-1}$

81. In axial flow fans and turbines fluid enters and leaves as follows

- (A) radially, axially (B) axially, axially
(C) axially, radially (D) combination of axial and radial

82. For a given head the discharge through a pelton turbine with increase in speed

- (A) Decreases (B) Increases
(C) Does not change (D) First increases then decreases

83. Francis and KAPLAN turbines fall under the category of

- (A) Impulse turbines (B) Reaction turbines
(C) Axial flow turbines (D) Mixed flow turbines

84. Multistage centrifugal pumps are used for

- (A) High discharge requirements (B) Obtaining high head
(C) Obtaining low discharge (D) Obtaining low head

85. The correction factor of multipass counterflow heat exchanger depends on
- (A) Fluid properties
 - (B) Geometry alone
 - ☒ (C) Temperature of Inlet and outlet fluid streams only
 - (D) Mass flow rates of hot and cold fluid streams
86. Cold water ($C_p = 4.18 \text{ KJ/kg}^\circ\text{C}$) enters a heat exchanger at 15°C at a rate of 0.5 kg/s , where it is heated by hot air ($C_p = 1.0 \text{ KJ/kg}^\circ\text{C}$) that enters the heat exchanger at 50°C at a rate of 1.8 kg/s . The maximum possible heat transfer rate in this heat exchanger is
- (A) 51.1 kW
 - ☒ (B) 63.0 kW
 - (C) 66.8 kW
 - (D) 73.2 kW
87. In a parallel flow heat exchanger, the NTU is calculated to be 2.5. The lowest possible effectiveness for this heat exchanger is
- (A) 10 %
 - (B) 27 %
 - (C) 41 %
 - ☒ (D) 50 %
88. Consider a surface at -5°C in an environment at 25°C . The maximum rate of heat that can be emitted from this surface by radiation is
- (A) 0 W/m^2
 - ☒ (B) 155 W/m^2
 - (C) 293 W/m^2
 - (D) 354 W/m^2
89. Hydraulic Diameter D_h of circular tubes
- ☒ (A) Equal to diameter of the tube
 - (B) Half of the diameter of the tube
 - (C) Twice the diameter of the tube
 - (D) Four times the diameter of the tube
90. The non dimensional number associated with hydrodynamic boundary layer is
- ☒ (A) Reynolds number
 - (B) Prandtl number
 - (C) Biot number
 - (D) Nussel number

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91. The efficiency of chimney is approximately
- (A) 80 % (B) 40 %
 (C) 20 % ~~(D) 0.25 %~~
92. The maximum efficiency for Parson's reaction turbine is given by
- (A) $\eta_{\max} = \frac{\cos \alpha}{1 + \cos \alpha}$
 (B) $\eta_{\max} = \frac{2 \cos \alpha}{1 + \cos \alpha}$
~~(C) $\eta_{\max} = \frac{2 \cos^2 \alpha}{1 + \cos^2 \alpha}$~~
 (D) $\eta_{\max} = \frac{1 + \cos^2 \alpha}{2 \cos^2 \alpha}$
93. Most high speed diesel engines work on www.upscstudymaterials.com
- (A) Diesel cycle (B) Carnot cycle
~~(C) Dual combustion cycle~~ (D) Otto cycle
94. Demand factor is defined as
- (A) Average load / maximum demand
~~(B) Maximum demand / connected load~~
 (C) Connected load / maximum demand
 (D) Maximum demand \times connected load
95. In a 4 - cylinder petrol engine the standard firing order is
- (A) 1 - 2 - 3 - 4 (B) 1 - 4 - 3 - 2
 (C) 1 - 3 - 2 - 4 ~~(D) 1 - 3 - 4 - 2~~

