2.5/15

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T.B.C. : PKL-D-MCH

Test Booklet Series

Serial No.	# TEST BOOKLET	**A**
C029593	Paper II (MECHANICAL ENGINEERING)	

Time Allowed : Three Hours

Maximum Marks : 300

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.

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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 150 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 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 (0·33)** 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 **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. Centroid of a body coincides with its centre of mass or its centre of gravity only if the material composing the body is

   (a) uniform or homogeneous

   (b) in equilibrium

   (c) in static equilibrium

   (d) translating with constant velocity

2. A cast-iron pipe of 750 mm diameter is used to carry water under a head of 60 m. What is the approximate thickness of the pipe if permissible stress is to be 20 MPa ? (Take specific weight of water as 9·81 kN/m^3)

   (a) 22 mm

   (b) 14 mm

   (c) 11 mm

   (d) 7 mm

3. A 120 mm wide and 10 mm thick steel plate is bent into a circular arc of 8 m radius. What is the bending moment which will produce the maximum stress ? (Take Young's modulus as 200 GPa)

   (a) 250 Nm

   (b) 212 Nm

   (c) 200 Nm

   (d) 172 Nm

4. A simply supported beam of 8 m length carries three-point loads of 8 kN, 4 kN and 10 kN at 2 m, 5 m and 6 m respectively from the left end. What are the left and right support reactions respectively ?

   (a) 12 kN and 10 kN

   (b) 9 kN and 11 kN

   (c) 11 kN and 9 kN

   (d) 10 kN and 12 kN

5. Which one of the following is NOT used as support for beams ?

   (a) Roller support

   (b) Hinged support

   (c) Fixed support

   (d) Independent support

6. The initial frictional resistance of an unloaded pulley block is 2·6 kN. The friction increases at the rate of 1·4 kN per 100 kN load lifted by the block. The velocity ratio is 18. The efficiency of the block at the load of 1200 kN is approximately

   (a) 64%

   (b) 77%

   (c) 85%

   (d) 87%

7. The distance between the supports of a simply supported beam is L. The beam has two equal overhangs of length $L/3$ over each support. The beam carries a point load $2W$ at the centre and a point load W at each end. Deflection at the centre is

(a) 1·8 mm

(b) 7·2 mm

(c) 0 mm

(d) 3·6 mm

8. The maximum bending moment at the fixed end in a cantilever of length L carrying a uniformly distributed load W per unit length across the whole span is

(a) $WL^2/2$

(b) $WL^2/4$

(c) $WL^3/4$

(d) $WL^3/8$

9. A body of weight 100 N is placed on a rough horizontal plane. If a horizontal force of 60 N just causes the body to slide over the horizontal plane, then the coefficient of friction between the body and the horizontal plane is

(a) 0·6

(b) 0·3

(c) 0·2

(d) 0·1

10. A fire engine raises water at the rate of 6000 litres per minute through a height of 2 m and discharges it at 10 m/s. The H.P. of fire engine is nearly equal to (Take acceleration due to gravity as $9·81$ m/s^2)

(a) 6·5

(b) 7·2

(c) 8·0

(d) 9·5

11. A spherical vessel has 1 m diameter. It is subjected to internal pressure of $1·5$ N/mm^2. If maximum stress is not to exceed 200 N/mm^2 and joint efficiency is 80%, then the thickness of the plate required is

(a) 3·20 mm

(b) 4·21 mm

(c) 5·22 mm

(d) 2·34 mm

12. A material has modulus of rigidity equal to $0·4 \times 10^5$ N/mm^2 and bulk modulus equal to $0·75 \times 10^5$ N/mm^2. The Poisson's ratio is

(a) 0·2736

(b) 0·1927

(c) 0·3121

(d) 0·4376

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13. For a 99·65 wt% Fe-0·35 wt% C alloy at a temperature just below the eutectoid, the fractions of the proeutectoid ferrite and pearlite are respectively

(a) 0·44 and 0·56

(b) 0·56 and 0·44

(c) 0·044 and 0·056

(d) 0·056 and 0·044

14. Consider the following statements regarding the mechanical behavior of iron-carbon alloys :

1. Martensitic steels are most ductile.

2. Tempered martensite is relatively brittle.

3. Fine pearlite is more brittle than coarse pearlite.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

15. Which one of the following contain other alloying elements such as copper, vanadium, nickel, and molybdenum in combined concentrations as high as 10 wt%, and possess higher strengths than the plain low-carbon steels ?

(a) Alloy steels

(b) Medium carbon steels

(c) Stainless steels

(d) High-strength, low-alloy steels

16. Which one of the following alloys is most suitable for applications in bearings, bushings, piston rings, steam fittings and gears ?

(a) Cartridge brass

(b) Tin bronze

(c) Leaded yellow brass

(d) Beryllium copper

17. In general, annealing is carried out to

(a) increase softness

(b) increase stresses

(c) decrease ductility

(d) decrease toughness

18. Consider the following statements related to compute the equilibrium concentrations of the two phases :

1. A tie line is constructed across the two-phase region at the temperature of the alloy.

2. The intersections of the tie line and the phase boundaries on either side are noted.

3. Perpendiculars are dropped from these intersections to the horizontal composition axis, from which the composition of each of the respective phases is read.

Which of the above statements is/are correct ?

(a) 1 only

(b) 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

19. In which of the following microconstituents, α-Ferrite + Fe_3C phases are present ?

    1. Spheroidite

    2. Coarse pearlite

    3. Fine pearlite

Select the correct answer using the code given below :

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

20. Which one of the following is the capacity of a material to absorb energy when it is deformed elastically and then, upon unloading, to have this energy recovered ?

(a) Resilience

(b) Ductility

(c) Brittleness

(d) Hardness

21. What is the shape of indenter for vickers microhardness testing technique ?

(a) Sphere

(b) Diamond cone

(c) Diamond pyramid

(d) Cube

22. Corrosion penetration rate is directly proportional to

(a) Exposed specimen area

(b) Density

(c) Weight loss after exposure time

(d) Exposure time

23. Which one of the following measures is correct to reduce the effects of galvanic corrosion ?

(a) It uses cathode area as large as possible

(b) It avoids an unfavorable anode-to-cathode surface area ratio

(c) It uses an anode area as small as possible

(d) It electrically insulates similar metals from each other

24. Consider the following statements regarding corrosion :

    1. The formation of a film of atoms or molecules on the surface of an anode so that corrosion is slowed down, is called passivation.

