

ENGINEERING SERVICES
EXAMINATION-2016

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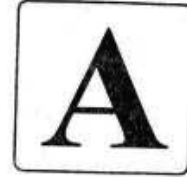
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Test Booklet Series

Serial No.

TEST BOOKLET
MECHANICAL ENGINEERING
Paper-I



Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER AND TEST BOOKLET SERIES CODE A, B, C OR D CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPROPRIATE PLACES IN THE OMR ANSWER SHEET. ANY OMISSION/ DISCREPANCY WILL RENDER THE ANSWER SHEET LIABLE FOR REJECTION.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains 120 items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator **only the Answer Sheet**. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
 - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
 - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
 - (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. In a differential manometer, a head of 0.5 m of fluid A in limb 1 is found to balance a head of 0.3 m of fluid B in limb 2. The atmospheric pressure is 760 mm of mercury. The ratio of specific gravities of A to B is:
- 0.25
 - 0.6
 - 2
 - 4
2. Consider the following processes :
- Extension of a spring
 - Plastic deformation of a material
 - Magnetization of a material exhibiting hysteresis
- Which of the above processes are irreversible ?
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3
3. Which of the following statements are correct for a throttling process ?
- It is an adiabatic steady flow process
 - The enthalpy before and after throttling is same
 - In the process, due to fall in pressure, the fluid velocity at outlet is always more than inlet velocity
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3
4. A Reversed Carnot Engine removes 50 kW from a heat sink. The temperature of the heat sink is 250 K and the temperature of the heat reservoir is 300 K. The power required of the engine is :
- 10 kW
 - 20 kW
 - 30 kW
 - 50 kW
5. A heat engine receives heat at the rate of 2500 kJ/min and gives an output of 12.4 kW. Its thermal efficiency is, nearly :
- 18%
 - 23%
 - 26%
 - 30%
6. One reversible heat engine operates between 1000 K and T_2 K and another reversible heat engine operates between T_2 K and 400 K. If both the engines have the same heat input and output, then the temperature T_2 must be equal to :
- 582.7 K
 - 632.5 K
 - 682.8 K
 - 732.5 K
7. Consider the following statements for isothermal process :
- Change in internal energy is zero
 - Heat transfer is zero
- Which of the above statements is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
8. A system of 100 kg mass undergoes a process in which its specific entropy increases from 0.3 kJ/kg K to 0.4 kJ/kg K. At the same time, the entropy of the surroundings decreases from 80 kJ/K to 75 kJ/K. The process is :
- Reversible and isothermal
 - Irreversible
 - Reversible only
 - Isothermal only

9. Which one of the following statements is correct during adiabatic charging of an ideal gas into an empty cylinder from a supply main ?
- The specific enthalpy of the gas in the supply main is equal to the specific enthalpy of the gas in the cylinder
 - The specific enthalpy of the gas in the supply main is equal to the specific internal energy of the gas in the cylinder
 - The specific internal energy of the gas in the supply main is equal to the specific enthalpy of the gas in the cylinder
 - The specific internal energy of the gas in the supply main is equal to the specific internal energy of the gas in the cylinder
10. Consider the following systems :
- An electric heater
 - A gas turbine
 - A reciprocating compressor
- The steady flow energy equation can be applied to which of the above systems ?
- 1 and 2 only
 - 1 and 3 only
 - 1, 2 and 3
 - 2 and 3 only
11. Consider the following statements pertaining to Clapeyron equation :
- It is useful in estimating properties like enthalpy from other measurable properties
 - At a change of phase, it can be used to find the latent heat at a given pressure
 - It is derived from the relationship

$$\left(\frac{\partial p}{\partial v}\right)_T = \left(\frac{\partial s}{\partial T}\right)_v$$
- Which of the above statements are correct?
- 1 and 3 only
 - 2 and 3 only
 - 1 and 2 only
 - 1, 2 and 3
12. Consider the following conditions for the reversibility of a cycle :
- The P and T of the working substance must not differ appreciably, from those of the surroundings at any state in the process
 - All the processes, taking place in the cycle, must be extremely slow
 - The working parts of the engine must be friction-free
- Which of the above conditions are correct ?
- 1, 2 and 3
 - 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only

13. A Carnot engine operates between 300 K and 600 K. If the entropy change during heat addition is 1 kJ/K, the work produced by the engine is :
- 100 kJ
 - 200 kJ
 - 300 kJ
 - 400 kJ
14. 1000 kJ/s of heat is transferred from a constant temperature heat reservoir maintained at 1000 K to a system at a constant temperature of 500 K. The temperature of the surroundings is 300 K. The net loss of available energy as a result of this heat transfer is :
- 450 kJ/s
 - 400 kJ/s
 - 350 kJ/s
 - 300 kJ/s
15. The effects of heat transfer from a high temperature body to a low temperature body are :
- The energy is conserved
 - The entropy is not conserved
 - The availability is not conserved
- Which of the above statements are correct ?
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3
16. Which of the following statements pertaining to entropy are correct ?
- The entropy of a system reaches its minimum value when it is in a state of equilibrium with its surroundings
 - Entropy is conserved in all reversible processes
 - Entropy of a substance is least in solid phase
 - Entropy of a solid solution is not zero at absolute zero temperature
- 1, 2 and 3 only
 - 2, 3 and 4 only
 - 3 and 4 only
 - 1, 2, 3 and 4
17. The maximum work developed by a closed cycle used in a gas turbine plant when it is working between 900 K and 289 K and using air as working substance is :
- 11 kJ/kg
 - 13 kJ/kg
 - 17 kJ/kg
 - 21 kJ/kg
18. Consider the following statements :
- Gases have a very low critical temperature
 - Gases can be liquefied by isothermal compression
 - In engineering problems, water vapour in atmosphere is treated as an ideal or perfect gas
- Which of the above statements are correct ?
- 1 and 2 only
 - 2 and 3 only
 - 1 and 3 only
 - 1, 2 and 3

19. The property of a thermodynamic system is :
- A path function
 - A point function
 - A quantity which does not change in reversible process
 - A quantity which changes when system undergoes a cycle
20. Consider the following statements :
- There is no change in temperature when a liquid is being evaporated into vapour
 - Vapour is a mixed phase of liquid and gas in the zone between saturated liquid line and saturated vapour line
 - The saturated dry vapour curve is steeper as compared to saturated liquid curve on a T-s diagram
 - The enthalpy of vaporization decreases with increase in pressure
- Which of the above statements are correct ?
- 1, 2 and 3 only
 - 3 and 4 only
 - 1, 2 and 4 only
 - 1, 2, 3 and 4
21. An ideal heat engine, operating on a reversible cycle, produces 9 kW. The engine operates between 27°C and 927°C. What is the fuel consumption given that the calorific value of the fuel is 40000 kJ/kg ?
- 0.8 kg/hr
 - 1.02 kg/hr
 - 1.08 kg/hr
 - 1.28 kg/hr
22. If angle of contact of a drop of liquid is acute, then
- Cohesion is equal to adhesion
 - Cohesion is more than adhesion
 - Adhesion is more than cohesion
 - Both adhesion and cohesion have no connection with angle of contact
23. The Carnot cycle is impracticable because :
- Isothermal process is very fast; and isentropic process is very slow
 - Isothermal process is very slow; and isentropic process is very fast
 - Isothermal process and isentropic process are both very slow
 - Isothermal process and isentropic process are both very fast
24. An ideal Otto-cycle works between minimum and maximum temperatures of 300 K and 1800 K. What is the compression ratio of the cycle for maximum work output when $\gamma = 1.5$ for this ideal gas ?
- 5
 - 6
 - 7
 - 8

25. Consider the following statements :

1. The air standard efficiency of an Otto cycle is a function of the properties of the working substance (gas)
2. For the same compression ratio and same input, the thermal efficiency of an Otto cycle is more than that of a Diesel cycle
3. The thermal efficiency of a Diesel cycle increases with decrease of cut-off ratio

Which of the above statements are correct?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

26. Consider the following statements :

1. Both Otto and Diesel cycles are special cases of dual combustion cycle
2. Combustion process in IC engines is neither fully constant volume nor fully constant pressure process
3. Combustion process in ideal cycle is replaced by heat addition from internal source in closed cycle
4. Exhaust process is replaced by heat rejection in ideal cycle

Which of the above statements are correct ?

