# IMU CET – 2020
## PG – MTech - Marine Engineering

1. What is the meaning of turn down ratio with reference to marine boilers ?
   (a) How soon one can shut down the boiler
   (b) Control of mass flow of the steam
   (c) The maximum to minimum fuel flow through burner
   (d) The air setting at which flame is put off

2. A multistaged compressor with intercooling can be ideally modeled as ?
   (a) Polytropic compression
   (b) Isentropic compression
   (c) Isothermal compression
   (d) Isenthalpic compression

3. Which of the following expression gives the specific work input to a screw compressor compressing air (gas) between two states 1 and 2. 'P' is pressure and 'v' is specific volume ?
   (a) $\int_1^2 P\,dv$
   (b) $\int_1^2 v\,dP$
   (c) $C_P \int_1^2 dT$
   (d) $C_v \int_1^2 dT$

4. Which of the following is an angular motion of the ship
   (a) Roll
   (b) Surge
   (c) Heave
   (d) Sway

5. Which of the following options is not a usual shipboard design constraint
   (a) Space availability
   (b) Weight
   (c) Ship motions
   (d) None of the above

6. Marine Engineering discipline is principally not responsible for design for which of the following option ?
   (a) Marine propulsion plant
   (b) The powering and mechanical aspects of ship's anchoring, cargo handling, heating ventilation and air conditioning (HVAC)
   (c) Hydrodynamic and hull form characteristics
   (d) Electrical power generation and distribution.

7. Which of the following is not classified as auxiliary ship system ?
   (a) Steering gear
   (b) Electric plant
   (c) Pollution control equipment
   (d) Heating, ventilation and air conditioning

8. The most common prime mover for merchant ships' propulsion is
   (a) Slow speed two stroke diesel engine
   (b) Gas turbine
   (c) Steam turbine
   (d) High speed four stroke diesel engine

9. Considering a well designed system, which of the following option is the most energy efficient power transmission ?
   (a) Mechanical shaft direct drive
   (b) Electrical transmission
   (c) Hydraulic transmission
   (d) Reduction gearing – planetary gear arrangement

10. Considering equivalent deadweight, large ocean going merchant ships, which of the following types of ship is usually fitted with the heaviest crane ?
   (a) Gas tanker ships
   (b) General cargo vessels
   (c) Reefer ships
   (d) Chemical tanker ships

11. Which of the following ship types are fitted with roll on / roll off arrangement ?
   (a) LPG carrier
   (b) Crude oil tanker ship
   (c) Car carrier ship
   (d) Container ship

12. How is shipboard noise usually categorized as ?
   (a) On the basis of excitation
   (b) By the way it is transmitted from a source to a receiver
   (c) On the basis of damping employed
   (d) None of the above

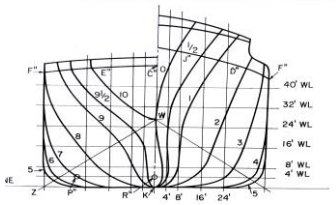
13. With regard to reliability and maintainability, MTBF is mean time between failures, MTTR is mean time to repair, availability is defined as probability in random time, that a system or equipment will be in operating condition. Then, long term availability is defined as -
   (a) Availability = MTBF / (MTBF + MTTR)
   (b) Availability = (MTBF + MTTR) / MTBF
   (c) Availability = MTBF / (MTBF – MTTR)
   (d) Availability = MTTR / (MTBF – MTTR)

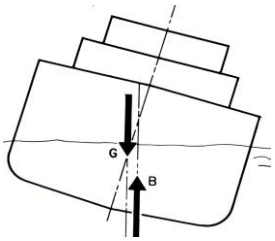
14. With reference to propulsion power profile and optimization which of the following statement is false ?
   (a) Most merchant ships operate at a high percentage of rated power.
   (b) Operation periods may include periods of operation at reduced speed.
   (c) Merchant ships economical operation corresponds to trade route
   (d) Ships propulsion plant is most economical at speeds below half of maximum power.