    2. Local corrosion attack resulting from the formation of small anodes on a metal surface, is known as intergranular corrosion.

    3. Preferential corrosion occuring at grain boundaries or at regions adjacent to the grain boundaries, is called pitting corrosion.

Which of the above statements is/are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 only

(d) 3 only

25. A cantilever beam of negligible mass has a mass m at its free end. If the length of the cantilever is halved, what is the factor by which its natural frequency is increased ?

(a) $\sqrt{8}$ times

(b) $\sqrt{6}$ times

(c) $\sqrt{5}$ times

(d) $\sqrt{3}$ times

26. Consider the following statements regarding kinematic pairs :

1. When a pair has a point or line contact between the links, it is known as lower pair.

2. When the elements of a pair are held together mechanically, it is known as closed pair.

3. If two mating links have a turning as well as sliding motion between them, they form a screw pair.

4. When two links of a pair are in contact either due to force of gravity, they constitute an un-closed pair.

Which of the above statements are correct ?

(a) 2 and 4 only

(b) 1 and 3 only

(c) 1, 3 and 4 only

(d) 2, 3 and 4

27. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0·45 m and a speed of 3000 rpm clockwise when looking from stern. If the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h, then the gyroscopic couple is

(a) 22·27 kN-m

(b) 21·27 kN-m

(c) 12·47 kN-m

(d) 11·47 kN-m

28. Consider the following statements regarding governors :

1. A Wilson governor is a spring-controlled governor in which the vertical arms of the bell-crank lever are fitted with spring balls.

2. A Hartung governor is a spring-loaded type governor in which two bell-crank levers are pivoted at the ends of two arms which rotate with the spindle.

3. In a spring-controlled gravity governor, two bell-crank levers are pivoted on the moving sleeve.

4. In a Watt governor, a pair of balls (masses) is attached to a spindle with the help of links.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 3 and 4 only

(c) 1, 3 and 4 only

(d) 1, 2, 3 and 4

29. Which one of the following principles states that the inertia forces and couples, and external forces and torques on a body together give statical equilibrium ?

(a) D'Alembert principle

(b) Paul Ehrlich principle

(c) David Hilbert principle

(d) Edward Jenner principle

30. Consider the following statements regarding gears :

1. A cycloid is the locus of a point on the circumference of a circle that rolls without slipping on a fixed straight line.

2. A hypocycloid is the locus of a point on the circumference of a circle that rolls without slipping on the circumference of another circle.

3. An epicycloid is the locus of a point on the circumference of a circle that rolls without slipping inside the circumference of another circle.

Which of the above statements is/are correct ?

(a) 1 and 3 only

(b) 2 only

(c) 2 and 3 only

(d) 1 only

31. Which one of the following is the angle through which the cam turns during the time the follower rises ?

(a) Angle of ascent

(b) Angle of dwell

(c) Angle of descent

(d) Angle of action

32. Consider the following statements regarding cams :

1. Base circle is the smallest circle tangent to the cam profile (contour) drawn from the centre of rotation of a radial cam.

2. Pitch curve is the curve drawn by the trace point assuming that the cam is fixed, and the trace point of the follower rotates around the cam.

3. Pitch circle is the circle passing through the pitch point and concentric with the base circle.

4. The smallest circle drawn tangent to the pitch curve is known as the prime circle.

Which of the above statements are correct ?

(a) 1 and 3 only

(b) 2 and 4 only

(c) 2 and 3 only

(d) 1, 2, 3 and 4

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33. Consider the following statements regarding acceleration analysis :

1. A graphical method to find the location of the centre of curvature of the locus of a point on a moving body, is known as Bobillier construction.

2. A graphical method by which inflection circle can be drawn without requiring the curvatures of the centrodes, is known as Hartmann construction.

3. Bobillier theorem states that the angle subtended by one of the rays with the centrode tangent is equal to negative of the angle subtended by the other ray with the collineation axis.

Which of the above statements is/are correct ?

(a) 1 and 3 only

(b) 3 only

(c) 2 only

(d) 1, 2 and 3

34. Consider the following parameters :

s = length of the shortest link,

l = length of the longest link,

p = length of one of the intermediate length links,

q = length of the other intermediate length links;

According to the Grashof's criteria, if $s + l > p + q$, then the category of four-bar mechanism is

(a) Double crank

(b) Crank-rocker

(c) Change point

(d) Triple rocker

35. A uniform disc of 150 mm diameter has mass of 5 kg. It is mounted centrally in bearings which maintain its axle in a horizontal plane. The disc spins about its axle with a constant speed of 1000 rpm, while the axle precesses uniformly about the vertical at 60 rpm. The gyroscopic couple acting on the disc is approximately

(a) 6·5 Nm

(b) 7·2 Nm

(c) 8·5 Nm

(d) 9·2 Nm

36. A system of rotating masses is in dynamic balance when

(a) there does not exist any resultant centrifugal force only

(b) there does not exist any resultant couple only

(c) there does not exist any resultant centrifugal force as well as resultant couple

(d) there exists both resultant centrifugal force and resultant couple

37. Wear rating of a long shoe drum brake is

(a) directly proportional to friction power

(b) directly proportional to brake shoe area

(c) inversely proportional to friction torque on drum

(d) inversely proportional to friction power

38. What is the required basic dynamic load rating, C, for a ball bearing to carry a radial load of 550 kg from a shaft rotating at 500 rpm that is part of an assembly conveyor in a manufacturing plant ? (Take the design life as 1×10^9 rev)

(a) 5000 kg

(b) 5500 kg

(c) 4000 kg

(d) 4500 kg

39. A catalog lists the basic dynamic load rating for a ball bearing to be 8000 kg for a rated life of 1×10^6 rev. What is the expected L_{10} life of the bearing if it is subjected to a load of 4000 kg ? (Take $k = 3$ for ball bearing)