- (a) 1, 2 and 3 only
- (b) 3 and 4 only
- (c) 1, 2 and 4 only
- (d) 1, 2, 3 and 4

27. A four-cylinder four-stroke SI engine develops an output of 44 kW. If the pumping work is 5% of the indicated work and mechanical loss is an additional 7%, then the power consumed in pumping work is :

- (a) 50 kW
- (b) 25 kW
- (c) 5.0 kW
- (d) 2.5 kW

28. In a two-stroke Petrol engine, fuel loss is maximum after :

- (a) Opening the exhaust port
- (b) Closing the exhaust port
- (c) Opening the inlet port
- (d) Closing the inlet port

29. In an Otto cycle, air is compressed from 2.2 l to 0.26 l from an initial pressure of 1.2 kg/cm². The net output/cycle is 440 kJ. What is the mean effective pressure of the cycle ?

- (a) 227 kPa
- (b) 207 kPa
- (c) 192 kPa
- (d) 185 kPa

30. A single cylinder, four-stroke cycle oil engine is fitted with a rope brake. The diameter of the brake wheel is 600 mm and the rope diameter is 26 mm. The dead load on the brake is 200 N and the spring balance reads 30 N. If the engine runs at 600 rpm, what will be the nearest magnitude of the brake power of the engine ?

- (a) 3.3 kW
- (b) 5.2 kW
- (c) 7.3 kW
- (d) 9.2 kW

31. In a furnace the heat loss through the 150 mm thick refractory wall lining is estimated to be 50 W/m^2 . If the average thermal conductivity of the refractory material is 0.05 W/mK , the temperature drop across the wall will be :
- (a) 140°C
 - (b) 150°C
 - (c) 160°C
 - (d) 170°C
32. Uniform flow occurs when :
- (a) At every point the velocity vector is identical in magnitude and direction at any given instance
 - (b) The flow is steady
 - (c) Discharge through a pipe is constant
 - (d) Conditions do not change with at any time
33. A plane wall is 20 cm thick with an area of 1 m^2 and has a thermal conductivity of 0.5 W/m. K . A temperature difference of 100°C is imposed across it. The heat flow is at :
- (a) 150 W
 - (b) 180 W
 - (c) 220 W
 - (d) 250 W
34. Hot gases enter a heat exchanger at 200°C and leave at 150°C . The cold air enters at 40°C and leaves at 140°C . The capacity ratio of the heat exchanger will be :
- (a) 0.40
 - (b) 0.45
 - (c) 0.50
 - (d) 0.52
35. During very cold weather conditions, cricket players prefer to wear white woolen sweaters rather than coloured woolen sweaters. The reason is that white wool comparatively :
1. Absorbs less heat from body
 2. Emits less heat to the atmosphere
- Which of the above statements is/are correct ?
- (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2
 - (d) Neither 1 nor 2
36. A pipe of 10 cm diameter and 10 m length is used for condensing steam on its outer surface. The average heat transfer coefficient h_h (when the pipe is horizontal) is n times the average heat transfer coefficient h_v (when the pipe is vertical). The value of n is :
- (a) 2.44
 - (b) 3.34
 - (c) 4.43
 - (d) 5.34

37. A cross-flow type air heater has an area of 50 m^2 . The overall transfer coefficient is $100 \text{ W/m}^2 \text{ K}$; and heat capacity of the stream, be it hot or cold, is 1000 W/K . What is the NTU ?
- 500
 - 50
 - 5
 - 0.5
38. The effectiveness of a counter-flow heat exchanger has been estimated as 0.25. Hot gases enter at 200°C and leave at 75°C . Cooling air enters at 40°C . The temperature of the air leaving the unit will be :
- 60°C
 - 70°C
 - 80°C
 - 90°C
39. Consider the following statements regarding C.I. engine :
- C.I. engines are more bulky than S.I. engines
 - C.I. engines are more efficient than S.I. engines
 - Lighter flywheels are required in C.I. engines
- Which of the above statements are correct ?
- 1 and 3 only
 - 2 and 3 only
 - 1 and 2 only
 - 1, 2 and 3
40. Thermal boundary layer is a region where :
- Heat dissipation is negligible
 - Inertia and convection are of the same order of magnitude
 - Convection and dissipation terms are of the same order of magnitude
 - Convection and conduction terms are of the same order of magnitude
41. Solar radiation of 1000 W/m^2 is incident on a grey opaque surface with emissivity of 0.4 and emissive power of 400 W/m^2 . The radiosity of the surface will be :
- 940 W/m^2
 - 850 W/m^2
 - 760 W/m^2
 - 670 W/m^2
42. A body 1 in the form of a sphere of 2 cm radius at temperature T_1 is located in body 2, which is a hollow cube of 5 cm side and is at temperature T_2 ($T_2 < T_1$). The shape factor F_{21} for radiation heat transfer becomes :
- 0.34
 - 0.43
 - 0.57
 - 0.63
43. Consider the following statements in respect of vapour compression refrigeration units :
- In actual units the refrigerant leaving the evaporator is superheated
 - Superheating of refrigerant at exit of evaporator increases the refrigerating effect
 - The superheating of refrigerant increases the work of the compressor
- Which of the above statements are correct ?
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3

44. In a vapour compression refrigerator, the heat rejected in condenser is 1500 kJ/kg of refrigerant flow and the work done by compressor is 250 kJ/kg. The COP of the refrigerator is :
- 5
 - 6
 - 7
 - 8
45. A refrigeration plant is designed to work between -3°C and 27°C . The plant works on the Carnot cycle. If the same plant is used as a heat-pump system, then the COP of the heat pump becomes :
- 10
 - 9
 - 8
 - 7
46. A refrigeration plant working on Carnot cycle is designed to take the load of 4 T of refrigeration. The cycle works between 2°C and 27°C . The power required to run the system is :
- 1.27 kW
 - 3.71 kW
 - 5.71 kW
 - 7.27 kW
47. The choice of a refrigerant depends upon :
- Refrigerating capacity
 - Type of compressor used (reciprocating, centrifugal or screw)
 - Service required (whether for air conditioning, cold storage or food freezing)
- Which of the above statements is/are correct ?
- 1 and 3 only
 - 1 only
 - 3 only
 - 1, 2 and 3
48. The COP of an ideal refrigerator of capacity 2.5 T is 5. The power of the motor required to run the plant is :
- 1.15 kW
 - 1.35 kW
 - 1.55 kW
 - 1.75 kW
49. The objective of supercharging an engine is :
- To reduce space occupied by the engine
 - To increase the power output of an engine when greater power is required
- Which of the above statements are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2

50. Two reversible refrigerators are arranged in series and their COPs are 5 and 6 respectively. The COP of composite refrigeration system would be :
- 1.5
 - 2.5
 - 3.5
 - 4.5
51. In an air-conditioning plant, air enters the cooling coil at 27°C . The coil surface temperature is -5°C . If the bypass factor of the unit is 0.4, the air will leave the coil at :
- 5.6°C
 - 7.8°C
 - 9.2°C
 - 11.2°C
52. The wet bulb and dry bulb temperatures of an air sample will be equal when :
1. Air is fully saturated
 2. Dew point temperature is reached
 3. Partial pressure of vapour equals the total pressure
 4. Humidity ratio is 100%
- Which of the above statements are correct ?
- 1 and 2
 - 2 and 3
 - 3 and 4
 - 1 and 4
53. Air at 25°C DBT and 80% RH is passed over a cooling coil whose surface temperature is 10°C which is below DPT of the air. If the air temperature coming out of the cooling coil is 15°C , then the bypass factor of the cooling coil is :
- 0.56
 - 0.67
 - 0.76
 - 0.87
54. Consider the following statements for the appropriate context :
1. The Relative Humidity of air remains constant during sensible heating or cooling
 2. The Dew Point Temperature of air remains constant during sensible heating or cooling
 3. The total enthalpy of air remains constant during adiabatic cooling
 4. It is necessary to cool the air below its Dew Point Temperature for dehumidifying
- Which of the above statements are correct ?
- 1, 2 and 3
 - 1, 2 and 4
 - 3 and 4 only
 - 2, 3 and 4
55. The discharge through an orifice fitted in a tank can be increased by :
- Fitting a short length of pipe to the outside
 - Sharpening the edge of orifice
 - Fitting a long length of pipe to the outside
 - Fitting a long length of pipe to the inside

56. The latent heat load in an auditorium is 25% of sensible heat load. The value of sensible heat factor is
- 0.3
 - 0.5
 - 0.8
 - 1.0
57. In a solar collector, the function of the transparent cover is to :
- Transmit solar radiation only
 - Protect the collector from dust
 - Decrease the heat loss from collector beneath to atmosphere
 - Absorb all types of radiation and protect the collector from dust
58. The most suitable refrigeration system utilizing solar energy is :
- Ammonia-Water vapour absorption refrigeration system
 - Lithium Bromide-Water vapour absorption refrigeration system
 - Desiccant refrigeration system
 - Thermoelectric refrigeration system
59. A house-top water tank is made of flat plates and is full to the brim. Its height is twice that of any side. The ratio of total thrust force on the bottom of the tank to that on any side will be :
- 4
 - 2
 - 1
 - 0.5
60. The water level in a dam is 10 m. The total force acting on vertical wall per metre length is :
- 49.05 kN
 - 490.5 kN
 - 981 kN
 - 490.5 N
61. A vacuum gauge fixed on a steam condenser reads 80 kPa vacuum. The barometer indicates 1.013 bar. The absolute pressure in terms of mercury head is, nearly
- 160 mm of Hg
 - 190 mm of Hg
 - 380 mm of Hg
 - 760 mm of Hg
62. The Orsat apparatus gives
- Volumetric analysis of dry products of combustion
 - Gravimetric analysis of dry products of combustion
- Which of the above statements is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
63. A 25 cm long prismatic homogeneous solid floats in water with its axis vertical and 10 cm projecting above water surface. If the same solid floats in some oil with its axis vertical and 5 cm projecting above the liquid surface, then the specific gravity of the oil is
- 0.55
 - 0.65
 - 0.75
 - 0.85

64. Consider the following statements :

The increase in metacentric height

1. Increases stability
2. Decreases stability
3. Increases comfort for passengers in a ship
4. Decreases comfort for passengers in a ship

Which of the above statements are correct ?

