61713

ROLL No. | | | | | |

TEST BOOKLET No. 4b

TEST FOR POST GRADUATE PROGRAMMES

INSTRUMENTATION

Time: 2 Hours | Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of **this page**

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen.**

4. The paper consists of 150 objective type questions. All questions carry equal marks.

5. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by a **Ball Point Pen** corresponding to the correct response as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

7. Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

INSTRUMENTATION

1. The change in the value of an analog signal during the conversion process produces

   (A) resolution error
   (B) Niquist error
   (C) quantisation error
   (D) sampling error

2. Holding current for an SCR is best defined as

   (A) the minimum current required for turn- off
   (B) the current required to maintain conduction
   (C) the current required for an SCR to turn on
   (D) the gate current required to maintain conduction

3. A measure of the repeatability of measurement of a quantity is

   (A) error
   (B) precision
   (C) accuracy
   (D) sensitivity

4. The digits of a measured number that are known to be correct are called

   (A) accuracy digits
   (B) precision digits
   (C) significant digits
   (D) correct digits

5. The condition for a resistor to have same value of resistance at medium frequencies is as with DC is

   (A) $CR^2=L$
   (B) $CR^2=2L$
   (C) $CR^2=WL$
   (D) $CR^2=2WL$

6. Which two values are plotted in a B-H curve?

   (A) Reluctance and Flux density
   (B) Magnetising force and Permeability
   (C) Permeability and Reluctance
   (D) Flux density and Magnetising force

7. For turbulent flow, the velocity at the centre is times the mean velocity.

(A) 1.2 (B) 2.2
(C) 2.0 (D) 1.5

8. MEMS is an acronym for

(A) Micro Electro Magnetic Systems
(B) Micro Electro Mechanical Systems
(C) Micro Electro Material Systems
(D) Micro Engineering of Mechanical systems

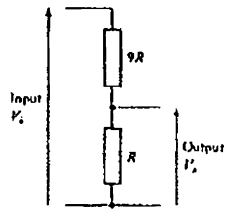
9 The bandwidth of electrocardiogram (ECG) amplifier is

(A) DC to 0.01 Hz (B) 550 to 1500 Hz
(C) 0.05 to 500 Hz (D) 2000 to 10000 Hz

10. The output of an LVDT is

(A) voltage (B) current
(C) inductance (D) capacitance

11. The gain of the passive attenuator shown below is



(A) 10 (B) 0.1
(C) 1 (D) 9

12. In a temperature control system, what represents the output of the system?

(A) Actual temperature achieved
(B) The required temperature
(C) Heating element
(D) Heat produced in the system

13. The Laplace transform of $e^{-2t} \sin 2\omega t$ is

(A) $2s / (s+2)^2 + 2\omega^2$ (B) $2\omega / (s+2)^2 + 4\omega^2$
(C) $2\omega / (s-2)^2 + 4\omega^2$ (D) $2s / (s-2)^2 + 2\omega^2$

14. In a n-p-n transistor circuit, the collector current is 10mA. If 90% of the electrons emitted reach the collector, then

(A) emitter current will be 9 mA
(B) emitter current will be 11 mA
(C) base current will be 1 mA
(D) base current will be −1mA

15. In a full wave rectifier circuit operating from 50Hz mains frequency, the fundamental frequency in the ripple would be

(A) 25Hz (B) 50Hz
(C) 70.7Hz (D) 100Hz

16. A truck's speed increases uniformly from 15 km/hr to 60 km/hr in 20 s. The average speed will be

(A) 10.4 m/s (B) 104 m/s
(C) 10.4 km/hr (D) 37.5 km/hr

17 A steel tape is calibrated at 20°C. On a cold day when the temperature is −15°C, what will be the percent error in the tape (α of steel is 1.1×10^{-5} /° C)?

(A) 0.039% (B) − 0.039%
(C) 3.9% (D) − 0.39%

18. Two electric bulbs, each designed to operate with a power of 500 watts in a 220 V line, are put in series in 110V line. What will be the power generated by each bulb?

(A) 31.25 watts (B) 62.50 watts
(C) 125 watts (D) 250 watts

19. We desire to measure the current through and voltage across a resistor connected in a circuit. How should the ammeter and the voltmeter be connected?