(a) 8×10^6 rev

(b) 6×10^6 rev

(c) 4×10^6 rev

(d) 2×10^6 rev

40. Which one of the following static loading failure theories is used for ductile materials ?

(a) Maximum shear stress theory

(b) Maximum normal stress theory

(c) Coulomb-mohr theory

(d) Modified mohr theory

41. In shaft rigidity and dynamic considerations, shorter shaft lengths

(a) increase deflections and reduce critical speeds

(b) increase deflections and raise critical speeds

(c) reduce deflections and reduce critical speeds

(d) reduce deflections and raise critical speeds

42. Wear performance of the brakes can be improved to

(a) keep the pressure between the friction material and the material of the disc or drum as high as practical

(b) specify friction materials that have low bonding strength between constituent particles

(c) specify friction materials that have relatively high adhesion when in contact with the disc or drum material

(d) provide high hardness on the surface of the disc or drum by heat treatment

43. Consider the following statements regarding the parameters involved in the rating of clutches and brakes :

1. Torque required to accelerate or decelerate the system.

2. Time required to accomplish the speed change.

3. The cycling rate is required.

Which of the above statements is/are correct ?

(a) 2 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

44. In the design of spur gear, the load-distribution factor can be minimized by specifying which of the following ?

   1. Accurate teeth

   2. Narrow face widths

   3. Long shaft spans between bearings

   Select the correct answer using the code given below :

   (a) 1 and 2 only

   (b) 1 and 3 only

   (c) 2 and 3 only

   (d) 1, 2 and 3

45. Which one of the following fatigue failure criterias is used in graphical method equation ?

   (a) Soderberg fatigue failure criteria

   (b) Goodman fatigue failure criteria

   (c) Smith diagram fatigue failure criteria

   (d) Gerber fatigue failure criteria

46. Which one of the following is used in case in which the clutch runs free when the machine is being driven in the intended direction ?

   (a) Overrunning

   (b) Backstopping

   (c) Under running

   (d) Front stopping

47. In a band brake, the tension in the band decreases from the value P_1 at the pivot side of the band to P_2 at the lever side. If r is the radius of the drum, then the net torque on the drum is

   (a) $(P_1 - P_2)/r$

   (b) $(P_1 - P_2)r$

   (c) $(P_1 + P_2)/r$

   (d) $(P_1 + P_2)r$

48. Consider the following statements regarding transmission shafts :

   1. Counter shaft is secondary shaft which is driven by the main shaft from which the power is supplied to a machine component.

   2. Jack shaft is an intermediate shaft between two shafts that is used in transmission of power.

   3. A line shaft consists of a number of shafts, which are connected in an axial direction by means of couplings.

   Which of the above statements is/are correct ?

   (a) 2 only

   (b) 1 and 3 only

   (c) 2 and 3 only

   (d) 1, 2 and 3

49. In the rolling process, if V_r is the velocity of roll surface, V_0 is the velocity of material at the entrance to the deformation zone and V_1 is the velocity of material at the exit of the rolls, then the forward slip is

(a) $\dfrac{V_r}{V_1 - V_r} \times 100$ percent

(b) $\dfrac{V_r}{V_r - V_0} \times 100$ percent

(c) $\dfrac{V_1 - V_r}{V_r} \times 100$ percent

(d) $\dfrac{V_r - V_0}{V_r} \times 100$ percent

50. Which one of the following fits is used for high-strength assemblies where high resulting pressures are required ?

(a) Light drive fit

(b) Medium drive fit

(c) Heavy drive fit

(d) Force fit

51. In PERT, which one of the following is the estimator expects that he may come across some sort of uncertainties and many a time the things will go right ?

(a) Optimistic time

(b) Pessimistic time

(c) Likely time

(d) Unlikely time

52. In which one of the following, the criticality of the item is most important than the cost factor of the item ?

(a) ABC analysis

(b) VED analysis

(c) p system

(d) q system

53. Which one of the following is the projections on a pattern that is used to make recesses in the mould to locate the core ?

(a) Sprue

(b) Core print

(c) Gate

(d) Riser

54. Which one of the following is a disadvantage of permanent mold or gravity die casting ?

(a) The surface of casting becomes hard due to chilling effect

(b) Good surface finish and surface details are obtained

(c) The process requires more labor

(d) Fast rate of production can be attained

55. In critical speed of a light shaft having a single disc without damping, the critical speed of the shaft is

(a) equal to the natural frequency of the system in longitudinal vibration

(b) equal to the natural frequency of the system in torsional vibration

(c) equal to the natural frequency of lateral vibration of the shaft

(d) no relationship to any of the natural frequency systems

56. Which one of the following is formed due to large friction and stronger adhesion between chips and tool face ?

(a) Continuous chip

(b) Discontinuous chip

(c) Continuous chip with built-up edge

(d) Discontinuous chip with built-up edge

57. Total Quality Management (TQM) and Quality assurance are the responsibility of everyone involved in designing and manufacturing of the product. Who among the following pioneers has NOT been quality control heightened ?

(a) Deming

(b) Taguchi

(c) Juran

(d) B. F. Skinner

58. Which one of the following is the angle between the planes of end flank immediately below the end cutting edge and line perpendicular to the base and right angle to the axis ?

(a) Back rake angle

(b) Side rake angle

(c) End relief angle

(d) Side relief angle

59. Consider the following statements related to stepless drive of machine tools :

1. The spindle speeds available are fixed, it is not possible to use optimum cutting speeds with any of the workpiece diameters.

2. Charging the axial distance of the discs will vary the point of contact between the belt and disc.

3. The surface finish achieved will not be uniform.

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 statements regarding machine vibration :

1. If the mechanical stresses are below the acceptable safe working stress levels of the materials involved, no direct protection methods are required.

2. If the stresses exceed the safe levels, corrective measures such as stiffening, reduction of inertia and bending moment effects, and incorporation of further support members, as well as possible uses of isolators, may be required.

3. Shock isolators differ from vibration isolators in that shock requires a stiffer spring and a higher natural frequency for the resilient element.

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

61. Consider the following statements regarding microprocessors and micro-controllers :

1. A microcontroller is a single, very large-scale integrated chip that contains programmable electronic components.
2. Address bus carries the signals relating to control actions.
3. A microcomputer consists of a central processing unit, I/O interface and a memory block.