- (a) 1 and 3
- (b) 1 and 4
- (c) 2 and 3
- (d) 2 and 4

65. An isosceles triangular lamina of base 1 m and height 2 m is located in the water in vertical plane and its vertex is 1 m below the free surface of the water. The position of force acting on the lamina from the free water surface is :

- (a) 2.42 m
- (b) 2.33 m
- (c) 2.00 m
- (d) 1.33 m

66. A solid body of specific gravity 0.5 is 10 m long 3 m wide and 2 m high. When it floats in water with its shortest edge vertical, its metacentric height is :

- (a) 0.75 m
- (b) 0.45 m
- (c) 0.25 m
- (d) 0.15 m

67. For a steady two-dimensional flow, the scalar components of the velocity field are $V_x = -2x$; $V_y = 2y$ and $V_z = 0$. The corresponding components of acceleration a_x and a_y , respectively are :

- (a) 0 and $4y$
- (b) $4x$ and 0
- (c) 0 and 0
- (d) $4x$ and $4y$

68. The velocity of flow from a tap of 12 mm diameter is 8 m/s. What is the diameter of the jet at 1.5 m from the tap when the flow is vertically upwards? Assuming that, the jet continues to be circular upto that level.

- (a) 44 mm
- (b) 34 mm
- (c) 24 mm
- (d) 14 mm

69. Consider the following statements about thermal conductivity :

1. Thermal conductivity decreases with increasing molecular weight
2. Thermal conductivity of non-metallic liquids generally decreases with increasing temperature
3. Thermal conductivity of gases and liquids is generally smaller than that of solids

Which of the above statements are correct ?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

70. A conical diffuser 3 m long is placed vertically. The velocity at the top (entry) is 4 m/s and at the lower end is 2 m/s. The pressure head at the top is 2 m of the oil flowing through the diffuser. The head loss in the diffuser is 0.4 m of the oil. The pressure head at the exit is :
- 3.18 m of oil
 - 5.21 m of oil
 - 7.18 m of oil
 - 9.21 m of oil
71. Bernoulli's equation, $\frac{p}{\rho} + \frac{v^2}{2} + gZ = \text{Constant}$, is valid for :
- Steady flow
 - Viscous flow
 - Incompressible flow
 - Flow along a streamline
- Which of the above are correct ?
- 1, 2 and 3
 - 1, 2 and 4
 - 1, 3 and 4
 - 2, 3 and 4
72. Consider the following statements:
- Absorptivity depends on wave length of incident radiation waves
 - Emissivity is dependent on wave length of incident radiation waves
- Which of the above statements is/are correct ?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
73. A steam turbine in which a part of the steam after expansion is used for process heating and the remaining steam is further expanded for power generation is/are :
- Impulse turbine
 - Pass out turbine
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
74. Two reservoirs connected by two pipe lines in parallel of the same diameter D and length. It is proposed to replace the two pipe lines by a single pipeline of the same length without affecting the total discharge and loss of head due to friction. The diameter of the equivalent pipe D_e in terms of the diameter of the existing pipe line, $\frac{D_e}{D}$, is :
- 4.0
 - $(2)^{\frac{1}{5}}$
 - $(4)^{\frac{1}{4}}$
 - $(4)^{\frac{1}{5}}$

75. A fluid jet is discharging from a 100 mm nozzle and the vena contracta formed has a diameter of 90 mm. If the coefficient of velocity is 0.98, then the coefficient of discharge for the nozzle is :

- (a) 0.673
- (b) 0.794
- (c) 0.872
- (d) 0.971

76. Consider fully developed laminar flow in a circular pipe of a fixed length :

1. The friction factor is inversely proportional to Reynolds number
2. The pressure drop in the pipe is proportional to the average velocity of the flow in the pipe
3. The friction factor is higher for a rough pipe as compared to a smooth pipe
4. The pressure drop in the pipe is proportional to the square of average of flow in the pipe

Which of the above statements are correct ?

- (a) 1 and 4
- (b) 3 and 4
- (c) 2 and 3
- (d) 1 and 2

77. The thickness of the boundary layer for a fluid flowing over a flat plate at a point 20 cm from the leading edge is found to be 4 mm. The Reynolds number at the point (adopting 5 as the relevant constant) is :

- (a) 48400
- (b) 57600
- (c) 62500
- (d) 77600

78. What is the ratio of displacement thickness to boundary layer thickness for a linear distribution of velocity $\frac{u}{u_{\infty}} = \frac{y}{\delta}$ in the

boundary layer on a flat plate, where δ is the boundary layer thickness and u_{∞} is the free stream velocity ?

- (a) 0.5
- (b) 0.67
- (c) 0.75
- (d) 0.8

79. The oil with specific gravity 0.8, dynamic viscosity of 8×10^{-3} Ns/m² flows through a smooth pipe of 100 mm diameter and with Reynolds number 2100. The average velocity in the pipe is :

- (a) 0.21 m/s
- (b) 0.42 m/s
- (c) 0.168 m/s
- (d) 0.105 m/s

80. In a psychrometric chart, relative humidity lines are :
- Curved
 - Inclined and straight but non-uniformly spaced
 - Horizontal and non-uniformly spaced
 - Horizontal and uniformly spaced
81. A solar collector receiving solar radiation at the rate of 0.6 kW/m^2 transforms it to the internal energy of a fluid at an overall efficiency of 50%. The fluid heated to 350 K is used to run a heat engine which rejects heat at 313 K. If the heat engine is to deliver 2.5 kW power, the minimum area of the solar collector required would be, nearly :
- 8 m^2
 - 17 m^2
 - 39 m^2
 - 79 m^2
82. A reversible heat engine, operating on Carnot cycle, between the temperature limits of 300 K and 1000 K produces 14 kW of power. If the calorific value of the fuel is 40,000 kJ/kg. The fuel consumption will be :
- 1.4 kg/hr
 - 1.8 kg/hr
 - 2.0 kg/hr
 - 2.2 kg/hr
83. Consider the following statements pertaining to the metacentric height of ocean-going vessels :
- Increase in the metacentric height reduces the period roll
 - Some control of period of roll is possible if Cargo is placed further from the centre line of ship
 - In warships and racing yachts, metacentric height will be larger than other categories of ships
 - For ocean-going vessels, metacentric height is of the order of 30 cm to 120 cm
- Which of the above statements are correct ?
- 1, 2, 3 and 4
 - 1, 2 and 3 only
 - 1, 2 and 4 only
 - 3 and 4 only
84. Consider the following statements pertaining to a convergent-divergent nozzle flow with Mach number 0.9 at the throat :
- The flow is subsonic in both the converging and the diverging sections
 - The Mach number at the exit is less than one
 - In the diverging section, the flow is supersonic
 - There is a shock in the diverging section
- Which of the above statements are correct ?
- 1 and 4
 - 1 and 2
 - 3 only
 - 3 and 4