15. Which of the following is not a basic operating requirement from a ships main propulsion system ?
   (a) Electrical power generation.
   (b) Propel the ship at the required sea speed for the endurance

(c) Stopping in the ship
(d) Backing the ship

16. Which of the following is not a longitudinal strength member of the ship ?
(a) Keel
(b) Stringer
(c) Deck girder
(d) Floor

17. The Fig. shows drawing of a ship. It is known as

(a) Half-breadth plan
(b) Body plan
(c) Sheer plan
(d) Profile

18. The Fig. shows effect of height of centre of gravity on ships' stability. Force G is equal to B. Choose correct alternative to describe the fig.


(a) Neutral stability
(b) Negative stability
(c) Positive stability
(d) Longitudinal stability

19. With reference to strength of ship structure, choose the wrong alternative.
(a) The strength of a structure concerns its ability to withstand the loads imposed on it.
(b) The stiffness of a structure is its resistance to deflection under load within the elastic limit of the material.
(c) Stiffness is directly proportional to the modulus of elasticity of the material
(d) In general ship structure is designed to provide adequate strength without reaching ultimate tensile strength of the material.

20. Choose the incorrect alternative with regard to shear and bending moment curves as applied to ships.
(a) The area under the buoyancy curve equals the area under the weight curve
(b) The net area of the load curve is always a positive value
(c) Points of contraflexion on the bending moment curve occur at the ordinates of peak shear values.
(d) The centroids of the areas under the weight and buoyancy curves are vertically in line.

21. Pick the wrong alternative among the following statements related to hydrostatic lift
(a) A body completely immersed in a liquid will be in stable equilibrium if its center of gravity is perpendicularly below that of the displaced fluid.
(b) A body completely immersed in a liquid will be in unstable equilibrium if its center of gravity is above that of the fluid.
(c) A body completely immersed in a liquid is at neutral equilibrium if the two centers of gravity, of the body and displaced liquid, coincide.
(d) The pressure is constant in any surface coincident to the field of force.

22. Identify the wrong alternative with reference to boiler fuel combustion.
(a) Combustion of the fuel oil is instantaneous releasing large amount of heat especially when residual fuel oils are used.
(b) The oil droplets first ignites and then burns and breaks down into constituents

(c) The carbon in fuel oil appears as minute flecks and make up most of the radiation.
(d) The carbon particles concentration is a function of time and rate of flow of gases through the furnace.

23. In the context of marine heat recovery steam plant, components or equipment, identify the wrong alternative.
(a) The feed water invariably flows inside the tubes.
(b) The portion of the heat transfer equipment that absorbs heat at temperature above the saturation temperature of the generated steam is considered to be heat recovery equipment.
(c) The heat recovery equipment absorbs the heat into the combustion air, into the incoming feed water.
(d) Extended surface economizers are employed to the exclusion of bare tube units.

24. Identify the incorrect statement regarding marine propulsion diesel engine ratings
(a) The rating stated for an engine by its manufacturer and approved by the regulatory bodies reflect their confidence that the engine will perform reliably at that level under specified conditions.
(b) An engine may be given different ratings for different applications.
(c) The continuous service rating (CSR) of an engine is same as its Maximum continuous service rating.
(d) When an engine is run at rated speed at rated mean effective pressure (MEP), 100% brake power equal to maximum continuous rating (MCR) is developed.

25. Identify the true statement with reference to a marine turbocharger
(a) Engine and turbocharger are independent machines and there exists no dependency on each other.
(b) Turbocharger RPM is proportional to the engine RPM.
(c) Supercharging and Turbocharging a diesel engine are same. We can use them interchangeably.
(d) A reverse flow of air can occur if the compressor discharge pressure falls below the pressure in the charge air manifold.

26. Which of the following is not a function of the fuel injection equipment for a marine diesel engine ?
(a) At the end of the injection period, the injection must terminate gradually to avoid failure of the system.
(b) The injection must commence at precisely the correct moment during the compression stroke.
(c) The droplets must penetrate far enough into the combustion space to ensure that they are evenly distributed without penetrating so far that they come in contact with the liner.
(d) The fuel must be accurately metered in response to the engine output required.

