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[4224] - 201

M.Sc.

PHYSICS

PHY UTN - 601 : Electrodynamics

(2008 Pattern) (Sem. - II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates :

- 1)

Question No. 1 is compulsory and solve any four questions from the remaining.
- 2)

Draw neat labelled diagrams wherever necessary.
- 3)

Figures to the right indicate full marks.
- 4)

Use of logarithmic tables and pocket calculator is allowed.
- Q1)

Attempt any four of the following :
- a)

Determine the skin-depth for copper at 1 MHz.  
Given :  $\mu \simeq \mu_0 = 4\pi \times 10^{-7}$  Wb/A-m and  $\sigma = 5.8 \times 10^7$  mho/m. [4]
- b)

The earth receives about 1300 watt/m<sup>2</sup> radiant energy from the sun. Assuming the normal incidence, calculate magnitude of electric field vector in sun light. Given :  $\epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N-m^2}$  and  $\mu_0 = 4\pi \times 10^{-7} \frac{Wb}{A-m}$ . [4]
- c)

Find the velocity at which the mass of the particle is double it's rest mass. Given :  $c = 3 \times 10^8$  m/sec. [4]
- d)

Calculate the electric field associated with a LASER beam having energy density 10<sup>6</sup> J/cm<sup>3</sup>. [4]
- e)

Two identical bodies move towards each other, the speed of each being 0.9 C. Find their speed relative to each other. [4]
- f)

Write the expression for force describing magnetic interaction between two current loops. [4]
- Q2)

a) If a medium is moving with a velocity  $\vec{u}$ , then show that the Faraday's law has the form  $\vec{\nabla} \times (\vec{E}' - \vec{u} \times \vec{B}) = -\frac{\partial \vec{B}}{\partial t}$ . [8]
- P.T.O.

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[4124] - 204

M.Sc. (Sem. - II)

PHYSICS

PHY UTN - 604 : Quantum Mechanics - II

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1)

Question No. 1 is compulsory. Attempt any four from the remaining.
- 2)

Figures to the right indicate full marks.
- 3)

Draw neat figures wherever necessary.
- 4)

Use of mathematical tables and calculator allowed.
- Q1)

Attempt any four of the following.
- a)

The harmonic oscillator is perturbed by  $H' = bx^4$ . Obtain first order perturbation in energy in n<sup>th</sup> state.  
 $\left( \text{Given : } \langle n | x^4 | n \rangle = \frac{3}{4\alpha^2} (2n^2 + 2n + 1) \right)$  [4]
- b)

Interpret the concept of Identical particles. What is difference between bosons and fermions? [4]
- c)

State the conditions for the validity of Born Approximation for scattering. [4]
- d)

Apply the WKB method to calculate the energy eigen values corresponding to harmonic oscillator potential,  $v(x) = \frac{1}{2}mw^2x^2$ . [4]
- e)

Using trial wave function  $\psi(x) = Ae^{-\alpha x^2}$ , where  $\alpha$  is variation parameter, obtain an upper bound for ground - state energy of linear harmonic oscillator. [4]
- f)

The transition probability for constant perturbation from time 0 to  $t$  is given by  
$$|a_n^{(1)}(t)|^2 = \frac{|H'_{nl}|^2}{\hbar^2} \cdot \frac{4\sin^2\left(W_{nl} \frac{t}{2}\right)}{W_{nl}^2}$$
  
Interpret it graphically as a function of  $w_{nl}$  for fixed  $t$ . [4]
- P.T.O.

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10. किसी परावैद्युत पदार्थ में ध्रुवन की प्रक्रिया समझाइये। परावैद्युत पदार्थ के लिए क्लॉसियस-मोसोटी का समीकरण व्युत्पादित कीजिए तथा इसकी कमियाँ बताइये।

Describe the mechanism of polarization in a dielectric material. Derive Clausius-Mosotti equation for a dielectric and give its limitations.

11. (अ) विषमचुम्बकीय, परा-चुम्बकीय एवं लौहचुम्बकीय पदार्थों में अन्तर उदाहरण सहित समझाइये।

Explain the difference in diamagnetic, paramagnetic and ferromagnetic materials with example.

- (अ) 10 सेमी. दूरी पर स्थित दो लम्बे समानान्तर तारों में 25 एम्पियर की धारा बह रही है। इन दोनों की प्रति इकाई लम्बाई में लगने वाले बल की गणना कीजिए।

A current of 25 ampere is flowing through two long parallel wires which are 10 cm apart. Compute the force per unit length of each wire.

12. मैक्सवेल के समीकरणों की सहायता से तरंग समीकरण स्थापित कीजिए। विद्युत चुम्बकीय तरंगों के लिए ऊर्जा घनत्व तथा पॉयंटिंग सिद्धान्त समझाइये।

Establish wave equations with the help of Maxwell's equation. Explain the energy density and Poynting theorem for electromagnetic wave.