85. For a two stage compressor, the ratio of diameters of L.P. cylinder to H.P. cylinder is equal to :
- Square of the ratio of final pressure to initial pressure
 - The ratio of final pressure to initial pressure
 - The square root of the ratio of final pressure to initial pressure
 - Cube root of the ratio of final pressure to initial pressure
86. The condition for power transmission by flow through a pipeline to be maximum is that the loss of head of the flow due to friction throughout the pipeline length is :
- One-third of the total head at inlet end
 - One-fourth of the total head at inlet end
 - Three-fourth of the total head at inlet end
 - One-half of the total head at inlet end
87. The correct chronological order, in development of steam generators, is :
- Fire tube boiler, Monotube boiler and Water tube boiler
 - Water tube boiler, Fire tube boiler and Monotube boiler
 - Fire tube boiler, Water tube boiler and Monotube boiler
 - Water tube boiler, Monotube boiler and Fire tube boiler
88. Supersaturated flow occurs in a steam nozzle due to delay in :
- Throttling
 - Condensation
 - Evaporation
 - Entropy drop
89. Under ideal conditions, the velocity of steam at the outlet of a nozzle for a heat drop of 450 kJ/kg from inlet reservoir condition upto the exit is :
- 649 m/s
 - 749 m/s
 - 849 m/s
 - 949 m/s
90. A shock wave which occurs in a supersonic flow represents a region in which :
- A zone of silence exists
 - There is no change in pressure, temperature and density
 - There is sudden change in pressure, temperature and density
 - Analogy with a hydraulic jump is not possible

91. A convergent-divergent nozzle is said to be choked when :
- Critical pressure is attained at the exit and Mach number at this section is sonic
 - Velocity at the throat becomes supersonic
 - Exit velocity becomes supersonic
 - Mass flow rate through the nozzle reaches a maximum value
92. In a gas turbine cycle, the turbine output is 600 kJ/kg, the compressor work is 400 kJ/kg, and the heat supplied is 1000 kJ/kg. The thermal efficiency of the cycle is :
- 20%
 - 30%
 - 40%
 - 50%
93. Which of the following units increase the work ratio in a gas turbine plant ?
- Regeneration
 - Reheating
 - Intercooling
- 1 and 2 only
 - 2 and 3 only
 - 1 and 3 only
 - 1, 2 and 3
94. The pressure at a point in water column is 3.924 N/cm². What is the corresponding height of water ?
- 8 m
 - 6 m
 - 4 m
 - 2 m
95. Consider the following statements :
- Thermal efficiency of the simple Steam or Rankine cycle can be improved by increasing the maximum system pressure and temperature
 - Increasing the superheat of the steam improves the specific work and decreases the moisture content of exhaust steam
 - Increasing maximum system pressure always increases the moisture content at the turbine exhaust
 - Lowering the minimum system pressure increases the specific work of the cycle
- Which of the above statements are correct ?
- 1, 2 and 3
 - 1, 2 and 4
 - 2, 3 and 4
 - 1, 3 and 4

96. The gas turbine blades are subjected to :
- High centrifugal stress and thermal stress
 - Tensile stress and compressive stress
 - High creep and compressive stress
 - Compressive stress and thermal stress
97. Which one of the following methods can be adopted to obtain isothermal compression in an air compressor ?
- Increasing the weight of the compressor
 - Interstage heating
 - Atmospheric cooling
 - Providing appropriate dimensions to the cylinder
98. Consider the following statements :
- The compression process in a centrifugal compressor is comparable with :
- Reversible and adiabatic
 - Irreversible and adiabatic
- Which of the above statements is/are correct?
- Both 1 and 2
 - Neither 1 nor 2
 - 1 only
 - 2 only
99. A portable compressor is taken from place where the barometric pressure is 750 mm Hg and the average intake temperature is 27°C to a mountainous region where the barometric pressure is 560 mm Hg and temperature is 7°C. The reduction in mass output of the machine is :
- 80 %
 - 60%
 - 40%
 - 20%
100. The ratio of static enthalpy rise in the rotor to the static enthalpy rise in the stage of an axial flow compressor is defined as :
- Power input factor
 - Flow coefficient
 - Temperature coefficient
 - Degree of reaction
101. The performance of a single stage reciprocating air compressor is evaluated by its :
- Isentropic efficiency
 - Isothermal efficiency
 - Adiabatic efficiency
 - Volumetric efficiency
102. In a two stage reciprocating air-compressor with a suction pressure of 2 bar and delivery pressure of 8 bar, the ideal intercooler pressure will be :
- 10 bar
 - 6 bar
 - 4 bar
 - 3 bar

● **Directions:** —

Each of the next **Eighteen (18)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below :

Codes:

- (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)
- (c) Statement (I) is true but Statement (II) is false
- (d) Statement (I) is false but Statement (II) is true

103. Statement (I) : Clausius inequality is valid for all cycles, reversible or irreversible including refrigeration cycles.

Statement (II) : Clausius statement is a negative statement which has no proof.

104. Statement (I) : Thermometers using different thermometric property substance may give different readings except at two fixed points.

Statement (II) : Thermodynamic temperature scale is independent of any particular thermometric substance.

105. Statement (I) : First law of thermodynamics analyses the problem quantitatively whereas second law of thermodynamics analyses the problem qualitatively.

Statement (II) : Throttling process is reversible process.

106. Statement (I) : To prevent knocking in SI engines the end gas should have a low density.

Statement (II) : Pre-ignition is caused due to detonation.

107. Statement (I) : Knocking in Petrol engine is the auto-ignition of the rich mixture entering the combustion chamber.

Statement (II) : Knocking is due to high compression ratio.

108. Statement (I) : Automotive Petrol engines require Petrol of Octane number between 85-95.

Statement (II) : Automotive Diesel engines require Diesel oil of Cetane number between 85-95.

109. Statement (I) : In Automotive Petrol engines during idling operation a rich mixture is required ($F/A \approx 0.08$)

Statement (II) : Rich mixture is required because mixture is diluted by products of combustion.

110. Statement (I) : Piston temperature profiles near full load are flattened in case of liquid cooled engines whereas for air cooled engines temperature profiles are steeper.

Statement (II) : The piston temperature profiles are different in nature for liquid cooled and air cooled engines because of the different values of heat capacities.

111. Statement (I) : Effective temperature is an index which correlates the combined effect of air temperature, air humidity and air movement upon human thermal comfort.

Statement (II) : Thermal comfort is not affected by mean radiant temperature.

112. Statement (I) : Commercial airplanes save fuel by flying at higher altitudes during long trips.

Statement (II) : At higher altitudes, the ambient temperature and the Carnot efficiency are low.

113. Statement (I) : In a venturimeter, the divergent section is much longer as compared to the convergent section.

Statement (II) : Flow separation occurs only in the diverging section of the venturimeter.

114. Statement (I) : In Fanno flow, heat transfer is neglected and friction is considered.

Statement (II) : In Rayleigh flow, heat transfer is considered and friction is neglected.

115. Statement (I) : In a choked flow in a convergent divergent nozzle, flow in the diverging section is supersonic.

Statement (II) : In a choked flow in a convergent divergent nozzle, the Mach number at the throat is larger than one.

116. Statement (I) : Non-dimensional performance curves are applicable to any pump in the homologous series.

Statement (II) : Viscosity of water varies with temperature causing cavitations on suction side.

117. Statement (I) : In subsonic flow in a diverging channel, it is possible that the flow may separate.
Statement (II) : In subsonic flow in a diverging channel, there is adverse pressure gradient in the channel.
118. Statement (I) : In a boundary layer formed by uniform flow past a flat plate, the pressure gradient in the x direction is zero.
Statement (II) : In a boundary layer formed by uniform flow past a flat plate, the pressure gradient in the y direction is negligible.
119. Statement (I) : Coolant and antifreeze refer to the same product.
Statement (II) : Gas engines do not require cooling.
120. Statement (I) : Given a flow with velocity field \vec{V} , $\nabla \times \vec{V} = 0$, if the flow is incompressible.
Statement (II) : Given a flow with velocity field \vec{V} , $\nabla \cdot (\nabla \times \vec{V}) = 0$.

SPACE FOR ROUGH WORK

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EXAMINATION-2016

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Paper—II

Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write anything else on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose *ONLY ONE* response for each item.
5. You have to mark all your responses *ONLY* on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. *All* items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
 - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
 - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
 - (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. Consider the following motions :

1. Piston reciprocating inside an engine cylinder
2. Motion of a shaft between foot-step bearings

Which of the above can rightly be considered as successfully constrained motion?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2. A rotor weighing 2 kN is supported on bearings A and B which are 1 m apart. The centre of mass of the rotor is at a distance 0.4 m from bearing A. It is observed that there is an unbalanced couple of magnitude 300 N-m which leaves the shaft balanced statically. The dynamic reactions at the supports will be

- (a) 800 N and 800 N
- (b) 300 N and 800 N
- (c) 800 N and -300 N
- (d) 300 N and -300 N

3. A cam is a mechanical member used to impart a desired motion to a follower by direct contact. Which one of the under-listed follower motion types will produce the least jerk to the system?