(A) Both are connected parallel with the resistor
(B) Both are connected in series with the resistor
(C) Ammeter is connected in series and voltmeter is connected parallel with the resistor
(D) Ammeter is connected in parallel and voltmeter is connected in series with the resistor

20 RC time constant in a R-C circuit is

(A) the time, in seconds taken for the current to drop to 0.368 of its original value
(B) the time, in seconds taken for the current to drop to 0.632 of its original value
(C) the time, in seconds taken for the current to drop to 0.500 of its original value
(D) the time, in seconds taken for the current to drop to 0.750 of its original value

21. One Tesla of magnetic field is equal to

(A) 10^4 Gauss (B) 10^3 Gauss
(C) 10^2 Gauss (D) 10^6 Gauss

22. The binary number 110000111101 corresponds to the hexa decimal number

(A) CFD (B) D3C
(C) DBF (D) C3D

23. Which of the following is most useful to measure temperature of the order of 3500K?

(A) Optical pyrometer (B) Carbon resistor
(C) Gas bulb thermometer (D) Thermocouple

24. Gray is a unit of

(A) radiation dose (B) photon energy
(C) phonon energy (D) magnetic field

25 The unit of luminous intensity is

(A) lumen (B) lux
(C) candela (D) watt

26. A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed, of

(A) 1000 (B) 3000
(C) 5000 (D) 7000

27 In physics, a radian per second is a unit of:

(A) angular displacement (B) angular acceleration
(C) angular velocity (D) angular momentum

28. Which of the following colors of visible light has the longest wavelength?

(A) violet (B) green
(C) yellow (D) red

29. The SI unit of pressure is

(A) Torr (B) Pascal
(C) Newton (D) Atmosphere

30. A 10 volt battery connected to a capacitor delivers a charge of 0.5 coulombs. The capacitance of the capacitor is

(A) 2×10^{-2} farads
(B) 5×10^{-2} farads
(C) 2 farads
(D) 5 farads

31 The half-life of an isotope of an element is 5 days. The mass of a 10 gram sample of this isotope remaining after 20 days is

(A) 0.312 grams
(B) 0.625 grams
(C) 1.25 grams
(D) 2.50 grams

32. The first instrument used for measuring temperature was the gas thermoscope invented by

(A) Celsius
(B) Galileo
(C) Centigrade
(D) Fahrenheit

33. Which of the following best completes the statement? The calorie is the amount of heat needed to raise

(A) 1 gram of water 1 degree Celsius
(B) 1 gram of water 1 degree Rankin
(C) 1 kilogram of water 1 degree Celsius
(D) 1 kilogram of water 1 degree Kelvin

34. Which one of the following is the name of a device used to measure voltage without drawing ANY current from the circuit being measured?

(A) A wattmeter
(B) An ammeter
(C) A galvanometer
(D) A potentiometer

35. When a person stands on a scale in an elevator at rest, the scale reads 800 Newtons. When the elevator is allowed to fall freely with acceleration of gravity, the scale reads

(A) 1600 Newtons
(B) 800 Newtons
(C) 400 Newtons
(D) 0 Newtons

36. The shape of a magnetic field around a long straight current carrying wire is

(A) elliptical
(B) circular
(C) varies depending on the magnitude of the current
(D) square

37 What represents the ratio of speed of an object to the speed of sound in the surrounding air?

(A) Mach number (B) Poissons ratio
(C) Reynolds number (D) Nautical mile

38. The electric field of a point charge varies

(A) linearly with distance and inversely with charge
(B) linearly with distance and inversely with charge squared
(C) linearly with charge and inversely with distance squared
(D) linearly with charge and inversely with distance

39. Ratio of absolute viscosity to the density of the fluid is called

(A) relative viscosity (B) viscosity index
(C) kinematic viscosity (D) fluidity

40. Tachometer is an instrument used for

(A) measuring rpm of a motor
(B) tracking magnetic objects
(C) tackle the spikes in an electrical circuit
(D) measuring the flow of liquids

41. In a full wave rectifier without a filter, the ripple factor is

(A) 0.482 (B) 1.21
(C) 2.05 (D) 1.79

42. In an intrinsic semiconductor, the Fermi-level is

(A) closer to the valence band
(B) closer to the conduction band
(C) midway between conduction and valence band
(D) within the valence band

43. A differential amplifier, amplifies

(A) and mathematically differentiates the average of the voltages on the two input lines
(B) and differentiates the input waveform on one line when the other line is grounded
(C) the difference of voltages between the two input lines
(D) and differentiates the sum of the two input waveforms