27. With reference to propulsion engine shaft alignment choose the incorrect option.
(a) The objective in an engine alignment procedure is to ensure that when the engine is in service and under load, its crankshaft axis is straight.
(b) The objective in an engine alignment procedure is to ensure that when the engine is in stopped condition, its crankshaft axis is straight as this state is taken as reference.
(c) The final alignment of the shafting of an engine should be made after its connected load has been aligned and secured with the ship afloat in its normal load condition.
(d) For direct coupled engines with short rigid shaft lines, the engine alignment is based on a straight line, tangent to the forward end of the faired shaft-alignment curve.

28. The kind of valve shown in the Figure 28 is a
    (a) Gate valve
    (b) Butterfly valve
    (c) Check valve
    (d) Storm valve

Figure 28

29. Identify the component in the Figure 29
    (a) Pneumatic motor assembly
    (b) Hydraulic filter assembly
    (c) Pneumatic Filter regulator lubricator assembly
    (d) Safety relief valve assembly pilot actuated

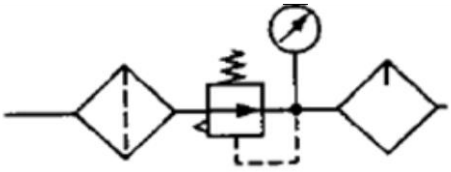


Figure 29

30. Figure 30 illustrates ?
    (a) Partial delivery of fuel position
    (b) Full delivery of fuel position
    (c) End of fuel injection
    (d) Zero fuel delivery

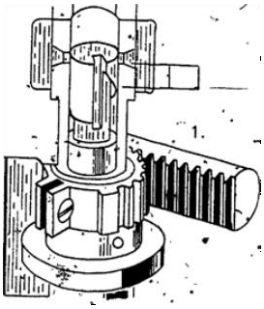



Figure 30

31. Figure 31 illustrates ?
    (a) End of fuel injection
    (b) Zero fuel delivery
    (c) Partial delivery of fuel position
    (d) Full delivery of fuel position

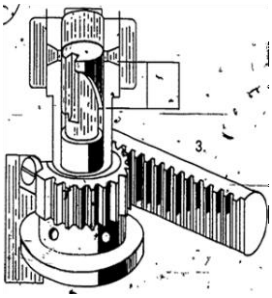



Figure 31

32. Figure 32 illustrates ?
    (a) Partial delivery of fuel position
    (b) Zero fuel delivery
    (c) Full delivery of fuel position
    (d) End of fuel injection

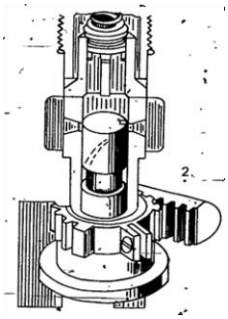



Figure 32

33. Vacuum in the parlance of pressure means
    (a) Pressure measured below absolute zero pressure.
    (b) Pressure measured below atmospheric pressure
    (c) Pressure measured by above atmospheric pressure
    (d) Pressure measured above absolute zero pressure.

34. Which of the following option regarding pumps is not correct ?
    (a) The net torque applied by the centrifugal pump impeller to the liquid passing through it is equal to the time rate of change in the liquid's angular momentum with respect to the axis of rotation.
    (b) The angular momentum of liquid at any radius in the impeller of a centrifugal pump is equal to the radius multiplied by the product of the liquid's mass times its peripheral velocity about the shaft axis
    (c) As the impeller of a centrifugal pump rotates the liquid along the front faces of its vanes is at a lesser pressure than the liquid adjacent to the back of each vane.
    (d) The theoretical rate of energy transfer to the fluid being pumped is equal to the product of the net change in torque multiplied by the impeller's angular velocity.

