

TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**

2081 Baishakh

Exam.	Regular (New Course - 2080 Batch)		
Level	BE	Full Marks	60
Programme	BEL, BEI, BCT, BAM, BIE, BGE, BAS	Pass Marks	24
Year / Part	I / I	Time	3 hrs.

**Subject: - Engineering Physics (SH 102)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define negative energy. [1]  
b) Explain the principle on which optical fiber works. [1]  
c) In which condition the dipole experience the maximum torque when it is placed in electric field? [1]  
d) Why and how Maxwell modified Ampere's law? [1]
2. a) Write an expression for amplitude of damped harmonic oscillator. Also plot a graph between amplitude and time to show different types of damping. [2]  
b) Calculate the change in entropy when 5 kg of water at 100°C is converted into steam at the same temperature. (Given latent heat of steam=540cal/gm). [2]  
c) The maximum electric field 10 m from an isotropic point source is 2 V/m. Calculate the value of maximum magnetic field at that point. [2]  
X d) State and explain Heisenberg's uncertainty principle. [2]
3. Prove that time period of oscillation is minimum when length of the pendulum is equal to radius of gyration in bar pendulum. [4]

OR

An object of mass 0.1 kg hung from a spring whose force constant is 100N/m. A resistive force  $-bv$  acts on the object with  $b = 1 \text{ N s/m}$ . The Object is subjected to a harmonic driving force in the form  $F_0 \cos \alpha t$ , where  $F_0 = 2\text{N}$  and  $\alpha = 50 \text{ rad/s}$ . In the steady state what is the amplitude of the oscillation and the phase relative to applied force. [2+2]

4. What is reverberation? Derive Sabine's relation. [1+3]
5. Define Pyrheliometer. Explain the construction and working of Pyrheliometer. [1+3]

OR

Establish the Clausius-Clapeyron's equation  $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$  and explain the effect of increase in pressure on boiling point of liquid and melting point of solid. [4]

6. a) White light is incident on a soap film at an angle  $\sin^{-1}(4/5)$  and the reflected light on examination by a spectrometer shows a dark band. The consecutive dark bands correspond to wavelength  $6.1 \times 10^{-5} \text{ cm}$  and  $6 \times 10^{-5} \text{ cm}$  overlap. If the refractive index of the film is 1.33 for the film, calculate its thickness. [4]
- X b) What are retardation plates? Find out an expression to find the thickness of a retardation plate that produces elliptically polarized light. [4]
- c) In a Fraunhofer's diffraction through a single slit, show that the intensity of the first secondary maximum is 4.5% of that of the principal maximum. [4]
- X d) Two thin converging lenses of focal length 3cm and 4cm respectively are placed coaxially in air and separated by a distance of 2cm. An object is placed 4cm in front of the first lens. Find the position and nature of the image. [4]

7. a) Derive an expression of electric field intensity on the axis of charged plastic ring of radius  $R$  and show that electric field is maximum at a distance  $\frac{R}{\sqrt{2}}$  from the center of ring. [4]

OR

Derive electric potential at any point due to an electric dipole and extend your result for the axial line. [3+1]

- b) An air-filled parallel plate capacitor has a capacitance of 1.32 pF. The separation of the plates is doubled and wax is inserted between them. The new capacitance is 2.57 pF. Find the dielectric constant of the wax. [4]
8. Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from Dees. The frequency of the applied emf is 10MHz. Find the flux density of the magnetic field and the velocity of deuterons emerging out of the cyclotron. Mass of deuteron =  $3.32 \times 10^{-27}$  Kg, charge =  $1.6 \times 10^{-19}$  C. [4]
9. Sun light just outside the Earth's atmosphere has an intensity of  $1.4 \text{ kW/m}^2$ . Calculate maximum electric and magnetic fields for sun light, assuming it to be a plane wave. [4]
10. Prove that energy states are quantized if the particle is confined in an infinitely deep one-dimensional potential well and hence determine the wavefunction. [4]

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$f \approx 2.4$

$x =$