44. It is required to construct a counter to count upto 100 (decimal). The minimum number of flip-flops required to construct the counter is

(A) 8 (B) 7
(C) 6 (D) 5

45. Transistor is a

(A) current controlled current device
(B) current controlled voltage device
(C) voltage controlled current device
(D) voltage controlled voltage device

46. The function of a bleeder resistor in a power supply is

(A) the same as that of load resistor
(B) to ensure a minimum current drain in the circuit
(C) to increase the output dc voltage
(D) to increase the output current

47. n-type silicon is obtained by

(A) doping with tetravalent element
(B) doping with pentavalent element
(C) doping with trivalent element
(D) doping with a mixture of trivalent and tetravalent element

48. The current amplification factor in CE configuration is

(A) α (B) $\beta + 1$
(C) $1/\beta$ (D) β

49 Two stages of BJT amplifiers are cascaded by RC coupling. The voltage gain of the first stage is 10 and that of the second stage is 20. The overall gain of the coupled amplifier is

(A) 10×20 (B) $10+20$
(C) $(10+20)^2$ (D) $(10 \times 20)/2$

50. When the temperature of a doped semiconductor is increased, its resistivity

(A) decreases
(B) increases
(C) does not change
(D) increases or decreases depending on whether it is p type or n type

51. Regulation of a dc power supply is given by

(A) product of no-load output voltage and full-load current
(B) ratio of full-load output voltage and full-load current
(C) change in output voltage from no-load to full-load
(D) change in output impedance from no-load to full-load

52. A Zener diode

(A) has a high forward voltage rating
(B) has a sharp breakdown at low reverse voltage
(C) is useful as an amplifier
(D) has a negative resistance

53. Negative feedback in an amplifier

(A) reduces the voltage gain
(B) increases the voltage gain
(C) does not affect the voltage gain
(D) converts the amplifier into an oscillator

54. Field effect transistor has

(A) large input impedance
(B) large power gain
(C) large output impedance
(D) large voltage gain

55. A single transistor can be used to build which of the following?

(A) AND gate (B) NOR gate
(C) NOT gate (D) NAND gate

56. The basic logic gate whose output is the complement of its input

(A) OR gate (B) Inverter gate
(C) AND gate (D) Comparator

57. What input values can cause an AND logic gate produce a HIGH output?

(A) At least one input is HIGH
(B) All inputs are HIGH
(C) At least one input is LOW
(D) All inputs are LOW

58. A resistor in a circuit dissipates energy at a rate of 1 W. If the voltage across the resistor is doubled, what will be the new rate of energy dissipation?

(A) 4W
(B) 0.5 W
(C) 2W
(D) 0.25 W

59. If one arsenic atom is added per 10^8 germanium atoms, the number of electrons present for conduction at 300 K will be

(A) $1.42\times10^{18}/m^3$
(B) $4.41\times10^{19}/m^3$
(C) $4.41\times10^{20}/m^3$
(D) $1.42\times10^{20}/m^3$

60. If $x=\sqrt{-1}$, then the value of x^x is

(A) $e^{-\pi/2}$
(B) $e^{\pi/2}$
(C) x
(D) 1

61. With the initial condition $x(1)$ 0.5, the solution of the differential equation $t\left(\frac{dx}{dt}\right)+x=t$ is

(A) $x=t-\left(\frac{1}{2}\right)$
(B) $x=t^2-\left(\frac{1}{2}\right)$
(C) $x=\frac{t^2}{2}$
(D) $x=\frac{t}{2}$

62. A psychrometric chart is used to determine

(A) pH
(B) relative humidity
(C) sound velocity in gases
(D) CO_2 concentration

63. A bridge method commonly used for finding mutual inductance is

(A) Heaviside-Campbell bridge
(B) De Sauty bridge
(C) Schering bridge
(D) Wien bridge

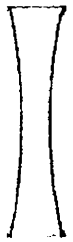
64. A fair coin is tossed till a head appears for the first time. The probability that the number of required tosses is odd is

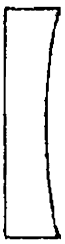
(A) 1/3 (B) 1/2
(C) 2/3 (D) 3/4

65. Two experimental techniques determine the mass of an object to be 11 ± 1 kg and 10 ± 2 kg. These two measurements can be combined to give a weighted average. The uncertainty of the weighted average is equal to

