Exam.		Regular		
Level	DE		Full Marks	80
Programme	BCE, BME, BGE		Pass Marks	32
Year / Part	I / II		Time	3 hrs.

Subject: - Engineering Physics (SH452)

✓ 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. How forced E-M oscillation is set up? Write the differential equation with its solution of such oscillation. And hence discuss about resonance curve and significance of Quality factor. [1+2+2]

2. A mass of 1 kg is suspended from a spring of spring constant 25N/m. If the undamped frequency is $\frac{2}{\sqrt{3}}$ times the damped frequency, what will be the damping factor? [5]

3. At t = 0; the displacement x(0) of the block in linear oscillator is -8.50 c.m. The Block's velocity v(0) then is -0.920 m/s and its acceleration a(0) is 47 m/s². Find [2.5+2.5]

   a) Angular frequency b) Phase constant

4. How Newton's Rings are differ from Haidinger fringes? Derive an expression for the diameter of bright rings in transmitted light. How can you obtain central fringe dark in this system? [1+3+1]

   OR

   Define diffraction of light. Show that the intensity of first maxima is 1/22 of the central maxima. [1+4]

5. Show that fringe width of wedge shaped film is constant for a given wedge angle. [5]

6. A Quarter wave plate is meant for $\lambda_0 = 5.893 \times 10^{-5}$ cm. what phase retardation ϕ will show for $\lambda = 4.358 \times 10^{-5}$ cm? (Neglect changes of μ_0 and μ_e with λ) [5]

7. Define cardinal points of a coaxial lens system. Find the equivalent focal length for the combination of two coaxial thin lens of focal length 'f_1' and 'f_2' separated by a distance 'd'. [2+3]

8. Discuss the significance of numerical aperture (NA). How does it depend on refractive index of cladding and core? [2+3]

9. How Gauss law is superior than Columb's law? Show that the electric field on the axis of a uniformly charged disk is equal to the electric field near an infinite plane of charge in limiting case. [1+4]

10. Show that the motion of an electron constrained to move along the axis of a thin non conducting ring of radius 'a' uniformly and positively charged with linear charge density λ is simple harmonic if it is displaced a small distance 'x' along the axis (x<<a) and released. Hence find the oscillating frequency. [5]

OR

...tor of capacitance c is discharged through a resistor of resistance R. After how many time constants is the stored energy $\frac{1}{4}$ of its initial value?

11. Prove that the capacitance of a concentric spherical capacitor of radii a and b is $C = 4\pi\varepsilon_0[b^2/(b-a)]$. If outer plate is charged positively and inner sphere is earthed. [5]

12. A copper wire has cross-sectional area 3.31×10^{-6} m^2 and carries a current of 10 A. What is the drift speed of the electrons? (Density of copper = 8.95 gm cm^{-3}, Avogadro's number $N_A = 6.02 \times 10^{23}$ mol^{-1}, molar mass of copper = 64 gm) [5]

13. A circular parallel plate capacitor of area 154 cm^2 is being charged has a uniform current density of a displacement current, having a magnitude 20 A/m^2. Calculate (a) the magnitude of magnetic field at the distance r = 50 mm about the central axis between the plates. (b) dE/dt in this region [2.5+2.5]

14. With necessary circuit and graph, derive an expression for rise and fall of current in LR circuit. Hence explain the inductive time constant for this circuit. [2+3]

OR

What is cyclotron? Show that the maximum energy of the ion in cyclotron is directly proportional to the square of the frequency. [1+4]

15. Sunlight strikes the earth outside its atmosphere with an intensity of 2 Cal/cm^2-min. Calculate the magnitude of electric and magnetic fields. [5]

16. Using Schrodinger wave equation, calculate the values of the energy of a particle in an one-dimensional infinitely deep potential well. Indicate graphically the first three wave function for such a particle. [3+2]

***

Subject: - Engineering Physics (SH452)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define centers of suspension and oscillation of compound pendulum and show that they are interchangeable. What length of the pendulum has its maximum time period?

OR

Derive a differential equation for LC oscillation. Show that the maximum value of electric and magnetic energies stored in LC circuit is equal.

2. What are basic conditions for acoustics of buildings? Derive Sabine's reverberation formula and also write its two importances.

3. A rod vibrating at 12Hz generates harmonics waves with amplitude of 1.5 mm in a string of linear mass density 2gm/m. If the tension in the string is 15N, what is the average power supplied by the source.

4. Explain the circular nature of the Newton's interference fringes. Show that square of radius of the nth bright fringe of Newton's ring due to the reflected light is proportional to $2n-1$.

OR

Show that coherent light waves represented by equation $E_x = E_1 \sin(wt+\delta)$
$$E_y = E_2 \sin wt$$
Give rise generally to an elliptically polorised wave that can become linearly and circularly polorised wave under special condition.

5. What is the highest order spectrum which may be seen with monochromatic light of wavelength 600 nm by means of a diffraction grating with 4500 Lines/cm.

6. Write the physical significance of dispersive and resolving power of grating. Also establish the relation between them.