96. Which of the following thermocouples has the lowest measuring range?
- (A) Iron – Constantan (B) Chromel – Alumel
~~(C) Copper – Constantan~~ (D) Chromel – Constantan
97. Which of the following is a positive displacement device?
- (A) Ultrasonic flow meter ~~(B) Turbine flow meter~~
(C) Laser Doppler Anemometer (D) Hot wire Anemometer
98. A Rotameter can be used
- ~~(A) Only in vertical orientation (direction)~~
(B) Only in horizontal orientation (direction)
(C) In any orientation (direction)
(D) For zero orientation (direction)
99. A hot wire anemometer is used to measure
- (A) Mean flow velocity
(B) Fluctuating component of velocities
~~(C) Both mean and fluctuating component of velocities~~
(D) Constant velocity
100. In control system terminology PID control stands for
- (A) Proportional Integrated Decimal
(B) Proportional Intelligent Definite
~~(C) Proportional Integral Derivative~~
(D) Principal Intelligent Derivative
101. In an electromagnetic flow meter the induced voltage is proportional to
- ~~(A) Flow rate~~ (B) Square root of flow rate
(C) Square of flow rate (D) Logarithm of flow rate

102. From a uniaxial tension test, the yield strength of steel was found to be 200 N/mm^2 . A steel shaft is subjected to a torque 'T', and a bending moment 'M'. The theory of failure which gives safest dimensions for the shaft and the relationship for design is
- (A) Maximum Principal Stress Theory $\sigma_1 = \sigma_y$
- (B) Maximum Principal Strain Theory $\frac{\sigma_1}{E} - \frac{\mu \sigma_2}{E} = \frac{\sigma_y}{E}$
- ~~(C)~~ Maximum Shear Stress Theory $\frac{\sigma_1 - \sigma_2}{2} = \frac{\sigma_y}{2}$
- (D) Total Strain Energy Theory $\frac{\sigma_1^2}{2E} + \frac{\sigma_2^2}{2E} = \frac{\sigma_y^2}{2E}$
103. A helical compression spring has a stiffness 'K'. If the spring is cut into two equal length springs, the stiffness of each spring is
- (A) K
- ~~(B)~~ 2K
- (C) K/2
- (D) K/4
104. If principal stresses in a plane stress problem are $\sigma_1 = 100 \text{ MPa}$ and $\sigma_2 = 40 \text{ MPa}$, then magnitude of the maximum shear stress (in MPa) will be,
- (A) 176.2
- (B) 196
- ~~(C)~~ 30
- (D) 981.0
105. Consider the following statements :
 Assertion (A) : An isotropic material is always homogeneous.
 Reason (R) : An isotropic material is one in which all the properties are same in all the directions at every point.
- Of these statements,
- ~~(A)~~ both (A) and (R) are true and (R) is the correct explanation of (A)
- (B) both (A) and (R) are true but (R) is not a correct explanation of (A)
- (C) (A) is true but (R) is false
- (D) (A) is false but (R) is true
106. The measurement of frictional power by William's Line is applicable only to
- (A) SI engines at a particular speed
- ~~(B)~~ CI engines at a particular speed
- (C) Any engine at a particular speed only
- (D) None of the above
107. Maximum shear stress developed in a solid circular shaft subjected to pure shear is 240 MPa . If the diameter of the shaft is doubled, then the maximum shear stress developed due to the same torque is
- (A) 120 MPa
- (B) 60 MPa
- ~~(C)~~ 30 MPa
- (D) 15 MPa
108. In a beam of I cross-section, subjected to a transverse load, the maximum shear stress is developed
- ~~(A)~~ at the centre of the web
- (B) at the top edge of the top flange
- (C) at the bottom edge of the top flange
- (D) at one third distance along the web