- (a) Simple harmonic
- (b) Constant acceleration and deceleration
- (c) Constant velocity
- (d) Cycloidal

4. In a circular arc cam with a roller follower, acceleration of the follower depends on

1. cam speed and location of centre of circular arc
2. roller diameter and radius of circular arc

Which of the above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

5. A manufacturing company is selling a product for ₹ 15 per unit with variable cost of ₹ 10 per unit. The fixed cost of the asset is ₹ 50,000. How many units should be produced to breakeven?

- (a) 2000
- (b) 5000
- (c) 8000
- (d) 10000

6. In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 200mm. The lengths of the driving crank and the slotted bar are 100 mm and 500mm, respectively. The length of the cutting stroke is

- (a) 100 mm
- (b) 300 mm
- (c) 500 mm
- (d) 700 mm

7. A gear of 28 cm pitch circle diameter has 40 teeth. The circular pitch will nearly be

- (a) 11 mm/tooth
- (b) 22 mm/tooth
- (c) 33 mm/tooth
- (d) 44 mm/tooth

8. Consider the following statements regarding gear tooth designing for gear drive :

1. Tooth profiles not designed as per 'law of gearing' will cause vibration and impact problems even at low speed.
2. As the gears go through their mesh, the pitch point must remain stationary on the line of centres.
3. In a correctly designed tooth profile, the line of action of successive instantaneous points of contact will pass through the stationary pitch point.

Which of the above statements are correct?

- (a) 1, 2 and 3
- (b) 1 and 2 only
- (c) 1 and 3 only
- (d) 2 and 3 only

9. The flywheel of a steam engine has a radius of gyration of 1 m and mass 2000 kg. The starting torque of the engine is 2000 N-m. The kinetic energy of the flywheel after 10 seconds from start is

- (a) 75 kN-m
- (b) 100 kN-m
- (c) 125 kN-m
- (d) 150 kN-m

10. Consider two shafts connected with two gears as per the following options :

1. One on each shaft
2. Through an intermediate gear mounted on an intermediate shaft, and every shaft having one gear only
3. Through an intermediate gear mounted on an intermediate shaft, with the intermediate shaft having two gears, whereas the other shafts have one gear each

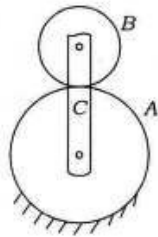
Which of the above represent(s) a simple gear train?

- (a) 1 only
- (b) 1 and 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

11. A riveting machine is driven by a constant-torque 3 kW motor. The moving parts including the flywheel are equivalent to 150 kg at 0.6 m radius. One riveting operation takes 1 second and absorbs 10000 N-m of energy. The speed of the flywheel is 300 r.p.m. before riveting. What is the speed (to nearest 10 r.p.m.) after riveting and what is the number of rivets that can be closed per minute?

- (a) 260 r.p.m. and 18
 (b) 290 r.p.m. and 15
 (c) 360 r.p.m. and 18
 (d) 390 r.p.m. and 15

12. With respect to the epicyclic gear train shown in the figure below, *A* has 75 teeth and *B* has 25 teeth; *A* is fixed and arm *C* makes 5 revolutions :



The number of revolutions made by *B* is

- (a) 10
 (b) 15
 (c) 20
 (d) 25

13. The equation of motion of a linear vibratory system with a single degree of freedom is

$$4\ddot{x} + 9\dot{x} + 16x = 0$$

The critical damping coefficient for the system is

- (a) 32
 (b) 16
 (c) 8
 (d) 4

14. Which one of the following statements is correct?

- (a) The product of diametral pitch and circular pitch is equal to unity.
 (b) The pressure angle for involute gears depends upon the size of teeth.
 (c) In a gear having involute teeth, the normal to the involute is a tangent to the base circle.
 (d) For commercially cut gears, the limiting pitch line velocity is 60 m/min.

15. The thickness of the continuous weld used for connecting a horizontal square bar of 150 mm size and of cantilevered length 500 mm to a vertical plate, with the bar carrying a 25 kN vertical load at its outer tip, given that the permissible direct shear stress of the weld is 20 N/mm^2 , is

- (a) 3 mm
 (b) 4 mm
 (c) 5 mm
 (d) 6 mm

16. A shaft of 50 mm diameter transmits a torque of 800 N-m. The width of the rectangular key used is 10 mm. The allowable shear stress of the material of the key being 40 MPa, the required length of the key would be
- (a) 60 mm
 - (b) 70 mm
 - (c) 80 mm
 - (d) 90 mm
17. A governor is said to be hunting if the speed of the engine
- (a) remains constant at the mean speed
 - (b) is above the mean speed
 - (c) is below the mean speed
 - (d) fluctuates continuously above and below the mean speed
18. The diameter of the pin in a bushed pin type flexible coupling is to be increased for the purpose of
- (a) higher stress due to shear
 - (b) keeping the magnitude of bending moment small by reducing the unsupported length of the pin
 - (c) fitting the pin in the bush
 - (d) reducing the thickness of the flange
19. The problem of interference in involute profile gears can be overcome by which one of the following means?
- (a) Decreasing the centre distance
 - (b) Using composite profile with cycloidal curve at the root of the tooth
 - (c) Using stub teeth of height more than the full depth teeth
 - (d) Proper lubrication
20. The bearing modulus for a bearing is 1628. What is the bearing characteristic number considered for bearing design?
- (a) 1628
 - (b) 3256
 - (c) 4884
 - (d) 6512

21. Two shafts of diameter 30 mm each are connected by a flange coupling. Six bolts, each of diameter 8 mm, are used on a pitch circle of diameter 90 mm. If the allowable shear stress of the bolt material is 80 MPa, what is the torque-transmitting capacity of the bolts to the nearest 10 units?
- (a) 780 N-m
 (b) 950 N-m
 (c) 1090 N-m
 (d) 1250 N-m
22. While selecting the elements of power transmission with speed reduction, the order of preference based on a minimum cost is
- (a) spur gear, belt pulley, worm and worm wheel
 (b) belt pulley, spur gear, worm and worm wheel
 (c) worm and worm wheel, spur gear, belt pulley
 (d) worm and worm wheel, belt pulley, spur gear
23. A solid shaft is designed to transmit 100 kW while rotating at N r.p.m. If the diameter of the shaft is doubled and is allowed to operate at $2N$ r.p.m., the power that can be transmitted by the latter shaft is
- (a) 200 kW
 (b) 400 kW
 (c) 800 kW
 (d) 1600 kW
24. What shall be the centre distance between the axes of pinion and gear when a 20° full-depth involute profile pinion with 20 teeth meshes with a gear that has 50 teeth for a module of 6 mm?
- (a) 70 mm
 (b) 140 mm
 (c) 210 mm
 (d) 280 mm
25. The diameter of a shaft to transmit 25 kW at 1500 r.p.m., given that the ultimate strength is 150 MPa and the factor of safety is 3, will nearly be
- (a) 12 mm
 (b) 16 mm
 (c) 20 mm
 (d) 26 mm
26. A thick lubrication is
- (a) a stable lubrication and there is no metal to metal contact
 (b) a stable lubrication because there is some amount of metal to metal contact
 (c) an unstable lubrication because there is some amount of metal to metal contact
 (d) an unstable lubrication because there is no metal to metal contact

27. A journal bearing sustains a radial load of 3672 N. The diameter of the bearing is 50 mm and the length is 0.1 m. The diametral clearance is 0.1 mm and the shaft rotates at 500 r.p.m. If the absolute viscosity of the oil is 0.06 kg/m-s, the value of Sommerfeld number is

- (a) 5.2×10^6
- (b) 10.3×10^6
- (c) 15.2×10^6
- (d) 20.3×10^6

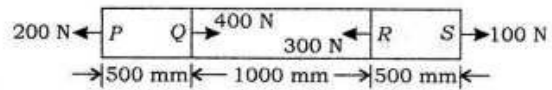
28. If the dynamic load capacity of a ball bearing is increased to 1.5 times its earlier value without changing its equivalent load, the life of the bearing increases to

- (a) 6.4 times its earlier life
- (b) 5.2 times its earlier life
- (c) 4.2 times its earlier life
- (d) 3.4 times its earlier life

29. The speed of the crankshaft is found to vary between 120 r.p.m. and 150 r.p.m. during one cycle of operation. What is the coefficient of fluctuation of speed?

