14 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAME, BIE, B. Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ 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) Deduce the time period of a simple harmonic vibration. Explain why a loaded bus is more comfortable than an empty bus. (3+2)

2) Explain forced oscillation with its differential equation. Write the relation for the frequency dependent amplitude and hence give a rough sketch of the resonance curve. (3+2)

Or

Calculate the average amplitude of a sinusoidal sound wave in air of a frequency of 1.5 KHz and average intensity 10-5W/cm^2, where density of air is 1.29kg/m^3. (5)

3) Give an account of bad acoustic properties of a hall and discuss the method to improve these defects. (5)

4) Explain the physical meaning of Dispersive and resolving powers of a Grating. Two spectral lines have wavelengths λ and $\lambda+\Delta\lambda$ respectively where $\Delta\lambda << \lambda$. Show that their angular separation $\Delta\theta$ in a grating spectrometer is $\Delta\theta = \frac{\Delta\lambda}{\sqrt{\left(\frac{d}{m}\right)^2 - \lambda^2}}$, where 'd' and 'm' are grating elements and no. of order respectively. (2+3)

Or

In newton's ring experiment, "Central spot is dark in reflected system" and "Fringes get closer as the no. of order increased" explain. Is it possible to make central spot bright in reflected system? If so how? (3+2)

5) A soap film $5*10^{-5}$ cm thick is viewed at an angle of 35° to the normal. Find the wavelength of the visible light which will be absent from the reflected light. (5)

6) Light of wavelength 580nm falls on a calcite crystal of certain thickness. The emerging light is circularly polarized. What must be the thickness of such crystal? (5)

7) Calculate the focal length of combination of two thin lenses of focal length f_1 and f_2 separated by a distance'd'. Find the position of two principal points. (5)

8) Trace the ray diagram that shows the propagation of light through the step and graded index optical fiber. Write the importance of self-focusing in an optical fiber. (3+2)

9) Charge of uniform density $\rho=3.2\mu C/m^2$ fills a non-conducting solid sphere of radius of 5.0 cm. What is the magnitude of the electric field a) at 3.5 cm b) 8.0 cm from the sphere's center (5)

Or

Two large parallel plates are separated by a distance of 5cm. The plates have equal but opposite charges that create an electric field in the region between the plates. An alpha particle ($q= 3.2*10^{-19}$ C, $m= 6.68*10^{-27}$kg) is released from the positively charged plate, and it strikes the negatively charged plate $2*10^{-6}$ sec later. Assuming that the electric field between plates is uniform and perpendicular to the plates, what is the strength of electric field? (5)

10) Calculate the potential at a point due to a uniform line of charge of length L at a distance D from its one end which lies in the perpendicular line. (5)

11) Explain how electric energy is stored in a capacitor and derive an expression for energy density of electric field. (2+3)

12) Explain super conductivity and its types with examples. Write the difference(s) between super conductor and perfect conductor. (3+2)

13) If a test charge revolves round a circular path of radius 8.5cm where the magnetic field increases at steady rate 0.13T/s, calculate the magnitude of induced electric field at a point 12.5 cm? (5)

14) Derive expression for inductances of a solenoid and toroid. Then show that inductance is the property of the coil. (5)

Or

What is Hall Effect? Write its importance. Show that the hall coefficient $R_H = -1/ne$, where the symbols have their own meanings. (1+1+3)

15) The Sun delivers about $10^3 W/m^2$ of energy to the earth's surface through EM radiation calculate a) the total power incident on a roof of dimensions 8m *20 m. b) Radiation pressure and force exerted on the roof, assuming roof is perfect absorber. (2+3)

16) A beam of electrons having energy of each 3ev is incident on a potential barrier of height 4ev .If the width of the barrier is 20nm, calculate the percentage transmission of the beam through the barrier. (5)

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14 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAME, BIE, B. Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Describe L.C oscillation qualitatively by using necessary circuits and graph.

OR

Define the terms sharpness of resonance and quality factor. Derive the relation of quality factor in terms of band width.

2. Define transverse wave. Develop a differential equation of the wave in a stretched string and then find the velocity of transverse wave.
3. A reverberation time of 2.3 sec is observed in a hall of volume 5500 m^3. The sound absorbing surface of the hall has an area of 750 m^2. Calculate the average absorption coefficient.
4. What are constructive and destructive interference? Prove that the path difference for constructive interference is integer multiple of λ and that for destructive interference is odd integer multiple of $\lambda/2$.