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

62. Consider the following statements regarding microprocessor instructions :

1. Compare instruction reads the contents of a particular memory location and copied to a specific register in the processor.
2. Jumps instruction changes the sequence in which the program is being carried out.
3. Decrement instruction subtracts 1 from the contents of a specified location.

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

63. Which one of the following statements is correct regarding characteristic parameters used in transducers ?

(a) Span is the deviation of the true value from the desired value
(b) Precision is defined as the degree of exactness for which an instrument is designed or intended to perform
(c) Sensitivity is the difference in the output for a given input when the value is approached from the opposite direction
(d) Hysteresis of an instrument is defining as the ratio of the magnitude of the output signal to the magnitude of the input signal

64. Consider the following statements regarding dynamic quantities in sensors and transducers :

1. The maximum amount by which the moving parts move beyond the steady state is known as over shoot.
2. An output whose magnitude does not repeat with time is known as transient.
3. An output whose magnitude has a definite repeating time cycle is called steady state periodic.

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

65. Consider the following statements regarding encoders :

1. An encoder is a device that provides a digital output in response to a linear or angular displacement.

2. A digital optical encoder is a device that converts motion into a sequence of digital pulses.

3. An incremental encoder produces equally spaced pulses from one or more concentric tracks on the code disk.

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

66. Which one of the following statements is NOT correct regarding accelerometers ?

(a) In displacement seismic accelerometer, the displacement of seismic mass is measured by displacement transducer itself

(b) In strain gauge accelerometer, the seismic mass is placed on a cantilever beam placed inside the housing

(c) In potentiometric accelerometer, in a spring-mass-damper system, the mass is connected with the wiper arm of the potentiometer

(d) The LVDT accelerometer consist of one primary and four secondary windings which are placed on either side of a central core

67. Which one of the following valves restricts or throttles the fluid in a particular direction to influence the volumetric flow of the fluid ?

(a) Check valve

(b) Flow control valve

(c) Quick exhaust valve

(d) Sequence valve

68. Which one of the following instructions is conditional instruction which allow the user to change the order in which the processor scans the program ?

(a) Sequence instruction

(b) Communications instruction

(c) Control instruction

(d) Arithmetic instruction

69. Which one of the following signals are external commands signals provided to the controller ?

(a) Control signals

(b) Controlled signals

(c) Disturbance signals

(d) Setpoint signals

70. Which one of the following is the smallest increment of movement into which the robot can divide its work volume ?

(a) Spatial resolution of a robot

(b) Accuracy of a robot

(c) Repeatability of a robot

(d) Compliance of a robot

71. Which one of the following sensors is a special type of force sensor composed of a matrix of force-sensing elements ?

(a) Touch sensor

(b) Tactile array sensor

(c) Range sensor

(d) Proximity sensor

72. Consider the following statements regarding robot end effectors :

1. Magnetic gripper can be a very feasible means of handling ferrous materials.

2. Hooks can be used as end effectors to handle containers of parts and to load and unload parts hanging from overhead conveyors.

3. Scoops and ladles can be used to handle certain materials in liquid or powder form.

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

73. A flat plate of area $1 \cdot 5 \times 10^6$ mm^2 is pulled with a speed of 0·4 m/s relative to another plate located at a distance of 0·15 mm from it. What is the power required to maintain this speed, if the fluid separating them is having viscosity as 1 poise ?

(a) 160 W

(b) 158 W

(c) 145 W

(d) 130 W

74. A gas weighs 16 N/m^3 at 25°C and at an absolute pressure 0·25 N/mm^2. What is the gas constant approximately ? (Take acceleration due to gravity as 9·81 m/s^2)

(a) 514·68 Nmkg^{-1} K^{-1}

(b) 542·55 Nmkg^{-1} K^{-1}

(c) 562·68 Nmkg^{-1} K^{-1}

(d) 592·55 Nmkg^{-1} K^{-1}

75. A pipe contains an oil of specific gravity 0·9. A differential manometer connected at the two points A and B shows a difference in mercury level as 15 cm. What is the difference of pressure at the two points ?

(Take acceleration due to gravity as 9·81 m/s^2, specific gravity of mercury as 13·6 and density of water as 1000 kg/m^3)

(a) 18688 N/m^2

(b) 19688 N/m^2

(c) 15688 N/m^2

(d) 17866 N/m^2

76. A body of dimensions 1·5 m × 1·0 m × 2 m, weighs 1962 N in water. What is the weight of the body in air ? (Take acceleration due to gravity as 9·81 m/s^2)

(a) 31392 N

(b) 23392 N

(c) 14392 N

(d) 46392 N

77. The following cases represent the two velocity components, $v = 2y^2$; $w = 2xyz$. What is the third component of velocity such that they satisfy the continuity equation ?

(a) $-4xy - x^2y + f(y, z)$

(b) $-3xy - x^3y + f(y, z)$

(c) $-5xy - 2x^2y + f(y, z)$

(d) $-4xy - 3x^2y + f(y, z)$

78. An open circular tank of 20 cm diameter and 100 cm long contains water upto a height of 60 cm. The tank is rotated about its vertical axis at 300 rpm. What is the depth of parabola formed at the free surface of water ? (Take acceleration due to gravity as 9·81 m/s²)

(a) 50·28 cm

(b) 55·28 cm

(c) 65·36 cm

(d) 69·36 cm

79. What is the velocity of flow at radius of 0·8 m, if the water is flowing radially outward in a horizontal plane from a source at a strength of 12 m²/s ?

(a) 9·55 m/s

(b) 4·77 m/s

(c) 2·38 m/s

(d) 5·62 m/s

80. A pitot-static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6 m and static pressure head is 5 m. What is the velocity of flow assuming the coefficient of tube equal to 0·98 ? (Take acceleration due to gravity as 9·81 m/s²)

(a) 1·24 m/s

(b) 2·68 m/s

(c) 3·56 m/s

(d) 4·34 m/s

81. A fluid of viscosity 0·7 Ns/m² and specific gravity 1·3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196·2 N/m². What is the pressure gradient of the flow ?

(a) 7848 N/m² per m

(b) −7848 N/m² per m

(c) −9848 N/m² per m

(d) 9848 N/m² per m

82. An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50 mm apart. What is the rate of flow of oil between the plates if the drop of pressure in a length of 1·2 m be 0·3 N/cm² and the width of the plate is 200 mm ?