- (a) 0.40
- (b) 0.31
- (c) 0.22
- (d) 0.13

30. A steel rod of cross-sectional area 10 mm^2 is subjected to loads at points P, Q, R and S as shown in the figure below :



If $E_{\text{steel}} = 200 \text{ GPa}$, the total change in length of the rod due to loading is

- (a) $-5 \mu\text{m}$
- (b) $-10 \mu\text{m}$
- (c) $-20 \mu\text{m}$
- (d) $-25 \mu\text{m}$

31. The state of stress at a point when completely specified enables one to determine the

1. maximum shearing stress at the point
2. stress components on any arbitrary plane containing that point

Which of the above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

32. A body is subjected to a direct tensile stress of 300 MPa in one plane accompanied by a simple shear stress of 200 MPa. The maximum normal stress on the plane will be
- (a) 100 MPa
(b) 200 MPa
(c) 300 MPa
(d) 400 MPa
33. A hub is press fitted on a shaft. An element in the hub is subjected to a radial compressive stress of 50 N/mm^2 and hoop stress of 75 N/mm^2 . If the hub is made of 30C8 steel with yield strength, $\sigma_y = 350 \text{ N/mm}^2$, what is the factor of safety using maximum shear stress theory?
- (a) 2.8
(b) 3.6
(c) 4.2
(d) 5.6
34. The state of stress at a point in a loaded member is $\sigma_x = 400 \text{ MPa}$, $\sigma_y = -400 \text{ MPa}$ and $\tau_{xy} = \pm 300 \text{ MPa}$. The principal stresses σ_1 and σ_2 are
- (a) 300 MPa and -700 MPa
(b) 400 MPa and -600 MPa
(c) 500 MPa and -500 MPa
(d) 600 MPa and -400 MPa
35. A circular steel rod of 20 cm^2 cross-sectional area and 10 m length is heated through 50°C with ends clamped before heating. Given, $E = 200 \text{ GPa}$ and coefficient of thermal expansion, $\alpha = 10 \times 10^{-6}/^\circ\text{C}$, the thrust thereby generated on the clamp is
- (a) 100 kN
(b) 150 kN
(c) 200 kN
(d) 250 kN
36. Two steel rods of identical length and material properties are subjected to equal axial loads. The first rod is solid with diameter d and the second is a hollow one with external diameter D and internal diameter 50% of D . If the two rods experience equal extensions, the ratio of $\frac{d}{D}$ is
- (a) $\frac{3}{4}$
(b) $\frac{\sqrt{3}}{2}$
(c) $\frac{1}{2}$
(d) $\frac{1}{4}$
37. A steel rod 10 m long is at a temperature of 20°C . The rod is heated to a temperature of 60°C . What is the stress induced in the rod if it is allowed to expand by 4 mm, when $E = 200 \text{ GPa}$ and $\alpha = 12 \times 10^{-6}/^\circ\text{C}$?
- (a) 64 MPa
(b) 48 MPa
(c) 32 MPa
(d) 16 MPa

38. A metal piece under the stress state of three principal stresses 30, 10 and 5 kg/mm² is undergoing plastic deformation. The principal strain rates will be in the proportions of
- 15, -5 and -10
 - 15, 5 and -10
 - 15, 5 and 10
 - 15, -5 and 10
39. An isotropic elastic material is characterized by
- two independent moduli of elasticity along two mutually perpendicular directions
 - two independent moduli of elasticity along two mutually perpendicular directions and Poisson's ratio
 - a modulus of elasticity, a modulus of rigidity and Poisson's ratio
 - any two out of a modulus of elasticity, a modulus of rigidity and Poisson's ratio
40. The Miller indices of a material in a plane are proportional to
- the reciprocal of numerical parameters of the intercepts
 - the square of unit cell dimensions
 - the intercepts of the planes on the coordinate axes
 - the interplanar spacing
41. Endurance limit is of primary concern in the design of a/an
- rotating shaft
 - industrial structure
 - column
 - machine base
- Which of the above is/are correct?
- 1 only
 - 2 only
 - 3 and 4 only
 - 1, 2, 3 and 4
42. A simply supported beam of rectangular cross-section is under transverse loading. Regarding the shear stress distribution across any section, the ratio of maximum shear stress to mean shear stress is
- 1.5
 - 2.5
 - 3.5
 - 4.5
43. Two beams, one having a square cross-section and another a circular cross-section, are subjected to the same amount of bending moment. If the cross-sectional area as well as the material of both the beams are the same, then
- both the beams will experience the same amount of deformation
 - the circular beam experiences more extreme flexural stress than the square one
- Which of the above is/are correct?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2

44. A coil-spring of stiffness k is cut exactly at the middle and the two springs thus made are arranged in parallel to take up together a compressive load. The equivalent stiffness of the two springs is
- $0.25k$
 - $0.5k$
 - $2k$
 - $4k$
45. Two solid shafts A and B are made of the same material. Shaft A is of 50 mm diameter and shaft B is of 100 mm diameter. The strength of shaft B is
- 2 times as that of shaft A
 - 4 times as that of shaft A
 - 6 times as that of shaft A
 - 8 times as that of shaft A
46. A closely-coiled helical spring is made of 10 mm diameter steel wire, with the coil consisting of 10 turns with a mean diameter 120 mm. The spring carries an axial pull of 200 N. What is the value of shear stress induced in the spring neglecting the effect of stress concentration and of deflection in the spring, when the modulus of rigidity is 80 kN/mm^2 ?
- 63.5 N/mm^2 and 34.6 mm
 - 54.2 N/mm^2 and 34.6 mm
 - 63.5 N/mm^2 and 42.6 mm
 - 54.2 N/mm^2 and 42.6 mm
47. Consider the following statements for a thick-walled cylinder, subjected to an internal pressure :
- Hoop stress is maximum at the inside radius.
 - Hoop stress is zero at the outside radius.
 - Shear stress is maximum at the inside radius.
 - Radial stress is uniform throughout the thickness of the wall.
- Which of the above statements are correct?
- 1 and 4
 - 1 and 3
 - 2 and 3
 - 2 and 4
48. A helical spring of 10 N/mm rating is mounted on top of another helical spring of 8 N/mm rating. The force required for a total combined deflection of 45 mm through the two springs is
- 100 N
 - 150 N
 - 200 N
 - 250 N
49. In waiting line problems if the arrivals are completely random, then the probability distribution of number of arrivals in a given time follows a/an
- Poisson distribution
 - normal distribution
 - exponential distribution
 - binomial distribution

50. Measured mechanical properties of material are same in a particular direction at each point. This property of the material is known as
- isotropy
 - homogeneity
 - orthotropy
 - anisotropy
51. A long column hinged at both the ends has certain critical Euler's buckling load-carrying capacity. If the same column be fixed at both the ends (in place of hinged ends), the load-carrying capacity then increases to
- 4 times
 - 3 times
 - 2 times
 - Nil
52. The strain energy per unit volume of a round bar under uniaxial tension with axial stress σ and modulus of elasticity E is
- $\frac{\sigma^2}{E}$
 - $\frac{\sigma^2}{2E}$
 - $\frac{\sigma^2}{3E}$
 - $\frac{\sigma^2}{4E}$
53. A steel hub of 100 mm internal diameter and uniform thickness of 10 mm was heated to a temperature of 300 °C to shrink fit it on a shaft. On cooling, a crack developed parallel to the direction of the length of the hub. The cause of the failure is attributable to
- tensile hoop stress
 - tensile radial stress
 - compressive hoop stress
 - compressive radial stress
54. Consider the following statements :
- A characteristic of the structure of metallic atoms is that
- their outermost orbital of electrons is nearly complete and they attract electrons from other atoms
 - their atoms are smaller and more compact than those of non-metallic elements
- Which of the above statements is/are correct?
- 1 only
 - 2 only
 - Both 1 and 2
 - Neither 1 nor 2
55. Spark sintering is a kind of hot pressure shaping technique in which
- the arc is produced inside the mould
 - the electrical heating of metallic powders by the production of spark in a graphite die is for a short time under pressure
 - before passing through the extrusion dies, a constant spark is produced
 - None of the above is applicable
56. The capacity of a material to absorb energy when deformed elastically and then to have this energy recovered upon unloading is called
- endurance
 - resilience
 - toughness
 - ductility

57. The recrystallization behaviour of a particular metal alloy is specified in terms of recrystallization temperature, which is typically 1/3rd of the absolute melting temperature of a metal or an alloy and depends on several factors including the amount of

1. cold working and purity of the metal and alloy
2. hot working and purity of the metal and alloy

Which of the above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

58. Consider the following pairs regarding plastics and their respective characteristics :

1. Polycarbonate : Poor impact resistance
2. PTFE : Low coefficient of friction
3. Polypropylene : Excellent fatigue strength

Which of the above pairs is/are correctly matched?

- (a) 1 only
- (b) 2 only
- (c) 1 and 3
- (d) 2 and 3

59. Consider the following statements :

1. Heat treatment is effective only in case of certain alloys.
2. Cooling rate is an important factor in any heat treatment process.
3. The temperature at which the change starts on heating the steel is called lower critical temperature.