109. The turbine rotor weighing 9.8 kN rotates at 2000 rpm clockwise when looking from stern. The vessel pitches with an angular velocity of 0.5 rad/sec. Calculate the gyroscopic couple during the rise of bow. Assume radius of gyration of the rotor as 25.4 cm.
- (A) 6451.61 N.m
(B) 6756.11 N.m
(C) 5404.89 N.m
(D) 8107.34 N.m
110. A crank of radius 12 cm is rotating at 60 rpm with an angular acceleration of 50 rad/sec². The tangential acceleration of the crank is
- (A) 4.75 m/s²
(B) 5.2 m/s²
(C) 6 m/s²
(D) 7.4 m/s²
111. ABCD is a mechanism with link lengths AB = 200 mm ; BC = 300 mm ; CD = 400 mm and DA = 350 mm. Which one of the links should be fixed for the resulting mechanism to be a double crank mechanism?
- (A) AB
(B) BC
(C) CD
(D) DA
112. Which of the following systems has 8 links?
- (A) Hart mechanism
(B) Peaucelliar mechanism
(C) Whitworth Quick return mechanism
(D) Scotch yoke mechanism
113. When the pitching motion causes the bow to rise, the rotor rotating in clockwise sense (as seen from stern) the gyroscopic effect tends to
- (A) turn the ship towards port side
(B) turn the ship towards star-board side
(C) depress the stern
(D) raise the stern
114. When a four wheeler moving forward at a speed above critical takes a turn to the right the wheel(s) that tends to leave the ground is
- (A) outer front wheel
(B) outer rear wheel
(C) both the inner wheels
(D) both the outer wheels
115. The frictional torque, transmitted in case of flat pivot bearing for uniform pressure is equal to if w = Total axial load , μ = coefficient of friction, R = Radius of bearing surface
- (A) $\mu w R$
(B) $\frac{2}{3} \mu w R$
(C) $\frac{1}{3} \mu w R$
(D) $\frac{1}{2} \mu w R$
116. The equivalent coefficient of friction for V threads is
- (A) equal to actual coefficient of friction
(B) less than actual coefficient of friction
(C) greater than actual coefficient of friction
(D) not related to the actual coefficient of friction

117. A journal bearing with hydrodynamic lubrication is running steadily with a certain amount of minimum film thickness. When the load and speed are doubled, how does the minimum film thickness vary?
- ☒ (A) remains unchanged
 (B) gets doubled
 (C) gets reduced to one fourth of original value
 (D) gets reduced to half of original value
118. A 15 cm shaft turns 900 rpm in a journal bearing of length 20 cm. If the load on the bearing is 3×10^4 N, the bearing pressure will be approximately
- (A) 75 N/cm²
 (B) 100 N/cm²
 (C) 170 N/cm²
 (D) 32 N/cm²
119. Which of the following does not belong to the category of sliding contact bearing?
- (A) picot bearing
 (B) ball bearing
 (C) bush bearing
 (D) foot step bearing
120. A journal bearing running at 900 rev/min has a bearing pressure of 100 N/cm². If the lubricant used has absolute viscosity of 15 centipoise, the bearing characteristic number will be equal to
- (A) 29.8
 (B) 13.5
 (C) 9.94
 (D) 2.85
121. Consider a carriage spring of 6 leaves breadth 5 cm, thickness 1 cm with the length of the longest leaf equal to 60 cm. If each leaf has an initial radius of curvature equal to 150 cm, the initial central deflection provided in the spring is
- ☒ (A) 3 cm
 (B) 4 cm
 (C) 6 cm
 (D) 8 cm
122. If the rotating mass of a rim type flywheel is distributed on another rim type flywheel whose mean radius is half the mean radius of the former, then energy stored in the latter at the same speed will be
- (A) four times the first one
 (B) same as the first one
☒ (C) one fourth of the first one
 (D) one and a half times the first one

123. Herringbone gears are used to

- (A) avoid interference
(C) eliminate axial thrust

- (B) avoid the effect of dynamic load
(D) reduce wear of teeth

124. For maximum power transmission in a belt drive the condition is

T_{\max} = Maximum tension

T_1 = Tight side tension

T_2 = Slack side tension

(A) $T_{\max} = mV^2$

(B) $T_{\max} = 3 mV^2$

(C) $T_{\max} = \frac{T_1 + T_2}{2}$

(D) $T_{\max} = 3 T_1$

125. The axial thrust on worm (W_A) is given by.

where W_T = Tangential force acting on the worm

ϕ = Pressure angle.

λ = Lead angle.