OR

How can you distinguish the plane, circularly and elliptically polarized light by using nicol prised and wave plate?

5. What is diffraction of light? Explain the dispersive power and resolving power of a diffraction grating. Derive the relation and also relate them.
6. A 30 cm long polarimeter tube containing 50 cm^3 of sugar solution produces an optical rotation 14.5° when placed on a polarimeter tube. If the specific rotation of sugar solution is 65°, calculate the quantity of sugar contained in the tube.
7. Two thin converging lenses of focal lengths 30 cm and 40 cm respectively are placed co-oxially in air separated by a distance of 20 cm. An object is placed 40 cm in front of the first lens. Find the position and nature of the image.
8. What is optical fiber? Explain numerical aperture and acceptance angle. Also compare the attenuation property efficiency and cost of single mode and multimode optical fibers.
9. What is electrical dipole and dipole moment? Derive an expression of the electric field intensity at a point due to dipole at equatorial line?

10. Define the three electric vectors E,P,D and develop a relation between them.

OR

A cylindrical capacitor has radii 'a' and 'b'. Show that half the energy stored lies within the cylinder whose radius is $r = \sqrt{ab}$.

11. What will be the conductivity of sodium metal having atomic weight 22.9 and density 1.013 gm/cm^{-3}? The relaxation time of sodium metal is 3×10^{-14} sec.

12. What type of particles can be accelerated by a cyclotron? Explain the working of cyclotron and synchrotron with their differences.

OR

Differentiate between electromagnetic induction and self-induction. Develop an expression for self-inductance of a teroid.

13. Using Ampere's law, calculate the magnetic field inside, outside and on the surface of a long current carrying conductor and hence plot a graph between the magnetic field versus distance from the center of the conductor.

14. Determine the energy stored in an inductor. Also, determine the energy density in magnetic field.

15. A radio wave transmits 25 W/m^2 of power per unit area. The flat surface area is perpendicular to the direction of propagation of the wave. Calculate the radiation pressure on it and maximum electric and magnetic field associated with the wave.

16. What are the significances of wave-function? Using the wave function derive and expression for the time dependent Schrodinger wave equation.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
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Programme	BEL, BEX, BAME, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Define centers of suspension and oscillation of a compound pendulum and show that they are interchangeable. What length of the pendulum has its minimum time period?

OR

Define SHM. Derive the expression for energy of SHM. Show that the KE and PE of simple harmonically oscillating object changes with time however the total energy is invariant.

2. What is LC oscillation? Derive the differential equation of free oscillation and compare its solution with mass spring system.
3. What is piezoelectric effect? Describe the construction of a piezoelectric oscillator for the production of ultrasonic waves.
4. Explain how interference fringes are formed by a thin wedge shaped film examining by normally reflected light. Derive a relation for the fringe width on such system of interference fringes.

OR

What is double refraction? Explain how would you use the phenomenon to produce linear polarized light and circularly polarized light.

5. A diffraction grating used at normal incidence gives a line (540 nm) in a certain order superposed on the violet line (405 nm) of the next higher order. How many lines per cm are there in the grating if the angle of diffraction is 30°?
6. In Ramsden's eyepiece a coaxial lens system is used. There are two lenses in air and are of equal focal length of separated by a distance 2f/3. Find positions of the cardinal points.
7. Discuss the physical significance of numerical aperture (NA). How does it depend on refractive index of core and cladding?
8. Calculate the thickness of doubly refracting plate capable of producing a path differences of $\frac{\lambda}{4}$ between extraordinary and ordinary rays of wavelength 5890 Å. (Use $\mu_0 = 1.53$; and $\mu_e = 1.54$)
9. What is an electric dipole and dipole moment? Show that electric field for a short dipole drops inversely to cube of the distance at any point from the dipole on an axial line.

OR

What is an electric qudrupole? Calculate potential for points on the axis of the qudrupole.

10. Two point charges 6μc and -24μc are 18 cm apart in air. Locate the positions of zero potential on the line joining the charges.

11. Two capacitors having capacitance 25μF and 5μF are connected in parallel and charged with a 100V power supply. Calculate the total energy stored in the two capacitors.