(a) 6·2 litre/s

(b) 3·2 litre/s

(c) 8·2 litre/s

(d) 5·2 litre/s

83. A shaft of diameter 0·35 m rotates at 200 rpm inside a sleeve 100 mm long. The dynamic viscosity of lubricating oil in the 2 mm gap between sleeve and shaft is 8 poises. What is the power lost in the bearing ?

   (a) 0·59 kW

   (b) 0·69 kW

   (c) 0·88 kW

   (d) 0·91 kW

84. A sphere of diameter 2 mm falls 150 mm in 20 seconds in a viscous liquid. The density of the sphere is 7500 kg/m³ and of liquid is 900 kg/m³. What is the coefficient of viscosity of the liquid ? (Take acceleration due to gravity as 9·81 m/s²)

   (a) 22·31 poise

   (b) 25·62 poise

   (c) 19·17 poise

   (d) 32·21 poise

85. The resistance wire of a 1200 W hair dryer is 80 cm long and has a diameter of 0·3 cm. What is the rate of heat generation in the wire per unit volume ?

   (a) 212 W/cm³

   (b) 312 W/cm³

   (c) 512 W/cm³

   (d) 412 W/cm³

86. A 2-kW resistance heater wire with thermal conductivity 15 W/m.°C, diameter 0·4 cm, and length 50 cm is used to boil the water by immersing it in water. Assuming the variation of the thermal conductivity of the wire with temperature to be negligible. What is the differential equation that describes the variation of the temperature in the wire during steady operation ?

   (a) $\dfrac{1}{r}\dfrac{d}{dr}\left(r\dfrac{dT}{dr}\right)+\dfrac{g}{k}=0$

   (b) $\dfrac{1}{2r}\dfrac{dT}{dr}\left(r\dfrac{dT}{dr}\right)+\dfrac{g}{k}=0$

   (c) $\dfrac{1}{r}\dfrac{d}{dr}\left(\dfrac{dT}{dr}\right)+\dfrac{g}{k}=0$

   (d) $\dfrac{1}{r}\dfrac{d}{dr}\left(r\dfrac{dT}{dr}\right)=0$

87. An electric current is passed through a wire 1 mm in diameter and 10 cm long. The wire is submerged in liquid water at atmospheric pressure and the current is increased until the water boils. For this situation, h is 5000 W/m².°C and the water temperature will be 100°C. How much electric power must be supplied to the wire to maintain the wire surface at 114°C ?

   (a) 21·99 W

   (b) 32·39 W

   (c) 42·39 W

   (d) 52·36 W

A – PKL-D-MCH

88. A 2-kW resistance heater wire whose thermal conductivity is 15 W/m.°C has a diameter of 4 mm and a length of 0·5 m, is used to boil the water. If the outer surface temperature of resistance wire is 105°C, what is the temperature at the centre of the wire ?

(a) 136°C

(b) 126°C

(c) 146°C

(d) 156°C

89. The thermal contact conductance at the interface of two 1-cm-thick aluminum plates is measured to be 11,000 W/m².°C. What is the thickness of the aluminum plate whose thermal resistance is equal to the thermal resistance of the interface between the plates ? (Take the thermal conductivity of aluminum at room temperature as 237 W/m.°C)

(a) 3·15 cm

(b) 5·13 cm

(c) 1·28 cm

(d) 2·15 cm

90. In the design of a fin, the error involved in one dimensional fin analysis is negligible (less than about 1%) when

(a) $\dfrac{h\delta}{k} < 0.2$

(b) $\dfrac{hk}{\delta} < 0.2$

(c) $\dfrac{h\delta}{k} < 2$

(d) $\dfrac{hk}{\delta} < 2$

91. Lumped system analysis assumes a uniform temperature distribution throughout the body, which will be the case only when the thermal resistance of the body to heat conduction is

(a) 3

(b) 2

(c) 1

(d) 0

92. Which one of the following is NOT a fluid property for convection heat transfer coefficient ?

(a) Dynamic viscosity

(b) Thermal conductivity

(c) Density

(d) Rate of convection

93. In friction coefficient, the boundary layer thickness (δ), the local friction coefficient (C_f) at location x and Reynolds number (R_e) at location x for turbulent flow over a flat plate are

(a) $\delta = \dfrac{5x}{Re_x^{0.5}}; \; C_f = \dfrac{0.664}{Re_x^{0.5}}$

(b) $\delta = \dfrac{0.382x}{Re_x^{0.5}}; \; C_f = \dfrac{0.0592}{Re_x^{0.5}}$

(c) $\delta = \dfrac{0.382x}{Re_x^{1/5}}; \; C_f = \dfrac{0.0592}{Re_x^{1/5}}$

(d) $\delta = \dfrac{5x}{Re_x^{1/5}}; \; C_f = \dfrac{0.664}{Re_x^{1/5}}$

94. The region from the tube inlet to the point at which the boundary layer merges at the centreline, is called

(a) Hydrodynamic entry length

(b) Thermal entrance region

(c) Hydrodynamic entrance region

(d) Thermal entry length

95. What is the traditional expression for calculation of heat transfer in fully developed turbulent flow in smooth tubes that recommended by Dittus Boelter ?