(A) $W_A = W_T \cdot \tan \phi$

(B) $W_A = W_T / \tan \phi$

(C) $W_A = W_T \cdot \tan \lambda$

(D) $W_A = W_T / \tan \lambda$

126. The cross-section most commonly used in flat belt drive pulleys is

(A) elliptical

(B) rectangular

(C) I-section

(D) circular

127. Two mating spur gears have 30 and 90 teeth respectively. The pinion rotates at 1200 rpm and transmits a torque of 20 Nm. The torque transmitted by the gear is

(A) 6.6 Nm

(B) 20 Nm

(C) 40 Nm

(D) 60 Nm

128. In a horizontal belt drive, it is preferable to have

(A) tight side on the top

(B) slack side on the top

(C) tight side tension twice slack side tension

(D) equal tensions on both sides

129. A V-belt designated as B 4430 L_p represents

(A) A vee belt of basic length 4430 mm

(B) A vee belt of B cross-section and pitch length 4430 mm

(C) A vee-belt of B cross-section and nominal inside length 4430 mm

(D) A vee-belt of B cross-section and 4430 times multiple of pitches

130. Reduction ratio of a worm gear drive with a 60 teeth wheel and a double start worm with 12 threads is

(A) 60

(B) 30

(C) 12

(D) 5

131. In which of the following milling operation the surface finish is better
- ☒ (A) climb (B) up
(C) drop (D) face
132. If in milling operation, depth of cut and width of cut are constant, if feed rate is doubled, then power consumption will increase by.
- (A) 100% (B) 90%
☒ (C) 50% (D) 30%
133. In abrasive jet machining, as the distance between the nozzle tip and work surface increases, the material removal rate
- (A) increases continuously
(B) decrease continuously
(C) decreases, becomes stable and then increases
☒ (D) increases, becomes stable and then decreases
134. The process of removing metal by feeding the work past a rotating multipoint cutter is known as
- (A) broaching (B) sawing
☒ (C) milling (D) grinding
135. The wear ratio for tungsten carbide work in EDM is
- ☒ (A) 0.5 (B) 1.0
(C) 2.0 (D) 3.0
136. The thickness of the chip is minimum at the beginning of the cut and maximum at the end of the cut in case of
- (A) climb milling ☒ (B) up milling
(C) down milling (D) face milling
137. Which one of the following processes is the reverse of electroplating process?
- (A) EDM ☒ (B) ECM
(C) PAM (D) LBM

138. The fundamental tolerance unit i in terms of mean diameter D is.
 (A) $i = 0.45\sqrt{D} + 0.1 D$ (B) $i = 0.45\sqrt{D} + 0.01 D$
 (C) $i = 0.45\sqrt{D} + 0.001 D$ (D) $i = 0.45\sqrt[3]{D} + 0.001 D$
139. $H_7 g_7$ is
 (A) clearance fit (B) interference fit
 (C) shrinkage fit (D) transition fit
140. Hole dimension is 50.00 ± 0.02 mm and Shaft dimension is $50.00 - 0.01$ mm.
 The fit is - 0.03
 (A) clearance (B) interference
 (C) transition (D) shrinkage
141. θ , Taper angle of dead centre measured in a sine bar is
 where h - height of slip gauges
 L - length of sine bar
 (A) $\theta = \sin^{-1} h / L$ (B) $\theta = \sin^{-2} h / L$
 (C) $\theta = \sin^{-1} L / h$ (D) $\theta = \sin^{-1} h / 2 L$
142. The cross-sectional area of slip gauges of above 10 mm is in mm^2
 (A) 30×5 (B) 30×9
 (C) 35×9 (D) 40×10
143. Composite error of gear is measured by
 (A) Base tangent comparator (B) Double Vernier
 (C) Gear tooth caliper (D) Parkinson rolling gear tester
144. The following is the standard press fit for easy dismantling of ferrous and non-ferrous parts assembly
 (A) $H_7 g_7$ (B) $H_7 h_6$
 (C) $H_7 n_6$ (D) $H_7 p_5$
145. Producer's risk in acceptance sampling is
 (A) chance of producing defective components
 (B) chance of accepting the defective components by the customer
 (C) chance of incurring high cost
 (D) chance of rejecting the parts by the customer of the specified quality
146. Five jobs are waiting in a machining centre which are to be assigned to process. The processing times and due dates are given in the following table. Determine the sequence of processing according to Earliest Due Date (EDD)