12. What is superconductor? Explain critical magnetic field. Describe the characteristics of superconductor.

OR

Explain Biot-Savart law. Show that a current carrying circular coil behaves as a magnetic dipole for a large distance.

13. Explain meaning of self induction. Calculate inductance for a solenoid and Toroid.

14. Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from dees. The frequency of the applied emf's 10 MHz. Find the flux density of the magnetic field and the energy of deuterons emerging out of the cyclotron. (mass of deuterons = 3.32×10^{-27} kg.)

15. What are Maxwell's equations? Using Maxwell equations derive electromagnetic (em) wave equation in dielectric medium. Prove that em wave travels with velocity less than velocity of light in such medium.

16. A non relativistic particle is moving three times as fast as an electron. The ratio of the de-Broglie wavelength of the particle to that of the electron is 1.813×10^{-4}. Calculate the mass of the particle.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BAME, BEL, BEX, BCT, BIE, B. Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ 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. Write the differences between mechanical oscillation and e.m. oscillation. Set up the differential equation of damped harmonic mechanical oscillation. Obtain the relation for frequency of such oscillation. Hence explain the conditions for different types of damped oscillation

OR

Define sharpness of resonance. Derive the relation for current amplitude of forced e-m oscillation.

2. What are the measures of good acoustic building? Show that the reverberation time decrease with increase in absorbing factors in a hall.
3. Two thin lenses of focal length f1 and f2 separated by a distance having an equivalent focal length 50 cm. The combination satisfies the condition for no chromatic aberration and minimum spherical aberration. Find the separation between the two lenses if both lenses are of same materials.
4. Prove that the intensity of first maxima is 4.54% of the central maxima in Fraunhoffer's single slit diffraction.

OR

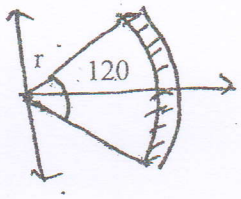
Write the physical meaning of dispersive power and resolving power of grating. Show that resolving power is directly proportional to the total number of rulings on the grating.

5. Newton's Rings arrangement is used with a source emitting two wavelength λ_1 and λ_2. It is found that the n^{th} dark ring due to λ_1 coincides with (n+1)th dark ring to λ_2. Find the diameter of n^{th} dark ring. ($\lambda_1 = 6\times10^{-5}$ cm, $\lambda_2 = 5.9\times10^{-5}$ cm radius of curvature of the lens R = 90 cm).
6. A quartz crystal has refractive indices 1.553 and 1.544. Calculate the thickness of a quarter wave plate for sodium light of wavelength 5890A°.
7. Explain the terms stimulated emission, population inversion, optical pumpling and metastable. Explain working principle of He-Nellaser.
8. A heavy circular ring of radius R oscillates in a vertical plane about a horizontal axis at a distance x from the center. Show that the time period is minimum when x = R

9. Derive the relation for potential at any point due to an electric dipole and show that no work is done in bringing a charge from infinity to dipole along the perpendicular bisector of the dipole.

OR

A plastic rod contains uniformly distributed Q charge. The rod has been bent in 120° circular arc of radius 'r' as shown in figure below. Prove that the electric field intensity at the center of bent rod is $E = \frac{0.83Q}{4\pi\varepsilon_0 r^2}$



10. Derive the relation for rise and fall of current in charging and discharging of capacitor through resistor. Plot graphs between current and time and explain the figures.
11. The space between two concentric conducting spherical shells of radii b = 1.70 cm and a = 1.70 cm and a = 1.20 cm is filled with a substance of dielectric constant k = 23.5. A potential difference V = 73 V is applied across the inner and outer shells. Determine (a) the capacitance of the device (b) the free charge q on the inner shell.
12. What is Hall-effect? Derive an expression for the Hall coefficient and established the relation between mobility of charge carrier and conductivity of material of wire.

OR

Derive a relation resistivity of a conductor using microscopic view. From your result, explain why resistivity of a conductor increase with necessary with increasing temperature.

13. Explain the phenomenon of self induction. Calculate the value of inductance for (a) long solenoid and (b) Toroid.
14. What is Ampere's law? Derive the expression for magnetic flux density outside and inside a long straight conductor carrying current I.
15. Define Poynting vector. Prove that $\vec{S} = \left(\vec{E} \times \vec{B}\right)/\mu_o$, where the symbols have their usual meanings.
16. Discuss the significance of the wave function and deduce the time independent Schrodinger's wave equation.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX,BCT BAME, BIE, B Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ 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. Differentiate between bar pendulum and torsional pendulum. Prove that there exists four collinear points in bar pendulum.