Which of the above statements are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

60. Consider the following processing methods for plastics :

1. Transfer moulding
2. Extrusion
3. Thermoforming
4. Calendering

Which of these are best suited for processing of plastics to their final shape?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 3 and 4 only
- (d) 1, 2, 3 and 4

61. A reaction-bonded silicon nitride ceramic has a strength of 300 MPa and a fracture toughness of $3.6 \text{ MPa} \sqrt{\text{m}}$. With $y = 1$ in the fracture toughness equation, what is the largest size of internal crack that this material can withstand without fracturing?

- (a) $91.6 \mu\text{m}$
- (b) $82.3 \mu\text{m}$
- (c) $74.6 \mu\text{m}$
- (d) $45.8 \mu\text{m}$

62. The modulus of elasticity of E-glass is 72 GPa and that of epoxy resin is 3 GPa. The modulus of elasticity (to the nearest unit magnitude) for a composite material consisting of 60% by volume of continuous E-glass fibre and 40% epoxy resin for the matrix, when stressed under isostress conditions, is

- (a) 4 GPa
- (b) 5 GPa
- (c) 6 GPa
- (d) 7 GPa

63. In developing abrasive ceramics which are used to wear, grind or cut away other materials which are (necessarily) softer, they should have, besides wear resistance,

- 1. a high degree of toughness
- 2. a low degree of toughness
- 3. refractoriness

Which of the above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) 1 and 3
- (d) 2 and 3

64. Consider the following in case of high-energy forming processes :

- 1. The evacuation between die and blank in explosive forming is done by a vacuum pump.
- 2. The pressure waves produced in water in explosive forming deform the blank to the die shape.
- 3. The electrohydraulic forming makes use of discharge of large amount of electrical energy used in a capacitor bank.
- 4. In Petroforge, the piston is moved by combustion of fuel moving at the rate of 150–200 m/s.

Which of the above are correct?

- (a) 1, 2, 3 and 4
- (b) 1, 2 and 3 only
- (c) 3 and 4 only
- (d) 1, 2 and 4 only

65. In abrasive jet machining process, the main mechanism of material removal takes place due to

- (a) electrochemical action
- (b) mechanical impact
- (c) fatigue failure of the material
- (d) sparking on impact

66. Consider that the following materials are usable for manufacturing dies, moulds in investment casting process for the purpose of large-scale production :

1. Aluminium alloy
2. Magnesium alloy
3. Brass
4. Low-carbon steel

Which of the above are correctly usable?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 3 and 4 only
- (d) 1, 2, 3 and 4

67. The occurrence of casting defect 'rat tail' is possible because of

1. soft ramming of sand
2. continuous large flat surface on the mould
3. excessive hardness of the mould

Which of the above reasons are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

68. Components produced by die casting have finer grain, higher strength and greater hardness at the skin than at the centre due to

- (a) decreased wall thickness of die cavity
- (b) rapid chilling of molten metal at the die walls
- (c) high temperature involved in the process
- (d) high tonnage of die casting machines

69. A 125 mm long, 10 mm diameter stainless steel rod is being turned to 9 mm diameter, 0.5 mm depth of cut. The spindle rotates at 360 r.p.m. With the tool traversing at an axial speed of 175 mm/min, the metal removal rate is nearly

- (a) 2200 mm³/min
- (b) 2400 mm³/min
- (c) 2600 mm³/min
- (d) 2800 mm³/min

70. The feed in face milling for a width of 70 mm with a cutter of 160 mm diameter, having 10 inserts and rotating at 360 r.p.m., with a feed rate of 0.5 m/min, is nearly

- (a) 0.21 mm/tooth
- (b) 0.18 mm/tooth
- (c) 0.14 mm/tooth
- (d) 0.11 mm/tooth

71. A lathe consumes 500 W when running idle and 2500 W when cutting a steel specimen at 30 m/min. If the depth of cut is 4 mm and feed rate is 0.25 mm/rev, the cutting force and the approximate value of torque at a spindle run of 120 r.p.m. will respectively be

- (a) 4000 N and 160 N-m
- (b) 3000 N and 160 N-m
- (c) 4000 N and 100 N-m
- (d) 3000 N and 100 N-m

72. For a shaper, the length of stroke is 210 mm, the number of double strokes per minute is 32 and the ratio of return time to cutting time is 2 : 3. The cutting speed will be

- (a) 8.1 m/min
- (b) 11.2 m/min
- (c) 14.3 m/min
- (d) 17.4 m/min

73. The headstock of a lathe has 9 speeds with minimum speed of 100 r.p.m. and maximum speed of 1600 r.p.m. If the speeds are in geometric progression, then the ratio is

- (a) 1.06
- (b) 1.22
- (c) 1.41
- (d) 1.64

74. Surface cracking occurring at low temperatures in hydrostatic extrusion is known as

- (a) fluid defect
- (b) bamboo defect
- (c) fishtailing
- (d) arrowhead fracture

75. Flank wear occurs mainly on the

1. nose part of the cutting tool
2. front relief face and side relief face of the cutting tool
3. face of the cutting tool at the shortest distance from the cutting edge

Which of the above is/are correct?

- (a) 1 and 2
- (b) 1 and 3
- (c) 2 only
- (d) 1 only

76. A part programme for any arbitrary object is given as follows :

```
N001 G91 G71 M03 S600 EOB
N002 G00 X 10.00 Y10.00 EOB
N003 G00 Z-10.00 EOB
N004 G83 Z-60.00 F100 EOB
N005 G80 EOB
N006 M02 EOB
```

The above programming format will be used as Canned cycle for

- (a) drilling
- (b) tapping
- (c) boring
- (d) grooving

77. In case of TIG welding of aluminium alloys, the amount of shielding gas used can be determined from the band of white deposit (aluminium oxide) alongside of the weld bead. A hairline width white band indicates that the quantum of shielding gas used has been

1. more than required
2. lesser than required
3. adequate as required

Which of the above is correct?

- (a) 1
- (b) 2
- (c) 3
- (d) Cannot be determined due to insufficient information

78. If H is the heat input, l is the weld length, V is the voltage applied, I is the current, v is the welding speed and e is the efficiency of the process, then the process-governing equation in arc welding is given by
- (a) $\frac{H}{l} = e \frac{VI}{v}$
 (b) $\frac{H}{v} = e \frac{VI}{l}$
 (c) $H = e \frac{VI}{vl}$
 (d) $H = eVI \cdot vl$
79. A Cylindrical Robot can reach any point in a cylinder of height L and radius $2L$, except for the points in an inner cylinder of height L and radius L . The volume for the Cylindrical Robot work envelope will be
- (a) $9.42L^3$
 (b) $6.24L^3$
 (c) $9.12L^3$
 (d) $9.86L^3$
80. Consider the following statements about forging :
1. Forgings have high strength and ductility.
 2. Forgings offer great resistance to impact and fatigue loads.
 3. Forging assures uniformity in density as well as dimensions of the forged parts.
- Which of the above statements are correct?
- (a) 1 and 2 only
 (b) 1 and 3 only
 (c) 2 and 3 only
 (d) 1, 2 and 3
81. In a machining test, a cutting speed of 100 m/min indicated the tool life as 16 min and a cutting speed of 200 m/min indicated the tool life as 4 min. The values of n and C are
- (a) 0.5 and 200
 (b) 0.25 and 200
 (c) 0.5 and 400
 (d) 0.25 and 400
82. Which of the following Robots has application for mobile platform handling in cockpit flight simulators?
- (a) SCARA Robot
 (b) Articulated Robot
 (c) Parallel Robot
 (d) Cylindrical Robot
83. What is the degree of operating leverage in the following cases?
1. Where profit is ₹ 5,00,000 and total fixed cost is ₹ 4,00,000
 2. Where 1% increase in output brings in 3% increase in profit
- (a) 0.8 and 3
 (b) 1.5 and 3
 (c) 0.8 and 4
 (d) 1.5 and 4
84. The input variables of EDM under a given combination of electrode (tool), dielectric and workpiece are
- (a) surface finish and metal removal rate
 (b) frequency of current and surface finish
 (c) amperage and frequency
 (d) metal removal rate and amperage

85. During the formation of chips in machining with a cutting tool, which one of the following relations holds good?

(a) $\frac{V}{\cos(\phi - \alpha)} = \frac{V_S}{\cos\alpha} = \frac{V_C}{\sin\alpha}$

(b) $\frac{V}{\sin(\phi - \alpha)} = \frac{V_S}{\cos\alpha} = \frac{V_C}{\cos\alpha}$

(c) $\frac{V}{\cos\alpha} = \frac{V_C}{\sin\alpha} = \frac{V_S}{\sin(\phi - \alpha)}$

(d) $V\cos\alpha = V_C\sin\alpha = V_S\cos(\alpha - \phi)$

where V is the cutting speed, V_C is the velocity of the chip, V_S is the velocity at which shearing takes place along the shear plane, ϕ is the shear angle and α is the rake angle.