13. निम्नलिखित पर संक्षिप्त टिप्पणियाँ लिखिए : प्रत्येक  $7\frac{1}{2}$

- (i) अन्वोय प्रेरण  
(ii) ऐम्पियर का वृत्तीय नियम

Write short notes on the following :

- (i) Mutual induction  
(ii) Ampere's circuital law

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6. मैक्सवेल के समीकरण लिखिए तथा इनके महत्व बताइये।

Write Maxwell's equations and state their importance.

7. स्व-प्रेरण का क्या महत्व है ? एक परिनालिका के स्व-प्रेरण के लिए संबंध निकालिए।

What is the significance of self-induction ? Derive the relation for self-induction of a solenoid.

खण्ड—B

प्रत्येक 15

(Section—B)

8. रेखीय समाकलन को उदाहरणों सहित समझाइये। एक सूक्ष्म आयत के आस-पास सदिश क्षेत्र के लिए रेखीय समाकलन का सूत्र निकालिए।

Explain line integral with examples. Derive the formula for line integral of a vector field around a infinitesimal rectangle.

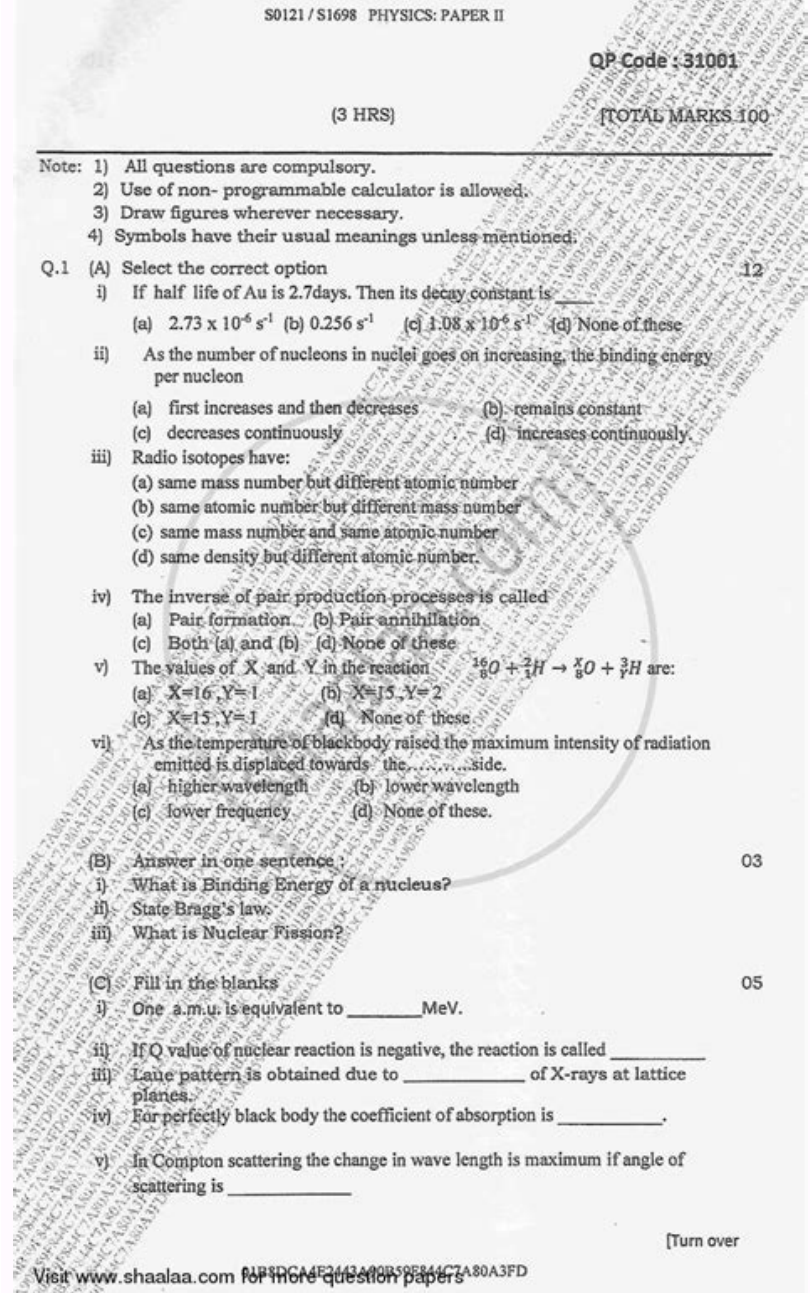
9. एकसमान रूप से आवेशित चक्रिका (डिस्क) के कारण निम्न स्थितियों में विद्युत क्षेत्र एवं विद्युत विभव के व्यंजक निकालिए :

- (i) एक अक्षीय बिन्दु पर  
(ii) चक्रिका के केन्द्र से सुदूर बिन्दु पर  
(iii) चक्रिका के किनारे पर।

Derive the expression for electric field and potential due to a uniformly charged disc under the following positions :

- (i) At an axial point  
(ii) At long distance point  
(iii) At the rim of the disc.





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