Job	Job Processing one day	Job due date
A	6	8
B	2	6
C	8	18
D	3	15
E	9	23

- (A) A B C D E (B) B D A C E
 (C) B A D C E (D) E C A D B

147. Shop loading
- (A) means the assignment of dates to specific jobs or operation steps
 - (B) is typically managed using an assembly chart
 - ~~(C)~~ means the assignment of jobs to work or processing centres
 - (D) is oriented toward the management of work in process inventories
148. The 9.9 style managers
- ~~(A)~~ who display in their actions the highest possible dedication both to people and to production
 - (B) who are concerned only with developing an efficient operation and have little concern for people
 - (C) who have medium concern for production and for people
 - (D) who have little concern for production but are concerned only for people
149. Participative leadership is suitable in
- (A) production organization
 - ~~(C)~~ research and development
 - (B) educational institution
 - (D) defence organizations
150. Find the traditional non budgetary control device
- (A) Gantt charts
 - ~~(B)~~ Operational audit
 - (C) Milestone budgeting
 - (D) Time-event network analysis
- www.upscstudymaterials.com
151. PERT was first formally applied to the planning and controlling in
- (A) Titan's way
 - ~~(B)~~ Polaris Weapon System
 - (C) JP Morgan
 - (D) Dow Jones
152. A change within a organization to a higher position that has greater responsibility and requiring advanced skills is known as
- (A) multiskilling
 - ~~(B)~~ promotion
 - (C) job enrichment
 - (D) job evaluation
153. Tendency to disperse decision making authority in an organized structure is called
- (A) distribution
 - ~~(C)~~ decentralisation
 - (B) sharing
 - (D) leadership
154. Management conflict can be addressed
- (A) making the situation that causes conflict
 - (B) creating motive between persons
 - ~~(C)~~ compromise
 - (D) attempts can be made to change the behaviour of manager

155. A torque of 50 N-m is applied on the wheel operating a valve. If the wheel is rotated through two revolutions, work done in Newton-metres is given by
 (A) 100 (B) 25
 (C) 314 (D) 628
156. Moment of Inertia of the rectangle of base 80 mm and height 10 mm about its centroidal (I_{xx}) axis
 (A) $6666.66 \text{ mm}^4 = I_{xx}$ (B) $5827.21 \text{ mm}^4 = I_{xx}$
 (C) $7777.22 \text{ mm}^4 = I_{xx}$ (D) $6826.11 \text{ mm}^4 = I_{xx}$
157. The coefficient of restitution e is ————— where V_b and V_a are the final velocities of the bodies 'a' and 'b' after impact, and U_a and U_b are the initial velocity of the bodies 'a' and 'b' before impact.
 (A) $\frac{U_a - U_b}{V_a - V_b}$ (B) $\frac{U_b - U_a}{V_a - V_b}$
 (C) $\frac{V_a - V_b}{U_a - U_b}$ (D) $\frac{V_b - V_a}{U_a - U_b}$
158. The tension in the cable supporting a lift moving upwards is twice the tension when the lift moves downwards. The acceleration of the lift is equal to
 (A) g (B) $g/2$
 (C) $g/3$ (D) $g/4$
159. Steam super heating is done at constant
 (A) Pressure (B) Mass flow rate
 (C) Entropy (D) Temperature
160. In a steady flow reversible adiabatic process work done is equal to
 (A) Change in internal energy (B) Change in entropy
 (C) Change in enthalpy (D) Heat transferred
161. In an Isentropic process
 (A) Work done is zero (B) Change in internal energy is zero
 (C) Change in entropy is zero (D) Change in enthalpy is zero
162. In the operation of steam engines the vapour cycle adopted is
 (A) Carnot cycle (B) Rankine cycle
 (C) Modified Rankine cycle (D) Regenerative cycle

