



RAN-1008

Third Year B. Sc. (Semester -V) Examination

March / April - 2019

Physics : Paper - VII

Electromagnetism and Optics

(New Course)

[Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of signs on your answer book

Name of the Examination:

Third Year B. Sc. (Semester -V)

Name of the Subject :

Physics : Paper - VII

Subject Code No.: 1 0 0 8

Seat No.:

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Student's Signature

Instructions:

- (1) Figures to the right indicate the total marks carried by the question.
- (2) Symbols used in the question paper have their usual meanings.
- (3) Students are permitted to use non-programmable scientific calculator.

Q:1 Answer the following in brief. (Any eight).

(8)

- (1) What is the difference between a dielectric and an insulator?
- (2) Which phenomenon of light is responsible for the blue color of the sky during the daytime?
- (3) What is motional emf?
- (4) State Lenz's law.
- (5) What do you understand by Debye length in plasma?
- (6) Can white light be used in obtaining interference fringes in Michelson's interferometer?

(7) Magnetic flux associated with a coil varies as

$$\phi(t) = 3t^2 - 4t - 1 \text{ Wb.}$$

What will be the value of induced emf in it at $t = 2\text{s}$?

(8) What is/are the condition(s) to be satisfied for total internal reflection to take place?

(9) Define: electromagnetic induction.

(10) What are electrets?

Q:2(A) Attempt any one of the following. (10)

(1) State and explain Gauss' law in the presence of dielectric.

Also derive boundary conditions on \vec{D} and \vec{E} across the interface of the dielectrics.

(2) Derive an equation for the self-inductance per unit length of a long straight wire.

(B) Solve any one of the following. (4)

(1) A parallel plate capacitor has square plates with side 5 cm kept at a separation of 2 mm . The region between the two plates is completely filled with a dielectric of dielectric constant 2.4 , what will be value of its capacitance? How much charge will be deposited on its plates if it is connected to a battery of 10 V ?

(2) A long solenoid has 200 turns per cm . If a current of 5 A is passed through it, what will be its self-inductance per unit length? The diameter of the solenoid is 4 cm .

Q:3(A) Attempt any one of the following. (10)

(1) Explain the principle on which the optical fibers operate. Explain numerical aperture in the case of optical fibers.

(2) Give the construction and working of Michelson's interferometer.

(B) Solve any one of the following. (4)

(1) When the movable mirror in the Michelson's interferometer is moved through a distance of 0.0589 mm , 200 fringes cross the field of view. What is the wavelength of the light used in it?

(2) What will be the critical angle when a glass slab having refractive index 1.68 is (i) kept in air and (ii) immersed in water? The refractive index of water is $4/3$.

Q:4 Write short note on any two of the following.

(14)

- (i) Polarization charge density
 - (ii) Skin effect
 - (iii) Pinch effect in plasma
 - (iv) Losses in optical fibers
 - (v) Haidinger's fringes
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