OR

Prove that LC circuit is an analogy of simple harmonic motion and hence prove that maximum energy stored in electric field is equal to maximum energy stored in magnetic field.

2. In simple harmonic motion, when the displacement is one-half the amplitude, what fraction of the total energy is KE and what fraction is PE? At what displacement is the energy half KE and half PE?
3. A source of sound has a frequency of 256 Hz and amplitude of 0.50 cm, calculate the energy flow across a square cm per sec. The velocity of sound in air is 330 m/s and density of air is 1.29 kg/m^3.
4. Prove that interference in thin film of reflected and transmitted light are complementary to each other.

OR

What is diffraction of light? Discuss the intensity distribution with special reference to diffraction of light in a single slit.

5. Two thin converging lenses of focal lengths 30 cm and 40 cm respectively are placed co-axially in air separated by a distance of 20 cm. An object is placed 40 cm in front of the first lens. Find the position and nature of the image.
6. A 200 mm long tube and containing 48 cm^3 of sugar solution produces an optical rotation of 11° when placed in a saccharimeter. If the specific rotation of sugar solution is 66°, calculate the quantity of sugar contained in the tube in the form of a solution.
7. In a Newton's ring experiment the diameter of the 10th ring changes from 1.40 cm to 1.27 cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid.
8. What is an optical fiber? Show that Numerical aperture of an optical fiber is given by the expression, $NA = \mu\sqrt{2\Delta}$, where the symbols carry their usual meanings.
9. Determine the electric field at a distance z on the central axis from the center of a charged ring. Also, find the maximum value of electric field.

OR

Calculate the potential at any point due to an electric dipole. Also, find the potential on the axial line.

10. Over certain region of space the electric potential is $v = 15x-3x^2y+12yz^2$. Find the expression for the x, y and z components of the electric field over this region. What is the magnitude of the field at the point P that has coordinates (1, 0, -2) m?

11. Write the general methods to calculate the capacitance of a capacitor and hence determine the capacitance of a cylindrical capacitor of inner and outer radii 'a' and 'b' respectively.

12. Calculate the drift speed of electrons when 20 A current is supplied through a copper wire of cross-sectional area 1 mm^2 and electron density 10^{28} m^{-3}.

13. Determine the energy stored in an inductor. Hence, prove that the energy density in magnetic field is directly proportional to square of magnetic field.

OR

Obtain an expression for magnetic field intensity due to a circular coil carrying current at its axial point

14. A copper strip 3.0 cm wide and 2.0 mm thick is placed in a magnetic field 1.75T. If a current of 150 A is setup in the strip, calculate (i) Hall voltage and (ii) Hall mobility if the number of electrons per unit volume is $8.4\times10^{28}m^{-3}$ and resistivity is 1.72×10^{-8} ohm-m.

15. Define poynting vector. Prove that $\vec{S}=\frac{1}{\mu}\left(\vec{E}\times\vec{B}\right)$

16. A beam of electrons having energy of 3eV is incident on a potential barrier of height 4 eV. If the width of the barrier is $20\,\mathring{A}$, calculate the percentage transmission of the beam through the barrier.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

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

1. Differentiate between bar pendulum and torsional pendulum. Using a torsional pendulum, derive a relation for modulus of rigidity of the metallic wire.

OR

Compare the damped and forced LCR oscillation. Derive the differential equation of forced em-oscillation and compare it with driven mechanical oscillation

2. Show that in a bar pendulum, minimum time period is achieved if radius of gyration is equal to the distance of point of suspension or point of oscillation from center of gravity.
3. Write some features of acoustically good auditorium. Derive Sabine's formula.
4. Two thin converging lenses of focal lengths 3 cm and 4 cm respectively are placed coaxially in air separated by a distance of 2 cm. An object is placed at 4 cm in front of first lens. Locate the positions of the principal points and final image.
5. What is polarization? Derive the relation for plane, elliptical and circular polarized light.