7. What is population inversion? Explain why laser action cannot occur without population inversion between atomic levels? Write a method for getting He-Ne Laser.

8. Two thin lens of focal length f_1 and f_2 separated by a distance d have equivalent focal length 50 cm. The combination satisfies the conditions for no chromatic aberration and minimum spherical aberration. Find the value of f_1, f_2 and d. Assume that both the lens are the same material.

9. What is quadruple? Derive an expression of the electric field intensity at a point due to quadruple at axial line?

OR

Find the expression for the electric field intensity at a point along the center perpendicular axis of the charge disk and distance z from center. Extend this result in infinite charge disk.

10. If copper coin has mass 3.11 gm, what is the total charge on the nucleus of the atoms in the coin? Also find number of protons inside the nucleus. Molar mass (M) = 63.5 gm/mole, Avogadro number (N_A) = 6.02×10^{23} atom/mole.

11. Discuss a microscopic view of ohm's law and show that resistivity of a conductor is independent of the external electric field.

OR

State and derive Ampere's law in magnetism. Why and how Maxwell modified it?

12. A circular coil having radius R carries a current I. Calculate the magnetic flux density at an axial distance x from the center of the coil. Explain how the coil bahaves for a large distance point and at what condition field will be maximum?

13. Find the expression for maximum energy of a rotating particle in a cyclotron. How cyclotron is different from synchrotron?

14. An inductance L is connected to a battery of emf E through a resistor. Show that the potential different across the inductance after time t is $V_L = Ee^{-(R/L)t}$. At what time is the potential difference across the inductance equal to that across the resistance such that $i = i_0/2$.

15. Write Maxwell equation in differential form. Convert them into internal form. Explain he physical significance of each of them.

16. Derive Schrodinger time independent wave equation. Explain the physical significance of the wave functions.

***

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

Exam.		BARRIER Only		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Physics (EG472SH)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Six** questions selecting **One** each from **Group A** and **Group D** and **Two** each from **Group B** and **Group C**.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

Group A

1. a) What is compound pendulum? What are the differences between simple pendulum and compound pendulum? Show that in a bar pendulum, there are four collinear points that have the same time period. Also prove point of suspension and point of oscillation are interchargable. [8]

   b) A mass of 1 kg is suspended from a spring of spring constant 25N/m. If the undamped frequency is $\frac{2}{\sqrt{3}}$ times the damped frequency, what will be the damping factor? [5]

2. a) What is reverberation? Obtain Sabine's formula and discuss what effect does the longer and shorter reverberation time make in an auditorium. [8]

   b) *A source of sound has a frequency of 256 Hz and amplitude 0.50 cm. Calculate the energy flow cross a square cm per sec. The velocity of sound in air is 330 m/s and density of air is 1.29 kg/m³.* [5]

Group B

3. a) Explain "optical pumping". How does laser light produce in He-Ne laser? Explain with energy levels. [9]

   b) Both surfaces of a double convex lens have radii of 28 cm. If the focal length is 26.2 cm, what is refractive index of the material of lens? [5]

4. a) What is interference? Obtain the relation obtaining the constructive and destructive interference in plane parallel film due to reflected light. [9]

   b) Suppose that Young's experiment is performed with light of wavelength 500 nm. The slits are 1.2 mm apart and viewing screen is 5.4 m from the slits. How far apart are the bring fringes near the center of the interference pattern? [5]

5. a) What is polarization of light? Obtain the mathematical relation to produce linearly, circularly and elliptically polarized light. [9]

   b) Light of wavelength 550 nm is incident normally on a grating that has 400 lines per mm. At what angle does the second order principle maximum occur? [5]

Group C

6. a) What is coulomb's law in electrostatics? Obtain an expression for electric field due to a line of charge. [8]

   b) Find an expression for electric potential due to a ring of charge of radius "a" at a distance y from the center of the ring. [5]

7. a) What is a capacitor? How many types of capacitor do you know? Show that charge at any instant in a capacitor decreases exponentially with maximum charge stored in the capacitor. Hence explain time constant. [8]

   b) What is drift velocity of copper wire if the diameter of copper wire is 12 mm carrying a current of 2.5A? (Take $N_A = 6.023 \times 10^{23}$/mole; at.wt. of copper = 64 gm/mole) [5]

8. a) State Faraday's law of electromagnetic induction. Show that the time constant in LR circuit is that time in which the electric current in the circuit will reach a vale of 1/e of its final equilibrium. [8]

   b) If earth is a spherical conductor of radius 6400 km, calculate the capacitance of earth. [5]

Group D

9. a) Discuss LC oscillation qualitatively, Then set up a differential equation for it. Also obtain a relation for its frequency. [8]

   b) Two capacitors of capacity 5µF are given. The series combination of the capacitors is connected to a 10 mH inductor. What will be the resonance frequency in such case? [5]

10. a) State Maxwell's equation in integral form convert them into differential form. Explain each of these equations. [8]

    b) Using Maxwell's equation prove the relation $\left[\dfrac{E}{B}\right] = C$, where the symbols have usual meanings. [5]

***