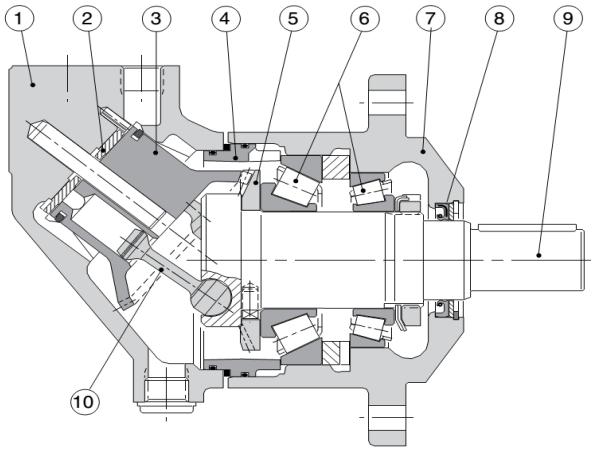


FIGURE FOR QUESTIONS 35 ~ 37

35. The equipment shown is for application in
    (a) Fuel oil pumping
    (b) Bilge water transfer
    (c) Hydraulic system
    (d) Air compression

36. The type of sealing on the shaft is
    (a) O ring
    (b) Gland packing
    (c) lip seal
    (d) Mechanical seal

37. The valve plate can be identified by
    (a) 2
    (b) 5
    (c) 8
    (d) 4

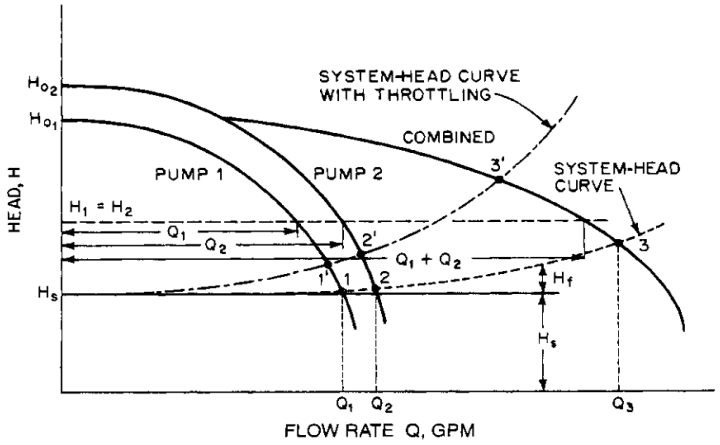



FIGURE Q 38 ~ 40

38. Which of the following statements is correct regarding the Figure Q38 ~ 40
    (a) The figure shows the actual pump performance in a series operation
    (b) The operating point of the pumps is no.3
    (c) The figure shows the analysis of the operating point of the pumps in parallel operation
    (d) The figure shows the analysis of the positive displacement pumps in the pipeline

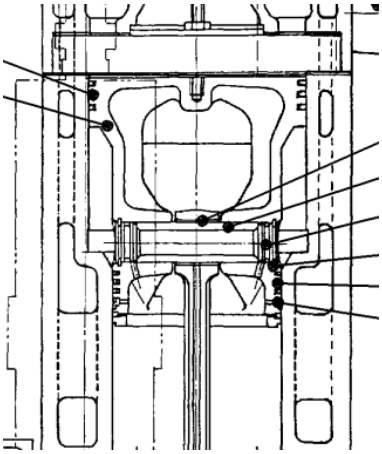
39. Identify the correct statement regarding the system head curve shown -
    (a) The pipeline
    (b) The pumps
    (c) system head is dependent on the NPSH (Net Positive Suction Head)
    (d) The system curve is a factious parameter and its use helps to understand pump operation.

40. Which of the following statement is true regarding the pumping analysis ?
    (a) The curves are independent of the fluid in use.
    (b) The intersection of any combined H-Q curve with the system-head curve is an operating point
    (c) The individual pump curves can be algebraically added to find operating point for series operation.
    (d) The individual pump curves can be algebraically added to find the operating point for parallel irrespective of the system curve.