OR

What are the coherent sources of light? How such sources develop in lab? Show that the square of diameters of the n^{th} dark ring by the reflected light of Newton's ring is directly proportional to the natural number.

6. Define acceptance angle and numerical aperture. In an optical fiber, show that Numerical Aperture (NA) = $\mu_{core}\sqrt{(2\Delta)}$, symbols have their usual meanings.
7. In a Fraunhofer Single slit diffraction, a convex lens of focal length 20 cm is placed just after a slit of width 0.6 mm. If a plane wave of wavelength 6000A° falls on slit normally, calculate the separation between the second minima on either side of central maximum.
8. Calculate the minimum no of lines per cm in a 2.5 cm wide grating which will just resolve the sodium lines 5890 $\mathring{A}$ and 5896 $\mathring{A}$ in second order spectrum.
9. A thin ring made of plastic of radius R is uniformly charged with linear charge density λ. Calculate the electric field intensity at any point at an axial distance y from the center. If electron is constrained to be in axial line of the same ring, show that the motion of electron is SHM.

OR

Discuss the behavior of dielectrics in a parallel plate capacitor. Based on Gauss law of electrostatic in dielectric, show that $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$, where symbols have their usual meaning.

10. The potential in a region between $x = 0m$ and $x = 6m$ is $V = a + bx^2$ where a = 10 and b = -7V/m. Determine (i) the potentials at x = 0m, 3m and 6m and (ii) the magnitude and direction of electric fields at x = 0m, 3m and 6m.

11. What are the current density and mobility? Explain the atomic view of the resistivity and show that $\rho = \{m/ne^2\tau\}$, where symbols have their usual meanings.

12. Give general method of calculating capacitance of a capacitor. Use the method to calculate the capacitance of a spherical capacitor.

13. A toroid has number of turns 1250, internal radius 52 mm, external radius 95 mm and thickness of the ring 13 mm, calculate the inductance.

OR

A solenoid having an inductance of 6.3 μH is connected in series with a 1.2 kΩ resistance. If a 14 V battery is connected across the pair, how long will it take for the current through the resistor to reach 80% of its final value?

14. Explain Hall effect. What results you can draw from Hall experiment? Obtain an expression for the Hall voltage in a current carrying specimen placed in a magnetic field.

15. State Maxwell equation in integral form. Convert them into differential form. Explain each of these equations.

16. A free particle is confined in a box of width L. Using Schrodinger wave equation find an expression for energy eigen value.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Derive a relation to find the moment of inertia of a rigid body about an axis passing through its center of gravity using the torsional pendulum.

OR

What is resonance? Formulate the differential equation of forced electromagnetic oscillation. Then determine the expression for resonant frequency.

2. A string has a linear density of 625 gm/m and is stretched with a tension 50N. A wave, whose frequency and amplitude are 160Hz and 10mm respectively, is travelling along the string. At what average rate is the wave transporting energy along the string?
3. Why is it important to study the reverberation time, before the construction of a Cinema Hall? Derive a relation for reverberation time based on absorption coefficient, volume and surface area of the hall.
4. What happens to the energy when waves perfectly cancel to each other in interference? Derive the relations for thin film interference by reflected light.

OR

Show that the diameters of the Newton's rings when two surfaces of radii R1 and R2 are placed in contact are related by the relation $(1/R_1)-(1/R_2) = (4n\lambda/d^2_n)$, where n is the integer number of the fringes.

5. A grating with 250 grooves/mm is used with an incandescent light source. Assume the visible spectrum to range in wavelength from 400 to 700 nm. In how many orders can one see the entire visible spectrum?
6. Define the polarization of light. Write its importance in different optical instruments. Derive the relation for the thickness of quarter wave plate and half wave plate.
7. Two thin converging lenses of focal length 3cm and 4cm respectively are placed coaxially in air and separated by distance of 2cm. An object is placed 4cm in front of the first lens. Find the position of the nature of the image and its lateral magnification.
8. A glass-clad fiber is made with a core glass of refractive index 1.55 and the cladding is doped to give a fractional index difference of 5.5×10^{-4}. Determine (i) Cladding index (ii) the critical internal reflection angle (iii) the external critical acceptance angle and (iv) numerical aperture (NA).
9. A particle of charge -q and mass m is placed midway between two equal positive charges q_0 of separation d. If the negative charge -q is displaced in perpendicular direction to the line joining them and released. Show that the particle describes a SHM with a period.

$$T = \sqrt{\frac{\epsilon_0 \, m \prod^3 d^3}{q q_0}}$$

OR

Calculate electric field at any point is axial distance due to a dipole and a quadrapole. What conclusion you can draw from your results.

