

# BSC. PART - II EXAMINATION - 2018

## PHYSICS HONOURS PAPER III

Answer five questions in all selecting two questions from Group - B and C each. Group - A (Q. No. 1) is compulsory.

### Group - A

1. Answer all questions by choosing correct answer out of the given alternatives for each of them :

(i) The correct expression relating energy ( $E$ ) to mass ( $m$ ) is given as :

(a)  $E = m^2 c^2$     (b)  $E = m^2 c$     (c)  $E = mc^2$     (d)  $E = \frac{m}{c^2}$

(ii) Thevenin's theorem reduces a two-terminal network to a :

- (a) Current source in parallel with an impedance
- (b) Voltage source in series with an impedance
- (c) Voltage source in parallel with an impedance
- (d) Current source in series with an impedance

(iii) In Boolean Algebra,  $Y = A + B$  implies :

- (a)  $Y$  equals  $A$  or  $B$     (b)  $Y$  equals  $A$  and  $B$
- (c)  $Y$  equals neither  $A$  nor  $B$     (d) None of the above

(iv) If  $E$  be the energy of a relativistic particle having a momentum  $p$ , the following relation holds good

(a)  $p = EC$     (b)  $p = \frac{E}{C}$     (c)  $p = \frac{C}{E}$     (d)  $p = \frac{E^2}{C^2}$

(v) Intrinsic silicon doped with phosphorus will produce

- (a) n-type semiconductor    (b) p-type semiconductor
- (c) Intrinsic semiconductor    (d) insulator

(vi)  $\vec{\nabla} \times \vec{\nabla} \psi$  is equal to <http://www.tmbuonline.com>

- (a) 1    (b) Zero    (c) Meaningless    (d) None of the above

(vii) Variation of mass with velocity is given by :

(a)  $m = m_0 \left( 1 - \frac{V^2}{C^2} \right)^{-\frac{1}{2}}$     (b)  $m = m_0 \left( 1 - \frac{V^2}{C^2} \right)$

(c)  $m = m_0 \left( 1 - \frac{V^2}{C^2} \right)^{\frac{1}{2}}$     (d)  $m = m_0 \left( 1 + \frac{V^2}{C^2} \right)^{-\frac{1}{2}}$

(viii) Relation between FET parameters viz  $\mu$ ,  $r_d$  and  $g_f$  is given by

- (a)  $\mu = r_d \cdot g_f$     (b)  $r_d = \mu \cdot g_f$     (c)  $\mu = \frac{g_f}{r_d}$     (d) None of the above

(ix) Decimal number corresponding to binary number 10110010 is :

- (a) 278    (b) 178    (c) 50    (d) None of the above

(x) The parameters  $\alpha$  and  $\beta$  of a transistor are related as :

(a)  $\beta = \frac{\alpha}{1+\alpha}$  (b)  $\beta = \frac{\alpha}{1-\alpha}$  (c)  $\beta = \frac{1-\alpha}{\alpha}$  (d)  $\beta = \frac{1+\alpha}{\alpha}$

**GROUP - B**

2. State and prove Gauss's divergence theorem.
3. Write down Laplace's equation in spherical polar coordinates and find its solution. Apply this equation to find the capacity of a spherical condenser.
4. Use Lorentz transformation equation to explain 'Lorentz Contraction', time dilation and twin paradox'.
5. Derive the expression for variation of mass with velocity. Find the expression for the rest mass of a photon.

**GROUP - C**

6. State and prove maximum power transfer theorem.
7. Discuss the working of BJT and FET transistors and mention their relative merits.
8. Explain the Barkhausen criterion of sustained oscillations. Discuss the working of Hartley oscillator with necessary circuit diagram.
9. Write short notes on any two of the following :  
(a) JK Flip flops (b) Characteristics of BJT in different modes of connection  
(c) Boolean Algebra (d) Unijunction transistor as a relaxation oscillator.