

Max. Marks: 60

ABHIMANYU BATCH PHYSICS : DCT Topic: Semi Conductors

- 1. If n_v and n_h represent the number of free electrons and holes respectively in a semiconducting material, then for N-type semiconducting material
 - $(a) \qquad n_e << n_h \qquad (b) \qquad n_e >> n_h \qquad (c) \qquad n_v = n_h \qquad (d) \qquad n_e = n_h = 0$
- 2. In extrinsic P and N-type semiconductor materials, the ratio of the impurity atoms to the pure semiconductor atoms is about
 - (a) 1 (b) 10^{-1} (c) 10^{-4} (d) 10^{-7}
- 3. Which of the following statements is true for an N-type semi-conductor
 - (a) The donor level lies closely below the bottom of the conduction band
 - (b) The donor level lies closely above the top of the valence band
 - (c) The donor level lies at the halfway mark of the forbidden energy gap
 - (d) None of these
- 4. Intrinsic semiconductor is electrically neutral. Extrinsic semiconductor having large number of current carries would be
 - (a) Positively charged
 - (b) Negatively charged
 - (c) Positively charged or negatively charged depending upon the type of impurity that has been added
 - (d) Electrically neutral

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5. The width of forbidden gap in silicon crystal is 1.1 eV. When the crystal is converted in to to a N-type semiconductor the distance of Fermi level from conduction band is

(b)

Greater in N region

- (a) Greater than 0.55 eV (b) Equal to 0.55 eV
- (c) Lesser than 0.55 eV (d) Equal to 1.1 eV
- 6. In a P-N junction diode if P region is heavily doped than n region then the depletion layer is
 - (a) Greater in P region
 - (c) Equal in both region (d) No depletion layer is formed in this case
- 7. A crystal diode is a
 - (a) Non-linear device (b) Amplifying device
 - (c) Linear device (d) Fluctuating device
- 8. Which one of the following statements is not correct
 - (a) A diode does not obey Ohm's law
 - (b) A PN junction diode symbol shows an arrow identify the direction of current (forward) flow
 - (c) An ideal diode is an open switch
 - (d) An ideal diode is an ideal one-way conductor
- 9. Hole is
 - (a) An anti-particle of electron
 - (b) A vacancy created when an electron leaves a covalent bond
 - (c) Absence of free electrons
 - (d) An artificially created particle

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- 10. What is the current in the circuit shown below 3000 10 4V $10^{-2} A$ (a) 0 A (b) (c) 1 A (d) 0.10 A On increasing the reverse bias to a large value in a PN-junction diode, current 11. (a) Increases slowly (b) Remains fixed (c) Suddenly increases (d) Decreases slowly In P-N junction, avalanche current flows in circuit when biasing is 12. Forward (b) Reverse (d) Excess (a) (c) Zero 13. What is the order of the reverse saturation current before breakdown in a zener diode Ampere (b) Milli-ampere (a) (c) It depends on the applied voltage (d) Micro-ampere 14. Avalanche breakdown is due to Collision of minority charge carrier (b) Increase in depletion layer thickness (a) Decrease in depletion layer thickness None of these (c) (d) 15. Avalanche breakdown in a PN junction diode is due to Sudden shift to Fermi level (a) (b) Increase in the width of forbidden gap Sudden increase of impurity concentration (c)
 - (d) Cumulative effect of increased electron collision and creative of added electron hole pairs

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ABHIMANYU BATCH MATHEMATICS : DCT Topic: Definite Equation