(A) ½ kg (B) $2/\sqrt{5}$ kg
(C) $2/\sqrt{3}$ kg (D) 2 kg

66. If the four lenses shown below are made of the same material, which lens has the shortest positive focal length?

(A) 

(B) 

(C) 

(D) 

67. The minimum resistance value for a blue, gray, red and silver resistor is

(A) 612 Ω (B) 6120 Ω
(C) 6210 Ω (D) 621 Ω

68. The conductance of an 8 ohm resistance is

(A) 125 mS
(B) 12.5 mS
(C) 125 S
(D) 12.5 S

69. In a certain loaded transformer, the secondary voltage is one fourth of the primary voltage. The secondary current is

(A) four times the primary current
(B) equal to the primary current
(C) one fourth of the primary current
(D) one eighth of the primary current

70. When a 12 volt battery is connected to a primary of a transformer with turns ratio of 12, the secondary voltage is

(A) zero
(B) 12 volts
(C) 144 volts
(D) 1 volt

71. In an RC integrator, when a 12 V input pulse with a width equal to one time constant is applied, the capacitor charges to

(A) 0 volts
(B) 12.56 volts
(C) 7.56 volts
(D) 12 volts

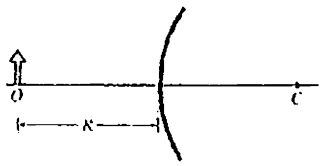
72. Van de Graff generators are useful for

(A) low voltage and high current applications
(B) high voltage and low current applications
(C) low voltage and low current applications
(D) high voltage and high current applications

73. The surface of the Sun has a temperature close to 6,000 K and it emits a blackbody spectrum that reaches a maximum near 500 nm. For a body with a surface temperature close to 300 K, at what wavelength would the thermal spectrum reach a maximum?

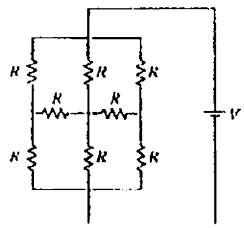
(A) 10 μm
(B) 100 μm
(C) 10 mm
(D) 100 mm

74. The figure below shows an object *O* placed at a distance *R* to the left of a convex spherical mirror that has a radius of curvature *R*. Point *C* is the center of curvature of the mirror. The image formed by the mirror is at



(A) a distance R to the right of the mirror and upright
(B) a distance R to the left of the mirror and inverted
(C) a distance R/3 to the right of the mirror and upright
(D) a distance R/3 to the left of the mirror and inverted

75. The circuit shown in the figure below consists of eight resistors, each with resistance *R*, and a battery with terminal voltage *V* and negligible internal resistance. What is the current flowing through the battery?

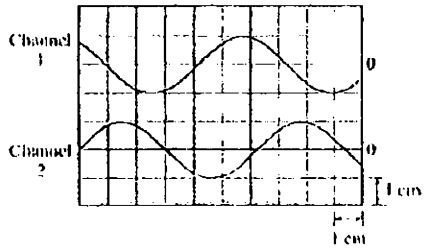


(A) V/3R
(B) V/2R
(C) V/R
(D) 3V/2R

76. Which of the following lasers utilises transitions that involve the energy levels of free atoms?

(A) Diode laser
(B) Dye laser
(C) Free-electron laser
(D) Gas laser

77 Two sinusoidal waveforms of the same frequency are displayed on an oscilloscope screen, as indicated below. The horizontal sweep of the oscilloscope is set to 100 ns/cm and the vertical gains of channels 1 and 2 are each set to 2 V/cm. The zero-voltage level of each channel is given at the right in the figure. The phase difference between the two waveforms is most nearly



(A) 120° (B) 45°
(C) 60° (D) 90°

78. A spring of force constant k is stretched a certain distance. It takes twice as much work to stretch a second spring by half this distance. The force constant of the second spring is

(A) k (B) $2k$
(C) $4k$ (D) $8k$

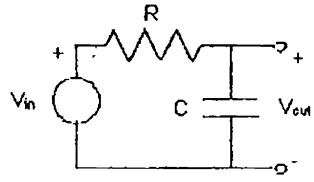
79 An electron has total energy equal to four times its rest energy. The momentum of the electron is

(A) $1mec$ (B) $\sqrt{2}\,mec$
(C) $\sqrt{15}\,mec$ (D) $4mec$

80. Pittot tube is an instrument used to measure

(A) flow (B) temperature
(C) pressure (D) density

81. A simple RC system shown below is an example of



(A) zero order system
(B) second order system
(C) first order system
(D) third order system