(a) $Nu_d = 0.023 \left(Re_d^{0.8}\right)(Pr)^n$

(b) $Nu_d = 0.023 \left(Re_d^{0.4}\right)(Pr)^{2n}$

(c) $Nu_d = 0.023 \left(Re_d^{0.8}\right)(Pr)^{2n}$

(d) $Nu_d = 0.023 \left(Re_d^{0.4}\right)(Pr)^n$

96. Which one of the following is having the highest value of fouling factor ?

(a) Sea water

(b) Refrigerating liquid

(c) Fuel oil

(d) Industrial air

97. The performance test of an air conditioning unit rated as 140·7 kW (40 TR) seems to be indicating poor cooling. The test on heat rejection to atmosphere in its condenser shows the following :

cooling water flow rate   – 4 L/s;

water temperature   – inlet 30°C and outlet 40°C;

power input to motor   – 48 kW (95% efficiency);

What is the actual refrigerating capacity of the unit ? (Take $C_w = 4.1868$)

(a) 34·7 TR

(b) 45·6 TR

(c) 52·6 TR

(d) 48·6 TR

98. Which one of the following is the intensive property in thermodynamic system ?

(a) Pressure

(b) Enthalpy

(c) Internal energy

(d) Entropy

99. 100 kg of ice at –5°C is placed in a bunker to cool some vegetables. 24 hours later, the ice has melted into water at 10°C. What is the average rate of cooling in kJ/h provided by the ice ? (Take specific heat of ice is 1·94 kJ/kg.K; Specific heat of water is 4·1868 kJ/kg.K; latent heat of fusion of ice at 0°C is 335 kJ/kg)

(a) 1611 kJ/h

(b) 1811 kJ/h

(c) 1711 kJ/h

(d) 1911 kJ/h

100. Which of the following principles and processes involved in the production of low temperatures are correct ?

    1. Adiabatic demagnetization

    2. Thermoelectric cooling

    3. Reversible adiabatic expansion of a gas

    4. Irreversible adiabatic expansion of a real gas

Select the correct answer using the code given below :

(a) 1 and 3 only

(b) 1, 3 and 4 only

(c) 1, 2 and 3 only

(d) 1, 2, 3 and 4

101. Which one of the following is used in aircraft refrigeration ?

(a) Vapor compression cycle refrigeration

(b) Gas cycle refrigeration

(c) Vapor absorption cycle refrigeration

(d) Steam ejector cycle refrigeration

102. An ammonia ice plant operates between a condenser temperature of 35°C and an evaporator temperature of −15°C. It produces 10 tons of ice per day from water at 30°C to ice at −5°C. Assume simple saturation cycle, what is the capacity of the refrigeration plant ? (Take Specific heat of ice is 1·94 kJ/kg.K; Specific heat of water is 4·1868 kJ/kg.K; latent heat of fusion of ice at 0°C is 335 kJ/kg)

(a) 54·43 kW

(b) 64·32 kW

(c) 74·52 kW

(d) 84·23 kW

103. Consider the following statements in a vapor compression refrigeration system :

It is observed that an increase in condenser pressure, similarly results in

    1. a decrease in the refrigerating capacity

    2. an increase in power consumption

    3. an increase in volumetric efficiency

Which of the above statements are correct ?

(a) 1 and 3 only

(b) 2 and 3 only

(c) 1 and 2 only

(d) 1, 2 and 3

104. Which one of the following is the designation for dichloro-tetrafluoro-ethane refrigerant used in refrigeration system ?

(a) R114

(b) R116

(c) R113

(d) R118

105. Which of the following are highly explosive and flammable in a refrigeration system ?

1. Methane

2. Butane

3. R134a

Select the correct answer using the code given below :

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

106. A hydrocarbon refrigerator operating on equal proportions of propane and isobutane by mass works on simple saturation cycle. The condenser and evaporator pressure are 14 bar and 1·4 bar. What is the approximate theoretical COP of the system ? (Take properties : $h_1 = 545$ kJ/kg; $h_3 = 341·15$ kJ/kg $= h_4$; $S_1 = 2·47$ kJ/kgK $= S_2$; $h_2 = 661$ kJ/kg and $T_2 = 63°C$)

(a) 1·8

(b) 5·4

(c) 3·6

(d) 2·7

107. The use of a single refrigerant in a simple vapor compression cycle for the production of low temperatures is limited by which of the following reasons ?

1. Solidification temperature of the refrigerant

2. Extremely low pressures in the evaporator and large suction volumes if a high-boiling refrigerant is selected

3. Very high-pressure ratio, therefore a low coefficient of performance

Select the correct answer using the code given below :

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

108. A capillary tube in a one-ton R22 air conditioner has a bore of 2·3 mm. Saturated liquid from the condenser enters at a temperature of 48°C and flows adiabatically through the tube until its temperature is 5°C. The friction factor is given as $f = 0·32/Re^{0·25}$. What is the length of the capillary tube ? (Take intermediate sections at 40°C, 30°C, 20°C and 10°C and the mass flow rate of the refrigerant as 0·02417 kg/s)

(a) 13·41 kg.s^{-1}.m^{-1}

(b) 16·42 kg.s^{-1}.m^{-1}

(c) 19·42 kg.s^{-1}.m^{-1}

(d) 22·46 kg.s^{-1}.m^{-1}

109. The work required for compressing one kg of air is minimum if the compression is carried out

(a) adiabatically

(b) isothermally

(c) isentropically

(d) isochorically

110. Consider the following statements regarding torque converter :

1. A torque converter is a modified form of fluid coupling.

2. A reciprocating pump is used in a torque converter.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

111. A one fourth scale model of a pump was tested in a laboratory at 1000 rpm. The head developed and power input at the best efficiency point were found to be 7 m and 25 kW respectively. What is the speed of the prototype if the prototype pump has to operate against a head of 36 m ?

(a) 467 rpm

(b) 567 rpm

(c) 667 rpm

(d) 767 rpm

112. Consider the following statements regarding Euler turbine equation :

1. The axial component produces a bending of the shaft which is taken by the journal bearings.

2. The axial force only can cause the rotation of the runner and produce work.

3. The tangential force only can cause the rotation of the runner and produce work.

4. The radial component produces a bending of the shaft which is taken by the journal bearings.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 3 and 4 only

(d) 2 and 4 only

113. Which one of the following turbines is the most popularly used one in the medium head range of 60 m – 300 m ?

(a) Kaplan turbine

(b) Francis turbine

(c) Pelton turbine

(d) Deriaz turbine

114. Match the following :

	List I (Turbine types)		List II (Flow directions)
A.	Deriaz turbine	1.	Mixed flow
B.	Propeller turbine	2.	Tangential flow
C.	Francis turbine	3.	Axial flow
D.	Pelton turbine	4.	Diagonal flow

Select the correct matching using the code given below :

	A	B	C	D
(a)	4	3	1	2
(b)	3	4	2	1
(c)	2	1	4	3
(d)	1	2	3	4

115. A Kaplan turbine plant develops 2000 kW under a head of 8 m while running at 100 rpm. The discharge is 250 m^3/s. The tip diameter of the runner is 6·5 m and the hub to tip ratio is 0·43. What is the flow ratio based on tip speed ? (Take acceleration due to gravity as 9·81 m/s^2)

(a) 0·43

(b) 0·58

(c) 0·62

(d) 0·73

116. The water in a jet-propelled boat is drawn amid-ship and discharged at the back with an absolute velocity of 15 m/s. The boat speed is 30 km/hr. The cross-sectional area of the jet at the back is 0·03 m^2. What is the efficiency of the jet propulsion ?

