

SVKM's NMIMS

MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B. Tech (All Streams)

Year: I

Semester: I

Academic Year: 2019-20

Subject: Physics

Marks: 100

Date: 08 November 2019

Time: 10.00 am - 1.00 pm

Durations: 3 (hrs)

No. of Pages: _____

Final Examination (2019-20)/ Re-Examination (2018-19)

Instructions:

- 1. Question 1 is compulsory.
- 2. Out of remaining questions, attempt any 4 questions.
- 3. In all 5 questions to be attempted.
- 4. All questions carry equal marks.
- 5. Assume suitable data if necessary.

Given fundamental constants: $h = 6.625 \times 10^{-34}$ J-s $= 4.14 \times 10^{-15}$ eV-s. $c = 3 \times 10^8$ m/s. $k = 1.38 \times 10^{-23}$ J/K.

$m_e = 9.1 \times 10^{-31}$ kg. $e = 1.602 \times 10^{-19}$ C. $\mu_0 = 4\pi \times 10^{-7}$ H/m. $\epsilon_0 = 8.854 \times 10^{-12}$ F/m]

Compulsory

Attempt any ten (10) questions.

Q. 1 List any four differences between step index and graded index fibres. 2

A.

Q. 1 State any four condition needed for sustainable interference. 2

B.

Q. 1 Define coherent sources. State two methods to obtain coherent sources. 2

C.

Q. 1 How orientation polarization vary with temperature? 2

D.

Q. 1 Define dielectric susceptibility and polarizability, also mention the formula to find total 2

E. polarizability.

What is Debye unit?

Q. 1 State Heisenberg's uncertainty principle.

G.

Q. 1 State Kirchhoff's law of blackbody radiation.

H.

Q. 1 What is ultra-violet catastrophe?

I.

Q. 1 An optical fiber has core refractive index (n_1) and cladding refractive index (n_2) as 1.49 and 1.41, respectively. Determine its numerical aperture and the critical angle at the core-cladding interface.

Q. 1. Two parallel plates having equal and opposite charge are separated by a 2 cm thick slab that has dielectric constant 3. If the electric field inside is 10^6 V/m. Calculate the displacement vector.

Q. 1 Uncertainty in time of an excited atom is about 10^{-8} s. What is the uncertainty in energy?

Optional

Q. 2 Discuss the phenomenon of interference in thin parallel films and derive the conditions for maxima and minima of light reflected from a thin transparent film of uniform thickness.

Q. 2 The critical angle of incidence for total reflection in case of water is 48° . What is the polarization angle? What is the angle of refraction corresponding to the polarization angle?

Q. 2 Explain in detail any two methods of production of polarized waves.

C.

Q. 3 Write a note on Fraunhofer diffraction. Draw the self-explanatory diagram to explain

- A. the formation of diffraction pattern through single slit, double slit and grating. Also state the general expression for intensity in case of single slit, double slit and grating, name each symbol used in the equations. Using that expression, draw the intensity distribution curve for the single slit, double slit and grating.
- Q. 3 Calculate the minimum thickness of soap film of refractive index 1.33 which will appear yellow (wavelength = 5893 Å) in reflected light when it is exposed to white light at an angle of 45°. 6
- Q. 3 Explain how the concept of displacement current help in removing discrepancy in Ampere's law. 4
- Q. 4 Deduce Internal field/ Lorentz equation for a solid dielectric material. 10
- A.
- Q. 4 Two small identical conducting spheres have charges of 2 nC and -0.5 nC respectively. 6
- B. When they are separated by 4 cm apart, calculate the magnitude of the force between them. If they are brought into contact and then again separated by 4 cm, find the force between them. Also comment about the type of forces in each case.
- Q. 4 Write four Maxwell's equations of electromagnetism in differential form. 4
- C.
- Q. 5 Explain ferromagnetism with Weiss domain theory. Prove that the losses in case of magnetization and demagnetization process can be calculated by the area under the B-H curve. 10
- A.
- Q. 5 Explain dielectric strength. A metallic sphere of 1 m diameter is immersed in oil of relative permittivity 2.5 and dielectric strength of 8×10^6 V/m. Calculate maximum amount of charge that can be held on the sphere. 6
- B.
- Q. 5 Explain blackbody radiation with its spectral diagram. Discuss Planck's hypothesis to explain the blackbody radiation. 4
- C.
- Q. 6 Explain Compton Effect and derive expression for Compton shift with the help of a suitable diagram. 10
- A.

Electron beam is accelerated from rest through a potential difference of 200 V. (i) Calculate the associated wavelength. (ii) This beam is passed through a diffraction grating of spacing 3 \AA . At what angle of deviation from the incident direction will be the first maximum observed?

Q. 6 Write the energy eigenvalues of a quantum harmonic oscillator and comment on the zero point energy.

Q. 7 Explain Davisson-Germer experiment and show that it experimentally validates de Broglie hypothesis.

Q. 7 An electron is confined to a potential well of width 10 nm. Calculate the minimum uncertainty in its velocity.

Q. 7 Define Resolving power and Dispersive power of grating with its mathematical form.