10. Charges ave uniformly distributed through out the volume of an infinitely large cylinder of radius 'a'. Show that the electric field at a distance 'r' from the cylinder axis r < a is given by $E = \frac{\rho r}{2\varepsilon_0}$ where ρ is the volume charge density.

11. A cylindrical capacitor has radii a and b. Show that half the stored electric potential energy lies within a cylinder whose radius is $r = \sqrt{ab}$

12. Explain Hall Effect. Derive a relation for hall resistance. From this relation explain the meaning of quantization of hall resistance.

13. The current density in a cylindrical wire of radius R = 2 mm and uniform cross-sectional area is given by $J = 2 \times 10^5$ Am^2. What is the current through the outer portion of the wire between radial distances R/2 and R?

14. Explain the phenomenon of "self-induction". Find an expression for the self-induction of a toroid having N numbers of turns, radius r and carrying current i.

OR

State Ampere's law. Find the exprerssions for magnetic field outside and inside the long straight wire by using this law.

15. Write down the Maxwell's equations for non conducting Find the equation of propagation of plane electromagnetic wave for E-field and B-field for such medium. Show that electromagnetic wave travels with velocity less than velocity of light in such medium.

16. Derive schodinger time independent wave equation. A particle is moving in one dimensional potential well of infinite height and width 'a'. Find the expression for energy of the particle.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
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Programme	BEL, BEX ,BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Distinguish between free and forced vibrations. Write the differential equation of forced oscillation. Determine the amplitude of oscillation for forced oscillation and hence explain sharpness of the resonance.

OR

Define simple harmonic motion. Show the average kinetic energy is half oft the total energy of a particle executing simple harmonic motion.

2. A 2μF capacitor is charged upto 50V. The battery is disconnected and 50mH coil is connected across the capacitor so that LC oscillation to occur. Calculate the maximum value of the current in the circuit.
3. The elastic limit of steel forming a piece of wire is equal to 2.70×10^8 Pa. What is the maximum speed at which transverse wave pulses can propagate along this wire without exceeding this stress? (density of steel = 7.89×10^3 kg/m^3)
4. What are Newton's rings? How can you use these rings to determine the refractive index of a given liquid?

OR

Discuss the phenomenon of Fraunhofer diffraction at a single slit. Show that the relative intensities of the successive maxima are $1:\frac{4}{9\pi^2}:\frac{4}{25\pi^2}$.....

5. Light of wavelength 6000 A falls normally on a thin wedge shaped film of refractive index 1.4, forming fringes that are 2 mm apart. Find the angle of the wedge.
6. If the plane of vibration of the incident beam makes an angle of 30° with the optic axis, compare the intensities of extraordinary and ordinary light.
7. Show that the diameter of circle of least confusion depends on the diameter of lens aperture and dispersive power of the material of the lens but is independent of the focal length of the lens.
8. An optical fiber has a numerical aperture of 0.22 and core refractive index 1.62. Determine the acceptance angle for the fiber in a liquid which has a refractive index of 1.25. Also, determine the fractional refractive index change.

9. Prove that electric field due to a short dipole at axial point is twice that at equatorial point.
10. A capacitor of capacitance C is discharging through a resistor of resistance R. After how many time constants is the stored energy 1/8 of its initial value?
11. Give a general method to calculate electric field and potential due to continuous charge distribution. Using your method, calculate electric field at an equitorial distance y due to a long charged rod having linear charge density λ.
12. Consider a circular coil of radius R carrying current I. Find the magnetic field at any point on the axis of the loop at a distance z from the center of the loop. Show that the circular current carrying coil behaves as a magnetic dipole for large distance.
13. In a Hall Effect experiment, a current of 3.2A lengthwise in a conductor 1.2 cm wide, 4.0 cm long and 9.5μm thick produces a transverse Hall voltage (across the width) of 40μV when a magnetic field of 1.4T is passed perpendicularly through the thin conductor. From this date, find (a) the drift velocity of the charge carriers and (b) the number density of charge carriers.
14. Derive an expression for growth and decay of current in LR circuit. Explain inductive time constant by sketching graph between current and time for both cases.

