**IIT-JEE-Physics–1998**

**Time : Three Hours**                                                        **Max. Marks : 100**
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**SECTION I**

1. You must first transfer the code given here on top of this Section to your Answer Sheet In the appropriate box marked. Question Paper Code.
2. Answer Section I only on the printed form on the third page of your answer book by writing the appropriate letters (A), (B), (C) etc. against the question number in the table. Answers for Section I written in this space alone will be awarded marks.
3. Section I consists of 40 objective type questions.
4. This section should take about one hour to answer.
5. Each question in this section carries 2 marks.

**1.** A transistor is used in common emitter mode as an amplifier, then :
(A)the base emitter junction is forward biased
(B)the base emitter junction is reverse biased
(C)the input signal is connected in series with the voltage  applied to bias the base emitter junction.
(D)the input signal is connected in series with the voltage applied to bias the base collector junction.

**2.** Water from a tap emerges vertically downwards with an initial speed of 1.0 m/s. The cross-sectional area of tap is 10–4 m2. Assume that the pressure is constant throughout the stream of water and that the flow is steady, the cross-sectional area of stream 0.15 m below the tap is :
(A) 5.0 × 10–4 m2 (B) 1.0 × 10–4 m2
(C) 5.0 × 10–5 m2 (D) 2.0 × 10–5 m2

**3.** A real image of a distant object is formed by a planoconvex lens on its principal axis. Spherical aberration:
(A) is absent
(B) is smaller if the curved surface of the lens faces the object
(C) is smaller if the plane surface of the lens faces the object
(D) is the same whichever side of the lens faces the object

**4.** Let v, vrms and vp respectively denote the mean speed, root mean square speed and most probable speed of the molecules in an ideal monoatomic gas at absolute temperature T. The mass of a molecule is m. Then :
(A) no molecule can have a energy greater then √2 Vrms
(B) no molecule can have speed less thenVp/√2
(C) Vp < V < Vrms
(D) the average kinetic energy of a molecule is 3/4 mvp2

**5.** A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300K. The ratio of the average rotational kinetic energy per O2 molecule to per N2 molecule is:
(A) 1 : 1
(B) 1 : 2
(C) 2 : 1
(D) depends on the moment of inertia of the two molecules.

**6.** A string of length 0.4 ma and mass 10–2 Kg is tightly clamped at its ends. The tension in the string is 1.6N. Identical wave pulses are produced at one end at equal intervals of time Δt. The minimum value of  Δt, which allows constructive interference between successive pulses, is :
(A) 0.05 s                                                                              (B) 0.10 s
(C) 0.20 s                                                    (D) 0.40 s

**7.** Two particles, each of mass m and charge q, are attached to the two ends of a light rigid rod of length 2R. The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod is :
(A) q/2m                                                                               (B) q/m
(C) 2q/m                                                     (D) q/πm

**8.** A ray of light travelling in a transparent medium falls on a surface separating the medium from air at an angle of incidence 450. The ray undergoes total internal reflection. If n is the refractive index of the medium with respect to air, select the possible value(s) of n from the following :
(A) 1.3                                                (B) 1.4
(C) 1.5                                                (D) 1.6

**9.** Let mp be the mass of proton, mn the mass of neutron. M1 the mass of 20/10 Ne nucleus and M2 the mass of 40/20 Ca nucleus. Then :
(A) M2 = 2M1                                        (B) M2 > 2M1
(C) M2 < 2M1                                        (D) M1 < 10 (mn + mp)

**10.** A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is:
(A) 0                                                  (B) π/2
(C) π                                                  (D) 2π

**11.** The electron in a hydrogen atom makes a transition n1 →n2 where n1 and n2 are the principal quantum numbers of two states. Assume the Bohr model to be valid. The time period of the electron in the initial state is eight times that in the final state. The possible values of n1 and n2 are :
(A) n1 = 4, n2 = 2                                  (B)n1 = 8, n2 = 2
(C) n1 = 8, n2 = 1                                  (D) n1 = 6, n2 = 3

**12.** A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time the stone is at its lowest position and has a speed u. The magnitude of the change in its velocity as it reaches a position, where the string is horizontal, is:
(A) √(u2-2gL)                                      (B) √2gL
(C) √(u2-gL)                                        (D) √2(u2- gL)

**13.** In the circuit shown in the figure, the current through:



(A) the 3Ω resistor is 0.50 A                       (B) the 3Ω resistor is 0.25 A
(C) the 4Ω resistor is 0.50 A                       (D) the 4Ω resistor is 0.25 A

**14.** A dielectric slab of thickness d is inserted in a parallel late capacitor whose negative plate is at  x = 0 and positive plate is at x = 3d. The slab iis equidistant from the plates. The capacitor is given some charge. As x goes from 0 to 3d:
(A) the magnitude of the electric field remains the same
(B) the direction of the electric field remains the same
(C) the electric potential increases continuously
(D) the electric potential increases at first, then decreases and again increases.

**15.** The (x, y) coordinated of the corners of a square plate are (0, 0), (L, 0), (L, L) and (0, L). The edges of the plate are clamped and transverse standing waves re set up in it. If u (x, y) denotes the displacements of the plate at the point (x, y) at some instant of time, the possible expression (s) for u is (are) (a = positive constant):
(A) a cos (πx/2L) cos (πy/2L)
(B) a sin (πx/L) sin (πy/L)
(C) a sin (πx/L) sin (2πy/L)
(D) a cos (2πx/L) sin (πy/L)

**16.** A force F= K(y î + x ĵ) (where K is a positive constant) acts on a particle moving in the xy plane. Starting from the origin, the particle is taken along the positive x-axis to the point (a, 0) and then parallel to the y-axis to the point (a, a). The total work done by the force F on the particle is:
(A) –2Ka2                                 (B) 2Ka2
(C) –Ka2                                    (D) Ka2

**17.** A small square loop of wire of side l is placed inside a large square loop of wire of side L(L >> l). The loops are coplanar and their centres coincide. The mutual inductance of the system is proportional to :
(A) l/L                                        (B) I2/L
(C) L/l                                        (D) L2/l.