82. If the power in a circuit is calculated from the measurements of voltage and current with maximum error of ±1% and ±2% respectively, then the possible error in the calculated value of power will be

(A) ±0.5%
(B) ±3%
(C) ±2%
(D) ±1.5%

83. Which of the following statements is not correct about a voltage follower circuit?

(A) It has high input impedance
(B) It has low input impedance
(C) It is a unity gain amplifier
(D) It has low output impedance

84. The cross section of a Bouden tube is

(A) elliptical
(B) circular
(C) rectangular
(D) square

85. Which of the following gauges can be used to measure 10^{-6} Torr pressure?

(A) Thermistor gauge
(B) U tube manometer
(C) Ionisation gauge
(D) Pirani gauge

86. LVDT is a transducer used to measure

(A) low voltages
(B) linear displacement
(C) circular displacement
(D) voltage difference

87. A pipe carrying a fluid vibrates at a frequency of 50Hz with displacements of 8 mm from the equilibrium position. The peak acceleration will be

(A) 790 m/s^2
(B) 400 m/s^2
(C) 6 m/s^2
(D) 200 m/s^2

88. A Hall effect transducer can be used to measure

(A) current
(B) power
(C) displacement
(D) current, power and displacement

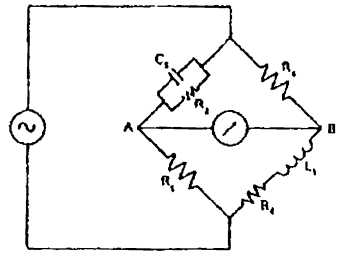
89. In an electromagnetic spectrum, if different regions are arranged in the increasing order of frequency, which of the following represents this arrangement?

(A) Microwaves, infra-red, gamma rays, visible spectrum
(B) Microwaves, infra-red, visible spectrum, ultraviolet
(C) X-rays, ultraviolet, visible, infrared
(D) X-rays, visible, ultraviolet, microwaves

90. An integrated circuit chip contains 10^5 transistors. The transistors have a mean current gain of 20 and a standard deviation of 2. How many transistors will have a current gain greater than 17?

(A) 93.32%
(B) 95%
(C) 90%
(D) 85%

91 In the Maxwell bridge shown below, if the value of R_3 is 5 Ω and C_1 is 1 mF, what will be the value of the inductance L_1 (at balance, the value of R_2 is 159 Ω and R_1 is10 Ω)?



(A) 40 mH (B) 40 H
(C) 50 mH (D) 50 H

92. The binary number 010111011001 when expressed in Octal code is

(A) 2731 (B) 2371
(C) 1732 (D) 7231

93. Which of the following numbers is given to four significant figures?

(A) 0.00020 (B) 0.0020
(C) 2.000 (D) 2000

94. A ball is swung on the end of a rope in a horizontal circle at constant speed. The rope breaks. Immediately after the rope breaks, the ball will

(A) fall straight down to the ground
(B) move inward toward the center of the circle
(C) move outward normal to the circle from the point the rope broke
(D) move outward tangent to the circle from the point the rope broke

95. A 40,000 kg freight car is coasting at a speed of 5.0 m/s along a straight track when it strikes a 30,000 kg stationary freight car and couples to it. What will be their combined speed after impact?

(A) 6.7 m/s
(B) 2.9 m/s
(C) 2.1 m/s
(D) 5.0 m/s

96. Just before striking the ground, a 2.0 kg mass has 400 J of KE. If friction can be ignored, from what height was it dropped?

(A) 200 m
(B) 20 m
(C) 40.8 m
(D) 40 m

97. A 300 g mass at the end of a spring executes SHM with a period of 2.4 s. Find the period of oscillation of a 133 g mass attached to the same spring.

(A) 1.6 s
(B) 0.033 s
(C) 24.7 s
(D) 0.41 s

98. Standing waves are produced by the superposition of two waves with

(A) the same amplitude, frequency, and direction of propagation
(B) the same amplitude and frequency, and opposite propagation directions
(C) the same amplitude and direction of propagation, but different frequencies
(D) the same amplitude, different frequencies, and opposite directions of propagation

99. The speed of light in a certain glass is 1.91×10^{8} m/s. What is the refractive index of the glass?

(A) 1.57
(B) 0.64
(C) 1.09
(D) 4.9

100. Two isotopes of an element have

(A) the same number of nucleons in their nuclei
(B) the same number of protons as well as neutrons
(C) the same number of protons but a different number of neutrons
(D) different number of protons but the same number of neutrons

101. Which of the following effects could *not* be observed for sound waves in air?

(A) Interference (B) Refraction
(C) Polarisation (D) Diffraction

102. A capacitor with air between its plates has capacitance of 3.0μF. What is its capacitance when wax of dielectric constant 2.8 is placed between the plates?