41. Choose the correct statement from the alternatives regarding air compressors
    (a) All dynamic compressors are essentially centrifugal compressors
    (b) Screw compressors are usually more efficient than reciprocating units of similar capacity.
    (c) Single acting compressors are same as the single stage compressors.
    (d) Dynamic compressors are usually chosen for low pressure and large air flow requirements.

42. The volumetric flow rate for a compressor is either specified as normal liters per second or the free air delivery liters per second. The difference between the two is due to:
    (a) Thermodynamic states of reference
    (b) Normal and angular flow of air in the piping
    (c) Pulsating flow
    (d) Air flow without any pipe components assuming the pipe line is free .

43. The figure shows cross section through a compressor onboard a ship. Which type of compressor is this ?
    (a) Dynamic compressor
    (b) Single acting compressor
    (c) Double acting compressor
    (d) Low pressure, high capacity compressor



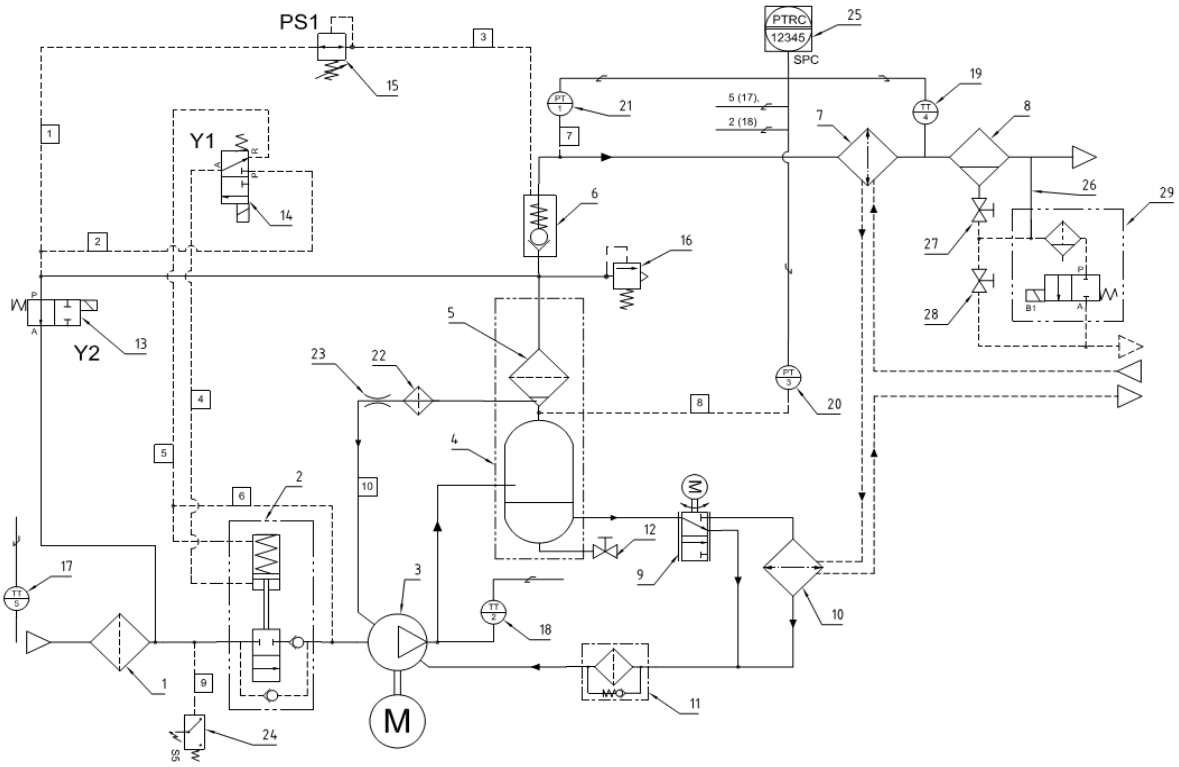



Figure for Questions 44 - 48

44. The Figure for Questions 44 – 48 shows the P&ID drawing of a compressor automation circuit. Identify the compressor by its reference number.
    (a) 9
    (b) 3
    (c) 2
    (d) 4

