

BSC. PART - II EXAMINATION - 2014

PHYSICS HONOURS PAPER III

Q. No. 1 is compulsory. Answer two questions from each of Group - A and Group - B.

1. (a) A spaceship moves towards you at $\frac{1}{3}C$, where C is the speed of light. The spaceship emits a beam of light in your direction. As measured in your frame of reference, the speed of light emitted by the spaceship is :

- (i) $\frac{4}{3}C$ (ii) C (iii) $\frac{2}{3}C$ (iv) $\frac{1}{3}C$

(b) The predictions of special relativity appear to us to be counterintuitive because:

- (i) They only apply to the behaviour of microscopic particles, like electrons
(ii) They apply only to inanimate objects like clocks and rods, and not to human beings
(iii) They are only noticeable at speeds much higher than we normally experience
(iv) Our intuition is based on experiences we have as infants, before we learn physics.

(c) A train is 200 feet long in its own frame, and a railway platform is 160 feet long in its own frame. The train rushes past the platform so that, in the platform's frame, the train and the platform are the same length. How fast was the train moving?

- (i) $\frac{4}{5}C$ (ii) $\frac{5}{4}C$ (iii) $\frac{3}{5}C$ (iv) $\frac{4}{3}C$

(d) Equation of continuity for a liquid flow can be expressed as :

- (i) $\text{div } \vec{v} = 0$ (ii) $\text{curl } \vec{v} = 0$ (iii) $\text{div } \vec{v} \neq 0$ (iv) $\text{curl } \vec{v} \neq 0$

(e) The partial differential equation $\frac{\partial^2 u}{\partial x^2} - C^2 \frac{\partial^2 u}{\partial t^2} = 0$ is :

- (i) Wave equation (ii) Heat equation (iii) Laplace equation (iv) None of these

(f) The MOSFET switch in its on-state may be considered equivalent to :

- (i) Resistor (ii) Inductor (iii) Capacitor (iv) Battery

(g) Negative feedback in an amplifier :

- (i) Reduces gain (ii) Increase frequency and phase distortion
(iii) Reduces band width (iv) Increases noise

(h) Which of the following is not associated with a p - n junction ?

- (i) Junction capacitance (ii) Charge storage capacitance
(iii) Depletion capacitance (iv) Channel length modulation

(i) The output of an AND gate with three inputs A, B and C is HIGH when :

- (i) $A = 1, B = 1, C = 0$ (ii) $A = 0, B = 0, C = 0$
(iii) $A = 1, B = 1, C = 1$ (iv) $A = 1, B = 0, C = 1$

(j) How many buses are connected as part of the 8085 A microprocessor ?

- (i) 2 (ii) 3 (iii) 5 (iv) 8

GROUP - A

2. State and prove Gauss's divergence theorem.
3. Obtain the solution of three dimensional wave equation by the method of separation of variables.
4. Describe Michelson-Morley experiment. How null result has been explained?
5. On the basis of Lorentz transformation equations explain the length contraction and times dilation.

GROUP - B

6. What is p-n junction diode? Explain its I-V characteristic.
7. Explain, with a neat diagram, the Bipolar junction Transistor Characteristics for common emitter configuration.
8. What is Barkhausen criterion of oscillation? Describe the working of a Hartley's Oscillator using a circuit diagram.
9. Discuss various types of memory. Explain ROM and RAM organisation and method of addressing.
10. Write short notes on any two of the following : (a) Clippers and limiters (b) MOSFET (c) NMOS and CMOS circuits (d) Two part analysis of an electrical network

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