(A) 0.93 μF (B) 1.1 μF
(C) 25.2 μF (D) 8.4 μF

103. Two long parallel wires are 4 cm apart and carry currents of 2A and 6A in the same direction. Compute the force between the wires per meter of wire length

(A) $6.0\times10^{-7} N/m$, attraction
(B) $6.0\times10^{-5} N/m$, attraction
(C) $2.5\times10^{-6} N/m$, attraction
(D) $6.0\times10^{-5} N/m$, repulsion

104. In a U tube, 50.0 cm height of olive oil in one arm is found to balance 46.0 cm of water in the other. What is the density of the olive oil?

(A) 920 kg/m^3 (B) 1080 kg/m^3
(C) 230 kg/m^3 (D) 0.920 kg/m^3

105. The speed of a fluid flowing in a pipe of internal diameter of 5.0 cm is 0.54 m/s. What will be the fluid's speed in a pipe of 3.0 cm internal diameter that connects to it, both pipes flowing full?

(A) 1.5 m/s
(B) 0.9 m/s
(C) 0.19 m/s
(D) 0.32 m/s

106. Power in a DC circuit is measured by measuring the voltage across and current through the circuit. The voltage and current measurement are made to an accuracy of ±2% and ±3% respectively. The errors are limiting errors. The error in measurement of power is

(A) ±2%
(B) ±3%
(C) ±1%
(D) ±5%

107. Two balls of equal mass, moving with speeds of 3 m/s, collide head-on. Find the speed of each after impact if (i) they stick together, (ii) the collision is perfectly elastic.

(A) (i) 3 m/s (ii) 0 m/s
(B) (i) 6 m/s (ii) 6 m/s
(C) (i) 0 m/s (ii) each rebounds at 3 m/s
(D) (i) 1.5 m/s (ii) 1.5 m/s

108. The exponential function $q = q_0e^{-t/RC}$ describes

(A) capacitor charging and discharging
(B) capacitor charging
(C) capacitor discharging
(D) inductor current build up

109. A constant voltage source has

(A) low internal resistance
(B) high internal resistance
(C) minimum efficiency
(D) minimum current capacity

110. According to Kirchoff's current law

(A) no current can leave the junction without some current entering it
(B) net current flow at the junction is negative
(C) total sum of currents meeting at the junction is zero
(D) the algebraic sum of the currents at the junction is zero

111. In a n-type semiconductor, the position of Fermi level

(A) is lower than the centre of the energy gap
(B) is at the centre of the energy gap
(C) is higher than the centre of the energy gap
(D) can be anywhere depending upon the doping concentration

112 Twenty seven drops of mercury of equal size merge into a big drop. Assuming the drops to be spherical, the capacity of the bigger drop compared to each drop is

(A) 27 times (B) 3 times
(C) 9 times (D) 18 times

113. Four capacitors of equal capacity are connected in the form of a square. The resultant capacity across a side of the square is

(A) 3C/4 (B) 4C
(C) C (D) C/4

114. The volume of the balloon filled with hydrogen, which will be sufficient to lift a load of 25 kg in air is (density of air and hydrogen are 0.00129 g/cc and 0.00009 g/cc)

(A) 20.83 m^3 (B) 2.83 m^3
(C) 208.3 m^3 (D) 0.283 m^3

115 A pendulum clock keeping correct time at sea level is taken to a place 1 km below sea level. The clock approximately

(A) gains 13.5 s per day (B) loses 13.5 s per day
(C) loses 7 s per day (D) gains 7 s per day

116. An X-ray tube operates at a voltage of 40 kV. It emits continuous X-ray spectrum with a short wavelength limit λ_{mi}

(A) 0.031 nm (B) 0.310 nm
(C) 3.10 nm (D) 31 nm

117. Four wires of same material are stretched by the same load. The dimensions of the wires are given below. Which of them will elongate the most?