(a) 68·5%

(b) 51·3%

(c) 45·9%

(d) 39·4%

117. Surge is a condition which occurs

(a) in forward movement of aircraft

(b) beyond the stable limit of operation

(c) in forward motion of aircraft with speed above sonic velocity

(d) due to the blast of air produced in a compressor

118. Consider the following statements regarding stalling in axial compressor :

1. The flow separation occurring on the suction side of the blade is called negative stalling.

2. The flow separation occurring on the pressure side of the blade is called positive stalling.

3. The rotating stall decreases the effectiveness of the compressor.

4. The delivery pressure significantly drops with large stalling leading to flow reversal.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 3 and 4 only

(d) 1 and 4 only

A – PKL-D-MCH

119. In a double acting pump, the work saved by fitting air vessels is about

(a) 19·2%

(b) 29·2%

(c) 39·2%

(d) 50·2%

120. A single acting reciprocating pump has a bore of 200 mm and a stroke of 350 mm and runs at 45 rpm. The suction head is 8 m and the delivery head is 20 m. What is the theoretical discharge of water if slip is 12%? (Take acceleration due to gravity as 9·81 m/s^2)

(a) 7·260 l/s

(b) 6·956 l/s

(c) 3·456 l/s

(d) 4·586 l/s

121. Which one of the following statements is NOT correct regarding Rankine cycle?

(a) For the steam boiler, the ideal process would be a reversible constant pressure heating process of water to form steam

(b) For the turbine, the ideal process would be a reversible adiabatic expansion of steam

(c) For the condenser, it would be a reversible constant pressure heat rejection as the steam condenses till it becomes saturated liquid

(d) For the pump, the ideal process would be the reversible adiabatic expansion of the liquid ending at the final pressure

122. Which one of the following statements is NOT correct?

(a) In surface condensers, the cooling water and exhaust steam do not come in direct contact with each other

(b) The vacuum efficiency is the ratio of ideal vacuum to actual vacuum

(c) The Hot well is a sump between the condenser and the boiler where the condensate coming from the condenser is collected

(d) Condenser is a closed vessel heat exchanger in which the steam coming from turbine is condensed using a supply of cooling water at atmospheric temperature

123. Which one of the following statements is correct?

(a) Ultimate analysis is the determination of the percentages of fixed carbon, volatile matter, moisture and ash in fuel

(b) The percentage of each constituent element in the fuel such as carbon, hydrogen, sulphur, oxygen, nitrogen, and ash, is determined by proximate analysis

(c) Calorific value of solid or liquid fuel is defined as the heat evolved by the complete combustion of unit mass of fuel

(d) Proximate analysis value of gaseous fuel is expressed as heat developed by the complete combustion of one cubic metre of gas at standard temperature and pressure

124. Which one of the following statements is NOT correct ?

(a) A simple and convenient apparatus used for the volumetric analysis of dry flue gases is known as orsat apparatus

(b) The calorific values of liquid fuels are generally determined by using an orsat apparatus

(c) The calorific values of solid and liquid fuels are generally determined by using a bomb calorimeter

(d) In orsat apparatus, potassium hydroxide used as absorbent to absorb carbon dioxide

125. Which one of the following statements is NOT correct ?

(a) Grate is the platform in the furnace of boiler upon which fuel is burnt and it is made of cast iron bars

(b) The removal of the mud and other impurities of water from the lowest part of the boiler is termed as blowing off

(c) Cochran boiler is one of the best types of vertical multi-tubular boiler.

(d) Babcock and Wilcox boiler is a fire tube boiler

126. Which one of the following statements is correct ?

(a) In water tube boiler, water surrounds the tubes and hot gases are inside the tubes

(b) The boilers which produce steam at pressures of 10 bar and below are called high pressure boiler

(c) Lancashire boilers are externally fired boiler

(d) Stirling boilers are externally fired boiler

127. In a power plant, the efficiencies of the electric generator, turbine (mechanical), boiler, cycle and overall plant are 0.97, 0.95, 0.92, 0.42 and 0.33 respectively. What percentage of the total electricity generated is consumed in running the auxiliaries ?

(a) 9·29%

(b) 8·50%

(c) 7·32%

(d) 6·76%

128. An ideal cycle is impracticable because

(a) there is an ideal fluid available which is considered as working fluid

(b) it is not possible to transfer heat of expanding steam to the fluid in the turbine itself

(c) it is always possible to transfer heat of expanding steam to the fluid in the turbine itself

(d) there is no possibility of excessive humidity in low pressure stages of the turbine

129. Match the following :

	List I (Boiler Type)	List II (Pressure (kg/cm^2))
A.	La Mont Boiler	1. 84
B.	Loeffler Boiler	2. 170
C.	Benson Boiler	3. 135
D.	Velox Boiler	4. 230

Select the correct matching using the code given below :

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	4	3
(c)	2	3	4	1
(d)	3	2	1	4

130. What is the amount of air required to burn one kg of fuel and product of combustion for a fuel the percentage composition of which is given as $C = 70\%$, $H_2 = 30\%$?