OR

Derive expressions for inductance of a Solenoid and Teroid. Then show that inductance is the property of the coil.

15. Write and explain Ampere's law in magnetism. How Maxwell modified it. Based on this modified equation, explain the term displacement current. Prove displacement current is equal to conduction current.
16. Explain Schrodinger's wave equation. Derive time independent Schrodinger wave equation. Use this equation to find energy for a particle in a box of infinite square well potential.

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24R TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH402)*

- ✓ 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. Point out the similarities and dissimilarities between the oscillations of bar pendulum and torsinal poendulum. Show that the radius of gyration is equal to distance from center of suspension to center of gravity of compound pendulum, when time period in minimum.
2. Derive a differential equation for LC Oscillation. Show that the maximum value of electric and magnetic energies stored in LC circuit is equal.

OR

Prove that if a transverse wave is travelling along a string, then the slope at any point of the string is numerically equal to the ratio of the particle speed to the wave speed at that point.

3. The time of reverberation of an empty hall is 1.5 sec with 500 audiences present in the hall, the reverberation time falls to 1.4sec. Find the no. of persons present in the hall if the reverberation time falls down to 1.32 sec.
4. Show that the intensity of the first subsidiary maxima of Fraunhoffer's diffraction at a single slit is 4.5% of that or principal maxima.

OR

What is double diffraction? Explain how Nicol prism can be used as polarizer and analyzer?

5. In a Newton's ring experiment, the radius of curvature of the lens is 5cm and the lens diameter is 20mm. (a) How many bright rings are produced? Assume that λ=589nm (b) How many bright rings would be produced if the arrangement were immersed in water (μ=1.33)?
6. A diffraction gratting 3cm wide produces the second order at 33° with light of wavelength 600nm. What is the total number of lines on the gratting.
7. What is population inversion? Explain why laser action cannot occur without population inversion between atomic levels?
8. What are cardinal points of an optical system? Determine the equivalent focal length of a combination of two thin lenses separated by a finite distances.
9. A ring has a charge q uniform distributed in it. Derive an expression for the electric field at any point on the axial line of the ring. Extend your result to find the potential.

OR

Write an expression for electric field at any point in the axial line of a charged ring. Using this equation, calculate the electric field at any point in the axial line of a charged disk.

10. What is the magnitude of the electric field at the point (3,2) m if the electric potential is given by $V = 2x+5xy+3y^2$ volts. What acceleration does an electron experiences in the x-direction.

11. Derive an equation $\vec{J} = \sigma \vec{E}$. Explain why resistivity of a conductor increases with increasing temperature plot a graph between R_θ (Resistance at any temperature θ) and temperature. Based on the graph, explain what are superconductor? How they differ from perfect conductor? Describe the characteristics of superconductor.

12. Derive an expression for energy stored in magnetic field. Show that the energy stored per unit volume is directly proportional to the square of the magnetic flux density. Compare this result with electric energy density.

OR

What is self induction? Define inductance of a coil. Show by calculation inductance of a coil depends on the permeability of a medium and the geometry of the coil.

13. A long circuit coil consisting of 50 turns with diameter 1.2m carries a current of 10Amp. (a) Find the magnetic field at a point along the axis 90cm from the center. (b) At what distance from the center, along the axis, the field is 1/8 greater as at the center.

14. Describe the principal and working of Cyclotron. Show that the time taken by the ion in a Dee to travel a semicircle is exactly same whatever be its radius and velocity.

15. Write Maxwell's equations in free space and dielectric medium. With the help of Maxwell's equations, Derive charge conservation theorem.

16. A beam of electrons having energy of each 3eV is incident on a potential barrier of height 4eV. If the width of the barrier is 20A°, calculate the transmission coefficient of the beam through the barrier.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.

2069 Ashad

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH 402)*

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

1. Obtain an expression for the time period of a compound pendulum and show that its time period is unaffected by the fixing of a small additional mass to it at its centre of suspension.

OR

What is electromagnetic oscillation? Derive differential equation of damped LCR oscillation and find its frequency.