45. The Figure for Questions 44 – 48 shows the P&ID drawing of a compressor automation circuit. Identify a 3 port two position pneumatic spool valve.
    (a) 24
    (b) 13
    (c) 11
    (d) 9

46. The Figure for Questions 44 – 48 shows the P&ID drawing of a compressor automation circuit. What is the purpose of the component identified by No.24
    (a) Push button switch for compressor start / stop
    (b) Indicates filter clogging
    (c) It is the compressor unloader device
    (d) It is an emergency stop switch for the compressor

47. The Figure for Questions 44 – 48 shows the P&ID drawing of a compressor automation circuit. In reference to the figure and the lubricating oil for the compressor, which of the following statement is true ?
    (a) Lubricating oil is rejecting part of the heat of compression.
    (b) Lubricating oil is actuating the component no.16.
    (c) Lubricating oil should not be allowed into the compressed air
    (d) Lubricating oil is used to clean the air.

48. The Figure for Questions 44 – 48 shows the P&ID drawing of a compressor automation circuit. Compressed air after compressor are fitted with water drainage device. Identify the auto-drain mechanism in the figure by its reference number.
    (a) 11
    (b) Y1
    (c) 29
    (d) 7

49. The picture shown towards right is a component used in process automation on ships and industries. The component is :
    (a) Temperature transmitter
    (b) PI Converter
    (c) Flow meter
    (d) Level switch

50. The picture shown towards right is a component used in process automation on ships and industries. From the following options identify a component that is not shown or evident in the picture.
    (a) Differential transmitter
    (b) Banjo couplings
    (c) Orifice
    (d) RTD Type Temperature Sensor

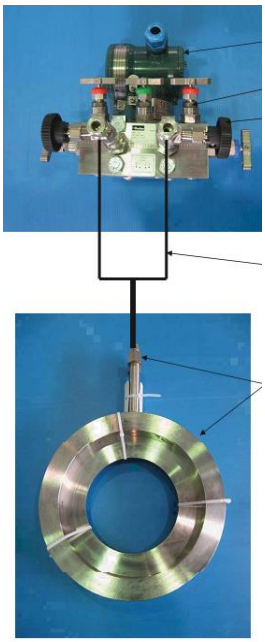


Figure for Question 49 and 50

51. Regarding heat transfer subject, which of the following number will represent natural convection effects ?
    (a) Biot Number
    (b) Prandtl Number
    (c) Grashof Number
    (d) Peclet Number

52. With reference to heat exchanger calculations choose the correct alternative from the options. When surface area for heat transfer is specified along with the inlet temperatures of the cold and hot fluids and it required to estimate outlet temperatures of the hot and cold fluids, the method that is adopted is known as
    (a) LMTD Method

(b) Performance NTU Method
(c) Pinch point analysis
(d) Nomograms.

53. With regard to insulation provided on piping, choosing the wrong statement:
(a) Diamond is among the poorest insulating materials.
(b) Perlite powder is a very good insulator
(c) More the insulation material is wrapped on exposed deck piping, the better is the resistance to heat transfer across the pipe wall.
(d) Polyurethane is a very good insulation that is commonly used on refrigerant piping.

54. Which of the following statements regarding corrosion is not true ?
(a) Hydrogen can enter into structural steels by chemical interaction and can cause cracking of the material.
(b) Crack development under the simultaneous action of corrosion and fluctuating, or cyclic, stress is referred to as stress induced corrosion.
(c) As a result of galvanic corrosion of the anodic metal, the corrosion of the cathodic, coupled metal or alloy is generally reduced. This effect has been well utilized in the application of sacrificial anodes.
(d) The choice of proper design configurations and principles to permit the material to perform in the desired manner greatly minimizes corrosion.