86. The complexity of a jig or a fixture is determined by

1. the number of pieces that must be produced
2. the degree of accuracy required
3. the number and kind of machining operations that must be performed

Which of the above are correct?

- (a) 1 and 2 only
 (b) 1 and 3 only
 (c) 2 and 3 only
 (d) 1, 2 and 3

87. For a small-scale industry, the fixed cost per month is ₹ 5,000. The variable cost per product is ₹ 20 and the sales price is ₹ 30 per piece. The break-even production per month will be

- (a) 300
 (b) 400
 (c) 500
 (d) 600

88. Coriolis component of acceleration depends on

1. angular velocity of the link
2. acceleration of the slider
3. angular acceleration of the link

Which of the above is/are correct?

- (a) 1 only
 (b) 2 only
 (c) 1 and 3
 (d) 2 and 3

89. Which one of the following distributions provides information regarding the uncertainty of duration time estimates in PERT described network?

- (a) Beta-distribution
 (b) Normal distribution
 (c) Poisson distribution
 (d) Binomial distribution

90. When an ordering cost is increased to 4 times, the EOQ will be increased to

- (a) 2 times
 (b) 4 times
 (c) 8 times
 (d) 16 times

91. The weekly sale for an item is A units. The ordering cost per order is B rupees. The carrying cost per unit per month is C rupees. The EOQ (with a year of 52 weeks as the basis) will nearly be

(a) $\sqrt{\frac{8 \cdot 7A}{BC}}$

(b) $\sqrt{\frac{8 \cdot 7AB}{C}}$

(c) $\sqrt{\frac{4 \cdot 35A}{BC}}$

(d) $\sqrt{\frac{4 \cdot 35AB}{C}}$

92. A self-service store employs one cashier at its counter. 8 customers arrive on an average every 5 minutes, whereas cashier can serve 10 customers in same time. Assuming Poisson distribution for service rate, the average time a customer spends in the queue will be

(a) 4 minutes

(b) 3 minutes

(c) 2 minutes

(d) 1 minute

93. In an internally pressurized thick cylinder, the hoop stress

1. remains constant but the radial stress varies parabolically
2. varies parabolically but the radial stress remains constant

Which of the above is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

94. Consider the following statements for down-milling operation :

1. The workpiece is forced against the holding device by the cutter.
2. The cutting tool rotates in the same direction.
3. Backlash elimination is not required.
4. The cut starts with a full chip thickness.

Which of the above statements are correct in this context?

(a) 1, 2 and 3 only

(b) 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

95. Consider the following functions regarding production control department :

1. Provision of resources
2. Preparation of production schedules
3. To maintain the requisite quality standards

Which of the above functions are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

96. Auditing of the measurement systems establishes

1. whether they are informing enough for decision making
2. whether the cost of data collection is merited
3. whether measurements are being taken accurately

Which of the above are correct?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

97. Consider the following statements with respect to flow diagram in work study :

1. Movement of machines is drawn in flow diagram.
2. Movement of men is drawn in flow diagram.
3. In flow diagram, all movements are drawn true to scale.

Which of the above statements are correct?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

98. An organization uses ABC approach for categorization of its stock. Which of the following describe class C items?

- (a) High value and high risk
- (b) High value and low risk
- (c) Low value and high risk
- (d) Low value and low risk

99. Consider the following elements of situation awareness :

1. Perception of elements in the environment within a volume of time and space, comprehension of their meaning and projection of their status in the future
2. Perception of elements in the environment within a volume of time and space, comprehension of their meaning, projection of their status in the future and interpretation of the results
3. Sensing of the elements in the environment, perception of those elements, analysis of consequences, projection of alternative outcomes and interpretation of the results

Which of the above is/are correct?

- (a) 1 only
- (b) 1 and 2
- (c) 2 and 3
- (d) 3 only

100. In case of design of friction clutches, uniform rate of wear theory is used over uniform pressure. The reasons may be the following :

1. It gives higher frictional torque.
2. It gives lower frictional torque.
3. The intensity of pressure is maximum at the inner radius and minimum at the outer radius of the friction or contact surfaces.
4. This concept is prevalent for running and old clutches.

Which of the above reasons are correct?

- (a) 1, 3 and 4
- (b) 1 and 3 only
- (c) 2 and 3
- (d) 2 and 4

Directions :

Each of the following **twenty (20)** items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the code given below.

Code :

- (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is **not** the correct explanation of Statement (I)
- (c) Statement (I) is true but Statement (II) is false
- (d) Statement (I) is false but Statement (II) is true

101. Statement (I) :

Automated guided vehicle (AGV) is a programmable mobile vehicle without human intervention and used for material handling.

Statement (II) :

Automated storage and retrieval system (AS/RS) is a part of CNC machine and used for machining operation.

102. Statement (I) :

The follower motion represented on the displacement diagram is achieved by proper cam profile.

Statement (II) :

The cam profile is constructed using the principle of kinematic inversion.

103. Statement (I) :

Composite material is combination of two or more chemically unlike materials.

Statement (II) :

Composite materials have their own specific properties and are different from their individual material properties.

104. Statement (I) :

The epicyclic gear train has a central gear and an epicyclic gear which produces epicyclic motion being moved by a crank arm.

Statement (II) :

The arm contains the bearings for the epicyclic gear to maintain two gears in mesh.

105. Statement (I) :

Two non-intersecting and non-parallel, i.e., non-coplanar, shafts connected by gears are called skew-bevel gears or spiral gears, and this type of gearing has a line contact the rotation of which about the axes generates the two hyperboloid pitch surfaces.

Statement (II) :

A hyperboloid is a 3D surface formed by revolving a straight line about an axis (not in the same plane), such that every point on the line remains at a constant distance from the axis.

106. Statement (I) :

Motor vehicles have differential gear mechanism at the back axle.

Statement (II) :

This mechanism is fitted to enable the vehicles to run on bumpy roads.

107. Statement (I) :

The distribution of mass along the axis of rotation of a shaft depends on the configuration of the part.

Statement (II) :

All mass centres must fall on straight line parallel to the axis of the shaft for complete dynamic balancing.

108. Statement (I) :

In resistance welding of sheet metal, filler rod is not used.

Statement (II) :

It is the filler rod which gets oxidized and deposits the oxide in the weldment.

109. Statement (I) :

The linear speed of the belt in a belt drive is controlled by the tensile strength of the material of the driven pulley (larger in diameter).

Statement (II) :

The rotating pulley rim is subjected to tensile hoop stress.

110. Statement (I) :

In an epicyclic gear train, the size of the gearbox is smaller than that of the spur gearbox for the same horsepower and the same velocity ratio.

Statement (II) :

In an epicyclic gearbox, more than one pair of gear pinion contacts always exist, whereas it is not so in spur gearbox.

111. Statement (I) :

Pursuant to plastic deformation of metals, the mechanical properties of the metals get changed.

Statement (II) :

Mechanical properties of metals depend on grain size also which gets changed by plastic deformation.

112. Statement (I) :

In quick return motion mechanism, Coriolis acceleration exists.

Statement (II) :

Two links in this mechanism oscillate with one sliding relative to the other.

113. Statement (I) :

Ceramics withstand very high temperatures that range from 1000 °C to 1600 °C.

Statement (II) :

Silicon carbide is an exception from among ceramics that can withstand high temperatures.

114. Statement (I) :

Employing the extrusion process is not economical in case of large billets.

Statement (II) :

A significant part of the press capacity is lost overcoming frictional resistance between workpiece and cylinder wall during the extrusion process.

115. Statement (I) :

In drop forging, the excess metal added to the stock for complete filling of the die cavity is called flash.

Statement (II) :

Flash acts as a cushion against impact blows attributable to the finishing impression.

116. Statement (I) :

In wire-drawing, the end of the stock is made 'pointed' to make for easier entrance of the wire into the die.

Statement (II) :

The pointing of the wire is done exclusively by rotary swaging and not by simple hammering.

117. Statement (I) :

Metal powders can be produced by atomization process.

Statement (II) :

In case of metals with low melting point, the size of particles cannot be controlled and the shape of the particles remains regular in atomization.

118. Statement (I) :

In shell moulding process, phenol formaldehyde is never used.

Statement (II) :

The resins used in this process are basically of the thermoplastic variety.

119. Statement (I) :

Both sand and metal moulds can be used for centrifugal casting.

Statement (II) :

In this process, sand moulds are recommended when chilling tendency is to be prevented.

120. Statement (I) :

In gas welding process, neutral flame is the most common flame used for welding and cutting stainless steel.

Statement (II) :

Neutral flame has tendency to react with stainless steel being welded.

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