163. Morse test in Multi cylinder engines is used to determine
 (A) Volumetric efficiency (B) Brake thermal efficiency
 (C) Mechanical efficiency (D) Brake power
164. In a 4 - cylinder, 4 - stroke Diesel engine operating at 1200 r.p.m., the duration of fuel injection is 20° . The time in seconds during which fuel is injected would be
 (A) $\frac{1}{360}$ secs (B) $\frac{1}{180}$ secs
 (C) $\frac{1}{720}$ secs (D) $\frac{1}{1440}$ secs
165. The output of an I.C. Engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 750 mm and rope diameter is 50mm. The dead load on the tight side is 400 N and the spring balance reading is 50 N. The engine consumes 4.2 kg/h of fuel at rated speed of 1000 rpm. Then the brake specific fuel consumption of the engine is
 (A) 0.143 kg/kWh (B) 0.286 kg/kWh
 (C) 0.268 kg/kWh (D) 0.134 kg/kWh
166. The process of increasing the mass of charge introduced into the same volume of an engine is called
 (A) Super charging (B) Scavenging
 (C) Idling (D) Tumbling
167. In case of petrol engine, at starting
 (A) Rich fuel air ratio is needed
 (B) Lean fuel air ratio is needed
 (C) Chemically correct fuel air ratio is needed
 (D) Any fuel air ratio will do
168. Morse test is used to determine the mechanical efficiency of
 (A) Single cylinder engine (B) Multi cylinder engine
 (C) Two stroke cycle engines (D) Four stroke cycle engine
169. The theoretically correct mixture of air and petrol is approximately equal to
 (A) 7:1 (B) 10:1
 (C) 15:1 (D) 20:1

170. At normal atmospheric conditions, the ratio of the speed of sound in water to that in air is about
- (A) 1.5 (B) 2.0
(C) 4.0 (D) 7.0
171. The inverse of Specific Propellant Consumption (SPC) of rocket engine is called
- (A) Impulse to Weight Ratio (IWR) (B) Specific impulse
(C) Thrust coefficient (D) Weight flow coefficient
172. An aircraft moves through the atmosphere with a velocity of 450 m/s. If the speed of sound in this medium is 300 m/s, the mach angle would be
- (A) $\cos^{-1}(2/3)$ (B) $\sin^{-1}(2/3)$
(C) $\tan^{-1}(2/3)$ (D) $\cos^{-1}(3/2)$
173. Which of the following has the lowest COP?
- (A) Vapour absorption cycle
(B) Vapour compression cycle using dry compression
(C) Vapour compression cycle with superheated vapour at the end of compression
(D) Vapour compression cycle with sub cooling
174. It is desired to condition the outside air from 70% RH and 45°C DBT to 50% RH and 25° DBT at room condition. The practical arrangement would be
- (A) Cooling and dehumidification (B) Cooling and humidification
(C) Heating and dehumidification (D) Heating and humidification
175. Dry ice is
- (A) Ice free from water (B) Ice free from dissolved air or gases
(C) Ice prepared from filtered water (D) Solid carbon dioxide
176. The Refrigerant R – 718 is
- (A) Ammonia (B) Water
(C) Air (D) Carbon dioxide

177. Mach angle (α) is defined as the

- (A) Quarter angle of the mach cone
- (B) Zero angle of the mach cone
- ☒ (C) Half of the angle of the mach cone
- (D) Full angle of the mach cone

178. A fluid in which resistance to deformation is independent of the shear stress is known as

- (A) Pseudo plastic fluid
- (B) Bingham plastic fluid
- (C) Dilatant fluid
- ☒ (D) Newtonian Fluid

179. For an irrotational flow the equation $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ is known as

- (A) Cauchy Riemann's equation
- (B) Euler's equation
- ☒ (C) Laplace equation
- (D) Poisson's equation

180. In Hagen – Poiseuille's flow of viscous fluid, one of the following pairs of forces are balanced

- ☒ (A) Inertia and viscous force
- (B) Pressure and viscous force
- (C) Gravity and viscous force
- (D) Inertia and gravity force

181. Newton's Law of viscosity states that

- (A) Shear stress is directly proportional to velocity
- (B) Shear stress is directly proportional to velocity gradient
- ☒ (C) Shear stress is directly proportional to shear strain
- (D) Shear stress is directly proportional to viscosity