(a) 16·54 Kg

(b) 17·54 Kg

(c) 18·54 Kg

(d) 19·54 Kg

131. Which one of the following statements is correct ?

(a) The Rankine cycle efficiency can be improved by increasing the average temperature at which heat is rejected

(b) The Rankine cycle efficiency can be improved by decreasing/ reducing the temperature at which heat is rejected

(c) If the steam is superheated before allowing it to expand the Rankine cycle efficiency may be decreased

(d) The thermal efficiency of the Rankine cycle can be amply improved by increasing the condenser pressure

132. Match the following :

	List I		List II
A.	Boiler to Turbine process	1.	Reversible adiabatic expansion in the turbine
B.	Turbine to Condenser process	2.	Constant pressure transfer of heat in the condenser
C.	Condenser to Pump process	3.	Reversible adiabatic pumping process in the feed pump
D.	Pump to Boiler process	4.	Constant pressure transfer of heat in the boiler

Select the correct matching using the code given below :

	A	B	C	D
(a)	3	4	1	2
(b)	4	3	2	1
(c)	2	1	4	3
(d)	1	2	3	4

133. Which one of the following fuel cells has lowest operating temperature ?

   (a) PEMFC

   (b) MCFC

   (c) PAFC

   (d) SOFC

134. Adjusting the nacelle about the vertical axis to bring the rotor facing wind is known as

   (a) Pitch control

   (b) Hub control

   (c) Rotor control

   (d) Yaw control

135. In a distributed collector solar thermal electric power plant, the heat collected in collectors is used to dissociate ammonia into nitrogen and hydrogen at approximately

   (a) 300 atm pressure

   (b) 150 atm pressure

   (c) 100 atm pressure

   (d) 40 atm pressure

136. Solar thermal water pumps work on

   (a) Rankine cycle

   (b) Otto cycle

   (c) Carnot cycle

   (d) Diesel cycle

137. The concentration ratio of as high a value as 3000 can be obtained by

   (a) modified flat plate collector

   (b) compound parabolic concentrator

   (c) cylindrical parabolic concentrator

   (d) central tower receiver

138. The angle between the sun's ray and its projection on a horizontal surface is known as

   (a) Inclination angle

   (b) Zenith angle

   (c) Solar azimuth angle

   (d) Hour angle

139. The total solar radiation received at any point on the earth's surface is the sum of the direct and diffuse radiation and is referred as

   (a) Total diffuse radiation

   (b) Insolation

   (c) Total radiation

   (d) Total specular radiation

140. The rate at which solar energy arrives at the top of the atmosphere is called

    (a) Total energy

    (b) Radiation

    (c) Solar constant

    (d) Radiation constant

141. Consider the following statements regarding solar ponds :

    1. It is possible to produce electricity from a solar pond by using a special 'High temperature' heat engine coupled to an electric generator.

    2. In a large solar pond, the thermal capacitance and resistance can be made large enough to retain the heat in the bottom layer from summer to winter and the pond can therefore be used for heating buildings in the winter.

    3. A solar pond is an ingenious collector, which uses water as its top cover.

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

142. Which one of the following is a vertical axis wind mill ?

    (a) Darrieus type wind mill

    (b) Propellor type wind mill

    (c) Sail type wind mill

    (d) Multi blade type wind mill

143. Consider the following statements regarding solar radiation measurement :

    1. Pyranometer collimates the radiation to determine the beam intensity as a function of incident angle.

    2. Pyranometer measures the total hemi-spherical solar radiation.

    3. Pyrheliometer collimates the radiation to determine the beam intensity as a function of incident angle.

Which of the above statements is/are correct ?

    (a) 1 only

    (b) 2 and 3 only

    (c) 1 and 2 only

    (d) 3 only

144. Which one of the following materials is used for heat collection element in parabolic trough plants of solar central receiver system ?

    (a) Copper

    (b) Mild steel

    (c) Stainless steel

    (d) Aluminum

Directions :

Each of the next **Six (06)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. You are to 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

145. Statement (I) : Centre of pressure is calculated by using the "Principle of Moments".

Statement(II) : The moment of the resultant force about an axis is equal to the sum of moments of the components about the same axis.

146. Statement (I) : Heat and work are boundary phenomenon and recognized only when they cross the boundary of a system.

Statement(II) : Heat and work depend on the path followed by the system during a process.

147. Statement (I) : The vapour absorption system uses heat energy to change the condition of the refrigerant from the evaporator.

Statement(II) : The load variations do not affect the performance of a Vapour absorption system.

148. Statement (I) : For moderate speed, the force of friction remains nearly constant and decrease slightly with increase of speed.

Statement(II) : Friction is dependent on extent of area but independent on normal reaction.

149. Statement (I) : The percent elongation is assumed to be based on a gage length of 2·00 in unless some other gage length is specifically indicated.

Statement(II) : Theoretically, a material is considered ductile if its percent elongation is greater than 5% (lower values indicate brittleness).

150. Statement (I) : Mechanization means something is done or operated by machinery as well as by hand.

Statement(II) : Mechanization of the manufacturing means milestone oriented trend towards minimizing the human efforts to the extent of its possibility, by adopting mechanical and electrical means or methods for automating the different manufacturing processes.

Examination:	ESE (P) - 2022								
Series: **A**		Subject	MECHANICAL ENGINEERING						
Max. marks	300	No. of Items dropped:	NIL						
Items to be taken for scoring:	150								

1	A	16	B	31	A	46	B	61	C	76	A	91	D	106	A	121	D	136	A
2	C	17	A	32	D	47	B	62	B	77	A	92	D	107	D	122	B	137	D
3	A	18	D	33	B	48	D	63	B	78	A	93	C	108	A	123	C	138	A
4	D	19	D	34	D	49	C	64	D	79	C	94	C	109	B	124	B	139	B
5	D	20	A	35	D	50	D	65	D	80	D	95	A	110	A	125	D	140	C
6	B	21	C	36	C	51	C	66	D	81	B	96	C	111	B	126	D	141	B
7	C	22	C	37	A	52	B	67	B	82	D	97	A	112	C	127	C	142	A
8	A	23	B	38	B	53	B	68	C	83	A	98	A	113	B	128	B	143	B
9	A	24	C	39	A	54	A	69	D	84	C	99	A	114	A	129	C	144	C
10	D	25	A	40	A	55	C	70	A	85	A	100	D	115	D	130	C	145	A
11	D	26	D	41	D	56	C	71	B	86	A	101	B	116	C	131	B	146	A
12	A	27	A	42	D	57	D	72	D	87	A	102	A	117	B	132	D	147	B
13	B	28	B	43	D	58	C	73	A	88	B	103	C	118	C	133	A	148	C
14	C	29	A	44	A	59	D	74	A	89	D	104	A	119	C	134	D	149	B
15	D	30	D	45	C	60	D	75	A	90	A	105	B	120	A	135	A	150	D