(A) Length 100 cm and diameter 1 mm
(B) Length 400 cm and diameter 0.5 mm
(C) Length 200 cm and diameter 2 mm
(D) Length 300 cm and diameter 3 mm

118. For constants α and β of a transistor

(A) $\alpha<1$, $\beta<1$ (B) $\alpha<1$, $\beta>1$
(C) $\alpha>1$, $\beta<1$ (D) $\alpha\beta=1$

119. A capacitor of 5μF is charged to a potential of 1 kV It is then shorted using a resistance of 10 kΩ. The heat energy dissipated in the resistor is

(A) 5 J (B) 2.5 J
(C) 20 J (D) 500 J

120. If A is the gain of an internal amplifier and B is the feedback coefficient, Barkhausen criterion for oscillations is

(A) AB<1 (B) AB=1
(C) AB>1 (D) AB=0

121. A series dissipative regulator is an example of a

(A) linear regulator (B) shunt regulator
(C) switching regulator (D) ac-dc converter

122. What device is similar to RTD but has negative temperature coefficient of resistance?

(A) Thermocouple
(B) Thermistor
(C) Negative RTD
(D) Strain gauge

123. The output of a typical thermocouple is

(A) less than 100 mV
(B) less than 100 mA
(C) more than 1 volt
(D) less than 100 Ohm

124. What is the zero-voltage switch used for?

(A) To reduce radiation of higher frequencies during turn on of a high current to load
(B) To control low voltage circuits
(C) To provide power to a circuit when power is lost
(D) For extremely low voltage applications

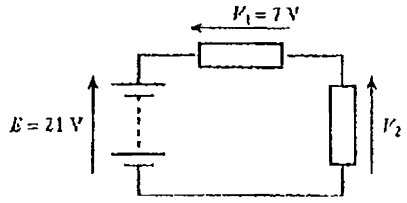
125. A low pass RC filter acts as a pure integrator when (ω is the applied frequency and τ is the RC time constant)

(A) $\omega\tau = 1$
(B) $\omega\tau >> 1$
(C) $\omega\tau << 1$
(D) $\omega\tau = 0$

126. A magnetic needle is kept in a non-uniform magnetic field. It experiences

(A) a force and a torque
(B) a torque but not a force
(C) a force but not a torque
(D) neither force nor torque

127. What is the magnitude of V_2 in the following circuit



(A) −14 V
(B) 28 V
(C) −28 V
(D) 14 V

128. Which of the following is a scalar quantity?

(A) Electric current
(B) Electric field
(C) Acceleration
(D) Linear momentum

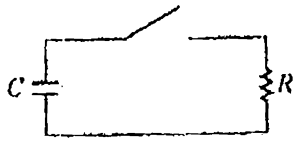
129. Which of the following is necessary for the operation of an induction motor?

(A) A fixed magnetic field in the motor
(B) A direct current supply to the motor
(C) A changing magnetic field to the motor
(D) Split rings conducting current to the motor

130. The temperature of a metal is reduced. Which of the following statements explains the change in electrical resistance of the metal?

(A) Electrical resistance increases because the metal freezes
(B) Electrical resistance decreases because of more number of free electrons available
(C) Electrical resistance increases because electrons move more slowly
(D) Electrical resistance reduces because of reduced lattice vibrations

131. The capacitor shown in the circuit is initially charged. After closing the switch, how much time elapses until one half of the capacitor's initial stored energy is displaced?



(A) RC
(B) RC/2
(C) RCln(2)/2
(D) 2RCln(2)

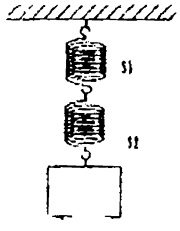
132 The longest wavelength X-ray that can undergo Bragg diffraction in a crystal for a given family of planes of spacing d is

(A) 2d
(B) d/2
(C) d
(D) 4d

133. A ball is dropped from a height h. As it bounces off the floor, its speed is 80 percent of what it was just before it hit the floor. The ball will rise to a height of most nearly

(A) 0.94h
(B) 0.80h
(C) 0.75h
(D) 0.64h

134. Two springs S_1 and S_2 have negligible masses and the spring constant of S_1 is 1/3 that of S_2. When a block is hung from the springs as shown in the figure below, and the springs come to equilibrium, then the ratio of work done in stretching S_1 to the work done in stretching S_2 is