182. A draft tube is used with

- (A) Centrifugal fan
- ☒ (C) Reaction turbine

- (B) Axial flow pump
- (D) Reciprocating Compressor

183. Which of the following pump is used for pumping viscous fluids?

- (A) Reciprocating pump
- ☒ (C) Screw pump

- (B) Centrifugal pump
- (D) Jet Pump

184. Impellers for high heads usually have

- (A) High specific speed
- (C) Constant specific speed

- ☒ (B) Low specific speed
- (D) Speed independent of head

185. If Net positive suction head requirements are not satisfied then

- (A) Pump will develop only less head
- ☒ (C) Pump will develop cavitation

- (B) Pump will not develop any head
- (D) Pump will consume excess power

186. If the specific speed of a turbine is in the range of 300 - 1000 then the turbine is

- (A) Pelton
- ☒ (C) Kaplan

- (B) Francis
- (D) Mixed

187. Capacity of a hydraulic accumulator is generally specified as

- (A) Quantity of liquid accumulated
- (B) Maximum pressure developed
- ☒ (C) Maximum energy stored
- (D) Maximum Quantity of discharge allowed

188. The fin efficiency is defined as the ratio of the actual heat transfer from the fin to

- (A) The heat transfer from the same fin with an adiabatic tip
- (B) The heat transfer from an equivalent fin which is infinitely long
- ☒ (C) The heat transfer from the same fin if the temperature along the entire length of the fin is the same as the base temperature
- (D) The heat transfer through the base area of the same fin

189. Radiosity (J) for black surface is
- (A) ~~Equivalent to emissive power E_b~~ (B) Greater than emissive power
(C) Less than emissive power (D) None of the above
190. Without the use of superheater a boiler produces steam of about
- (A) 80% dryness fraction (B) 90% dryness fraction
(C) ~~98% dryness fraction~~ (D) 88% dryness fraction
191. The radiation heat transfer through large plates separated by N radiation shields becomes, when the emissivities of all surfaces are equal
- (A) ~~\dot{Q}_{12} , N shields = $\frac{1}{N+1} \dot{Q}_{12}$, no shield~~ (B) \dot{Q}_{12} , N shields = $\frac{1}{N+1} \dot{Q}_{12}$, no shield
(C) \dot{Q}_{12} , N shields = $(N+1) \dot{Q}_{12}$, no shield (D) \dot{Q}_{12} , N shields = $N(N+1) \dot{Q}_{12}$, no shield
192. Anything whether in the sender, the transmission or the receiver that bindery communication is called
- (A) Signal (B) ~~Noise~~
(C) Miscommunication (D) Distortion
193. The isothermal efficiency of a reciprocating compressor is defined as
- (A) $\frac{\text{Actual workdone during compression}}{\text{Isothermal workdone during compression}}$
(B) $\frac{\text{Adiabatic workdone during compression}}{\text{Isothermal workdone during compression}}$
(C) $\frac{\text{Isothermal workdone during compression}}{\text{Actual workdone during compression}}$
(D) ~~$\frac{\text{Isothermal workdone during compression}}{\text{Actual workdone during adiabatic compression}}$~~
194. The draught which a chimney produced is called
- (A) Induced draught (B) ~~Natural draught~~
(C) Forced draught (D) Balanced draught

195. Water hammer is developed in
☒ (A) Penstock (B) Draft tube
(C) Turbine (D) Surge Tank
196. The function of a moderator in nuclear reactor is
☒ (A) To slow down the fast moving electrons
(B) To speed up the slow moving electrons
(C) To start the chain reaction
(D) To transfer heat produced inside the reactor to a heat exchanger
197. In a Pressurised Water Reactor (PWR)
(A) The coolant water is pressurised to work as moderator
(B) The coolant water boils in the core of the reactor
☒ (C) The coolant water is pressurised to prevent boiling of water in the core
(D) No moderator is used
198. Bi-Metallic strips made of two different materials bend during a rise in temperature because of
☒ (A) Differences in coefficient of linear expansion
(B) Differences in elastic properties
(C) Differences in thermal conductivities
(D) Difference in stress
199. The principle of working of the constant volume thermometer is based on
☒ (A) Boyle's law (B) Charle's law
(C) Gay - Lussac's law (D) Equation of state
200. The instrument which measures the temperature of the source without direct contact is
(A) Bi-metallic cut-out
(B) Vapour pressure thermometer
☒ (C) Pyrometer
(D) Thin film thermometer