55. Which of the following physics concepts regarding mass and inertia is stated wrongly ?
(a) The ratio of magnitude of the accelerations acquired by two bodies during their interaction depends on the nature of the interaction and is not determined only by the bodies themselves.
(b) When a body is moving without acceleration, it moves by inertia.
(c) The longer the time required for changing velocity by a given value, the more inertia the body has.
(d) The mass of a body is the quantity which characterizes its inertia.

56. Which of the following physics concepts regarding force and momentum is wrongly stated ?
(a) A body moves rectilinearly when the vectors of force and velocity have opposite directions.
(b) Force can never be directed at right angles to the velocity.
(c) A reference system exists relative to which a body in translatory motion conserves its velocity if the resultant of all the forces applied to the body is zero.
(d) Newton's second law is valid only for intertial reference systems.

57. Which of the following statements regarding entropy is wrong ?
(a) We cannot achieve a process where the total entropy of the systems and surrounding decreases.
(b) Expansion of ideal gas into vacuum is an example of a completely reversible process.
(c) It is possible for a body to achieve lower entropies by removal of thermal energy (as heat) from it.
(d) The cyclical integral of the ratio – of a very small thermal energy change (as heat) to the absolute temperature, at which this change happens for all real thermodynamic cycles is less than zero.

58. The third most abundant gas in the atmospheric air is
(a) Carbon dioxide
(b) Xenon

(c) Argon
(d) Krypton

59. Choose the wrong option regarding application of dimensional analysis in the domain of fluid dynamics
    (a) To generate non-dimensional parameters that help in the design of experiments
    (b) To obtain scaling laws so that prototype performance can be predicated from model performance.
    (c) To predict the numerical approximation
    (d) Predict trends in the relationship between parameters

60. Which of the following statements is wrong regarding fluid flow over surfaces ?
    (a) A body is said to be streamlined if a conscious effort is made to align its shape with the anticipated streamlines in the flow.
    (b) A body that tends to block the flow of fluid over it is called a bluff or blunt.
    (c) A moving fluid exerts tangential shear forces on the bodies in the stream due to zero slip condition of the boundary layer sticking to the solid surface of the body.
    (d) A stationary fluid can only exert tangential force on the surfaces of the bodies immersed in the stream.

61. Which of the following points regarding Motor circuit protection is true ?
    (a) Only Circuit breakers with instantaneous trips are permitted.
    (b) Switch board efficiency is about 0.99
    (c) Protective device shall not permit current rating more than the Full Load Current.
    (d) Protective device setting cannot exceed 150% of the maximum allowable feeder cable current rating.

62. Which of the following statements is NOT true ?
    (a) A PLC is an industrial computer that accepts inputs from switches and sensors, evaluates these in accordance with a stored program, and generates outputs to control machines and processes.
    (b) A PLC is is a solid state device that uses soft wired logic contained in the controller's memory to duplicate the functions of relays and hardwired solid state control devices.
    (c) SCADA is the new name for PLC
    (d) A PLC is an electronic device that control machines and processes.

63. The fundamental difference between a over-current fault and a short-circuit fault is
    (a) Upto 15 times the normal operating current value is called over - current fault and above is short-circuit fault
    (b) Usually breach of insulation causes over-current fault
    (c) The faults are characterized by the conducting paths.
    (d) Only two phases getting in contact with each other is called short-circuit fault.

64. Which of the following is NOT correct regarding Electrical power distribution system onboard a ship.
    (a) The ungrounded distribution system causes equipment to shut down under a single-line fault condition
    (b) The grounded electrical system onboard ship produces high fault current.
    (c) Ungrounded electrical system, galvanically separated, is provided with a ground fault detection system.
    (d) System isolation can be made by using transformers

65. Choose the correct option regarding how the generated voltage from an alternator is adjusted
    (a) By varying speed of the prime mover
    (b) By varying fuel supply to the prime mover
    (c) By a potentiometer incorporated into the generator's panel
    (d) Voltage generated is fixed by design and cannot be adjusted in service.