(A) 1/9
(B) 1/3
(C) 1
(D) 3

135. Equal resistances of 100Ω each are connected in each arm of a Wheatstone bridge, which is supplied by a 2V battery. A galvanometer of negligible resistance connected to the bridge can sense as low a current as 1μA. The smallest value of resistance that can be measured is

(A) 20mΩ (B) 2$\mu\Omega$
(C) 20$\mu\Omega$ (D) 0.2Ω

136. Inversion temperature of a gas is the temperature above which

(A) the gas shows cooling effect while passing through a narrow orifice
(B) the temperature of the gas remains unaltered while passing through narrow orifice
(C) the gas shows heating effect while passing through a narrow orifice
(D) the gas can be liquefied

137 An electron microscope is used to look at an atom of 0.1 nm diameter. If the desired resolution is 0.005 nm, the minimum energy of the electron should be

(A) 0.957 eV (B) 6×10^4 eV
(C) 1×10^7 eV (D) 1.24 keV

138. The colour of light that travels with maximum speed in glass is

(A) red (B) blue
(C) violet (D) green

139. A noise level meter reads the sound level in a room to be 85 dB. What is the sound intensity in the room?

(A) 1×10^{-5} W/m^2 (B) 3.16×10^{-4} W/m^2
(C) 3.16×10^{-5} W/m^2 (D) 3.16×10^{-3} W/m^2

140. The truth table given below is for (A and B are inputs, Y is output)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(A) NAND gate
(B) XOR gate
(C) AND gate
(D) NOR gate

141. If the distance between the Earth and the Moon were halved, the force of the attraction between them would be

(A) one fourth as great
(B) twice as great
(C) one half as great
(D) four times as great

142. Two identical springs with spring constant k are connected to identical masses of mass M, as shown in the figures below. The ratio of the period for the springs connected in parallel (Figure 1) to the period for the springs connected in series (Figure 2) is

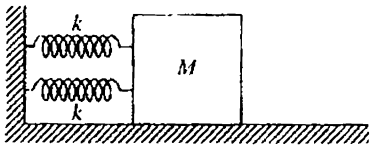


Figure 1

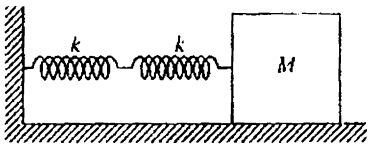
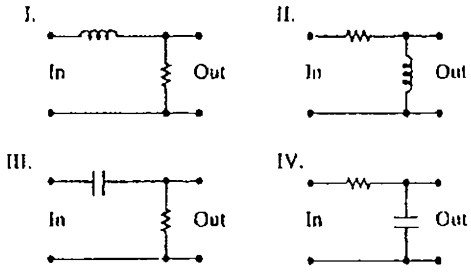


Figure 2

(A) $\frac{1}{2}$
(B) $\frac{1}{\sqrt{2}}$
(C) 1
(D) $\sqrt{2}$

143. Which two of the following circuits are high pass filters?



(A) I and II
(B) I and III
(C) I and IV
(D) II and III

144. If the sum of all forces acting on a moving object is zero, the object will

(A) slow down and stop its motion
(B) accelerate uniformly
(C) change the direction of its motion
(D) continue moving with constant velocity

145. Field Effect Transistors (FETs) are

(A) voltage driven devices
(B) power driven devices
(C) current driven devices
(D) temperature driven devices

146. Two capacitors of capacities $4\mu F$ and $6\mu F$ are connected to a battery of potential 10 V. The charge present in $4\mu F$ is

(A) $4\mu C$
(B) $40\mu C$
(C) $6\mu C$
(D) $60\mu C$

147. Two vibrating particles that are "out of phase" differ in the phase of their vibration by

(A) 1/4 cycle
(B) 1/2 cycle
(C) 3/4 cycle
(D) 1 cycle

148. To convert a galvanometer to a voltmeter, you should add a

(A) high resistance in series
(B) low resistance in series
(C) high resistance in parallel
(D) low resistance in parallel

149. The potential drop between the terminals of a battery is equal to the battery's EMF when

(A) no current is drawn from the battery
(B) a very large current is drawn from the battery
(C) the internal resistance of the battery is very large
(D) the resistance in the external circuit is small

150. A transducer has an output impedance of 1kΩ and a load resistance of 1Ω. It behaves as

(A) a constant current source
(B) a constant voltage source
(C) a constant impedance source
(D) a signal conditioner