The order and degree of differential equation $\begin{vmatrix} x^2 & y^2 & 1 \\ x & y\alpha & 0 \\ 1 & y\alpha^1 + \alpha^2 & 0 \end{vmatrix} = 0$, where $a^1 = \frac{dy}{dx}$ are 16. 1.2 (a) 2,1 (b) (d) 1,1 The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c > 0 is a parameter is of order 17. and degree as follows: 2,2 1,1 (a) (b) 1.3 (c) (d) 1, 2 The order of the differential equation whose general solution is 18. $y = c_1 e^{2x+c_2} + c_3 e^x + c_4 \sin(x+c_5)$ is _____ (a) (b) 3 2 (c) (d) 4 19. Which of the following equations has the same order and degree? (b) $\frac{d^4 y}{dt^4} c + \left(\frac{dy}{dx}\right)^2 \int_{0}^{3/2} dx$ $\frac{\mathrm{d}^3 x}{\mathrm{d}t^3} + \frac{\mathrm{d}^2 x}{\mathrm{d}t^2} + \left(\frac{\mathrm{d}x}{\mathrm{d}t}\right)^2 = 0$ (a) $y\frac{d^2y}{dx^2} = y^2 + 1$ (d) $\sqrt{1-y^2}dx + \sqrt{1-x^2}dy = 0$ (c) 20. The differential equation which represents the family of curves $y = e^x (A \cos x + B \sin x)$ is (c) $y_2 = 2y_1 - 2y$ (d) $y_2 = 2y_1 + y_2$ $y_2 = 2y_1 - y_1$ $y_2 = y_1 - 2y$ (b) (a) From the differential equation of the equation $y = c_1 x^2 + c_2 x$ is 21. $x^2y'' + 2xy' - 2y = 0$ (b) (d) $x^{2}y'' - 2xy' + 2y = 0$ $x^{2}y'' + 2xy' + 2y = 0$ (a) $x^2y'' - 2xy' - 2y = 0$ (c) If the differential equation of the equation $y = a + be^{5x} + ce^{-7x}$ is Ay''' + By'' + Cy' = 0, then the value of $A + B + be^{5x} + ce^{-7x}$ 22. C is (a) 32 (b) (c) -32 (d) 2 -11

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23. Form a differential equation of
$$\sqrt{1-x^2} + \sqrt{1-y^2} = \alpha(x-y)$$
 is
(a) $y_1 = \sqrt{\frac{1+x^2}{1+y^2}}$ (b) $y_1 = \sqrt{\frac{1-x^2}{1-y^2}}$ (c) $y_1 = \sqrt{\frac{1+y^2}{1+x^2}}$ (d) $y_1 = \sqrt{\frac{1-y^2}{1-x^2}}$
24. The differential equation of the family of circles passing through the points (2, 0) and (-2, 0) is
(a) $(x^2 - y^2 - 4)y_1 = 2xy$ (b) $(x^2 - y^2 + 4)y_1 = 2xy$
(c) $(x^2 + y^2 - 4)y_1 = 2xy$ (d) $(x^2 - y^2 - 4)y_1 + 2xy = 0$
25. The differential equation of family of circles which are passing through the origin and having their centres on the
Y-axis is
(a) $(x^2 + y^2)y_1 = 2xy$ (b) $(x^2 + y^2)y_1 = xy$ (c) $(x^2 - y^2)y_1 = 2xy$ (d) $(x^2 - y^2)y_1 = 2xyy_1$
26. The differential equation of all circles in XY plane with centres on the Y-axis and radius r is $x^2 = (a - x^2)\left(\frac{dy}{dx}\right)^2$, then the value of a is
(a) 1 (b) r (c) r^2 (d) $\frac{1}{r^2}$
27. The differential equation of all parabolas whose axes are parallel to the Y-axis is
(a) $y_3 = 1$ (b) $y_3 = -1$ (c) $y_3 = 0$ (d) $y_3 + y_1 = 0$
28. The general solution of the differential equation $(e^y + 1)\cos x \, dx + e^y \sin x \, dy = 0$ is
(a) $-\sin x (1 - e^y) - c$ (b) $\sin x + (1 + e^y) - c$ (c) $\sin x (1 + e^y) - c$ (d) $\sin x - (1 + e^y) - c$
29. The general solution of $\frac{dx}{dt} = \frac{x \log x}{t}$ is
(a) $x = e^t$ (b) $x = c^t$ (c) $x = c^4$ (d) $x = e^4$
30. The general solution of $\frac{dy}{dx} = x\sqrt{100 - x^2}$ is
(a) $3y = c + (100 - x^2)^{3/2}$ (b) $3y = c - (100 - x^2)^{3/2}$
(c) $3y = c + (x - 100)^{3/2}$ (b) $3y = c - (100 - x^2)^{3/2}$

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ABHIMANYU BATCH PHYSICS : DCT ANSWER KEY Topic: Semi Conductors

1.	(b)	2.	(d)	3.	(a)	4.	(d)	5.	(c)
6.	(b)	7.	(a)	8.	(c)	9.	(b)	10.	(a)
11.	(c)	12.	(b)	13.	(d)	14.	(a)	15.	(d)

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ABHIMANYU BATCH MATHEMATICS : DCT ANSWER KEY Topic: Definite Equation

16.	(a)	17.	(b)	18.	(d)	19.	(d)	20.	(c)
21.	(b)	22.	(c)	23.	(d)	24.	(a)	25.	(c)
26.	(c)	27.	(c)	28.	(c)	29.	(b)	30.	(b)