66. The IP ratings – IP 51 means ?
    (a) Protected against dust - limited ingress, no harmful deposit and Protected against vertically falling drops of water
    (b) Totally protected against dust and Protected against direct sprays from all directions limited ingress permitted
    (c) Protected against dust – limited ingress, no harmful deposit and Protected against direct sprays up to 15° from the vertical
    (d) Totally protected against dust and Protected against vertically falling drops of water

67. A 40 cm long wire is bent to make a right angled triangle, with the hypotenuse at 17 cm. What is the area of the triangle formed
    (a) 55 sq. cm
    (b) 58 sq.cm
    (c) 60 sq.cm
    (d) 62 sq.cm

68. Which of the following statements about maxima minima is not true ?
    (a) If derivative exists at interior minimum or maximum, they are zero
    (b) The derivative at the interior minimum or maximum is always zero
    (c) If a function f has an absolute minimum at the point (x0, y0) then f(x0, y0) is always less than or equal to f(x, y) in the domain.
    (d) None of the above

69. Choose the wrong statement for the question: At (0,0) the quadratic function $f(x,y) = ax^2 + 2bxy + cy^2$ has a
    (a) Minimum if $a > 0$ and $ac > b^2$
    (b) Maximum if $a < 0$ and $ac > b^2$
    (c) Saddle point if $ac < b^2$
    (d) Minimum if $a > 0$ and $ac < b^2$

70. The value of the matrix is $\begin{pmatrix} 2 & 1 & 1 \\ 3 & 1 & 0 \\ 0 & 1 & 2 \end{pmatrix}^2$
    (a) $\begin{pmatrix} 7 & 4 & 4 \\ 9 & 4 & 3 \\ 3 & 3 & 4 \end{pmatrix}$
    (b) $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{pmatrix}$
    (c) $\begin{pmatrix} 3 & 1 & 1 \\ 2 & 1 & 2 \\ 1 & 2 & 3 \end{pmatrix}$
    (d) $\begin{pmatrix} 1 & 2 & 1 \\ 0 & 1 & 2 \\ 3 & 1 & 1 \end{pmatrix}$

71. The best approximate value of $\sqrt[4]{7}$ is
(a) 2.03125
(b) 2.81761
(c) 1.89743
(d) 3.01123

72. The best approximate distance of the point (1,2,3) from its origin is
(a) 3.45832
(b) 2.98763
(c) 3.74165
(d) 3.99832

73. The distance of the point (5,3) from the line $4x_1 + 2x_2 - 8$ is approximately
(a) 5
(b) 7
(c) 4
(d) 3

74. Sum the even numbers between 1000 and 2000 inclusive is
(a) 751500
(b) 252500
(c) 354500
(d) 800500

75. The example of a vector field from the physical quantities specified are -
(a) Pressure
(b) Electrostatic potential
(c) Electric field
(d) Temperature

76. With reference to vector calculus, choose the wrong statement.
(a) Gradient of a scalar field does not exist
(b) Level curves are given by f(x,y) = constant
(c) The direction of greatest increase of a function f is in the direction of its gradient
(d) Curl of a vector field represents the circulation per unit area.

77. For a function to be expanded as a fourier series, it has to meet certain conditions. In this context choose the wrong statement from the following -
(a) the function must be periodic
(b) it must be single-valued and continuous, except possibly at a finite number of finite discontinuities
(c) the integral over one period of |f(x)| must diverge.
(d) it must have only a finite number of maxima and minima within one period

78. What type of extinguisher is used to extinguish a class E fire involving energized electrical equipment?
(a) Dry chemical powder
(b) Wet chemical
(c) Foam
(d) Air-pressurised water

79. Testing equipment for the highest level of electrical power and is suitable for measurements with respect to mains, power consumption meters and off-peak switching devices is classed as
    (a) Category I
    (b) Category II
    (c) Category IV
    (d) Category III

80. 25 deg. Centigrade is equal to
    (a) 300 Kelvin
    (b) 77 deg. Fahrenheit
    (c) 45.88 deg. Fahrenheit
    (d) 20 Rankines