2. A particle is moving with simple harmonic motion in a straight line. If it has a speed v_1 when the displacement is x_1 and speed v_2 when the displacement is x_2 then show that the amplitude of the motion is, $a = \left[\frac{v_2^2 x_1^2 - v_1^2 x_2^2}{v_2^2 - v_1^2}\right]^{\frac{1}{2}}$.

3. In the progressive wave, show that the potential energy and kinetic energy of every particle will change with time but the average K.E. per unit volume and P.E. per unit volume remains constant.

4. Two coherent sources having constant phase δ but different amplitudes A_1 and A_2 superimpose, prove that the intensity of superimposed beam is $I = A_1^2 + A_2^2 + 2A_1A_2\cos\delta$.

OR

Explain the phenomenon of double refraction. Describe the construction and action of Nicol prism.

5. White light is incident on a soap film at an angle $\sin^{-1}\left(\frac{4}{5}\right)$ and the reflected light on examination by a spectrometer shows dark bands. The consecutive dark bands correspond to wavelength 6.1×10^{-5}cm and 6.0×10^{-5}cm. If μ=1.33 for the film, calculate its thickness.

6. Light of wavelength 600nm is incident normally on a slit of width 0.1mm. Calculate the intensity at θ=0.2°.

7. Two lenses of focal lengths 8cm and 4cm are placed at a certain distance apart. Calculate the position of principal points if they form an achromatic combination.

8. An optical fiber has a NA of 0.2 and a cladding refractive index of 1.59. Determine acceptance angle for the fiber in water which has a refractive index of 1.33.

9. A ring has a charge q uniformly distributed in it. Find the expression for the electric field at any point on the axial line of the ring. Locate the point at which the field is maximum.

OR

Prove that electric field due to a short dipole at axial point is twice that at equatorial point.

10. A particle of charge $-q$ and a mass m is placed midway between two equal positive charges q_o of separation d. If the negative charge $-q$ is displaced in perpendicular direction to the line joining them and released, show that the particle descries a SHM with a period $T = \left[\frac{\epsilon_o m\pi^3 d^3}{qq_o}\right]^{\frac{1}{2}}$.

11. 11A cylindrical capacitor has radii a and b. Show that half the stored electric potential energy lies within a cylinder of radius $r = \sqrt{ab}$.

12. A flat silver strip of width 1.5cm and thickness 1.5mm carries a current of 150A. a magnetic field of 2.0 Tesla is applied perpendicular to the flat face of the strip. The emf developed across the width of strip is measured to be 17.9μV. Estimate the number density of free electrons in the metal.

13. A straight wire segment of length l carries current I. Show that the magnetic field B produced by that segment at a displace y from it along a perpendicular bisector is $B = (\mu_0 / 2\pi y)\,[l/(l^2+4y^2)]$.

14. Find the inductance of a toroid having N number of turns and radius R.

OR

Show that the energy per unit volume in electric field and magnetic field are proportional to the square of their fields.

15. State and explain Maxwell's equations. Derive the continuity equation: $\nabla.\vec{J} = \frac{\partial \delta}{\partial t}$.

16. Determine the total energy of a particle using Schrodinger equation, when the potential energy has value V=0 for $0<x<a$, and V=α for $x \leq 0$ and $x \geq a$.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	All	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH 402)*

- ✓ 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. Differentiate between linear and angular harmonic motion. Show that the motion of torsion pendulum is angular harmonic motion. Also find its time period.

OR

Derive the differential equation of the forced oscillation of LCR circuit with an AC source and find the expression for the current amplitude. Hence explain the condition of current resonance in such circuit.

2. A 750g block oscillates on the end of a spring whose force constant, k=56N/m. The mass moves in a fluid which offers a resistive force F = -bv, where b = 0.162Ns/m. What is the period of the oscillation?

3. A room has dimensions 6m×4m×5m. Find:
   i) Mean free path of sound wave in the room
   ii) The number of reflections made persecond by the sound wave with the walls of the room. (Take velocity of sound in air= $350ms^{-1}$).

4. Define interference. Show that interference in thin film due to reflected and transmitted lights are complementary.

OR

What are Newton's rings? How can you determine the refractive index of given liquid using Newton's rings experiment?

5. Explain the dispersive and resolving power of a diffraction grating. Derive expressions and develop a relation between them.

6. A 200mm long tube containing $48cm^3$ of sugar solution produces an optical rotation of 11° when placed on a saccharimeter. If the specific rotation of sugar solution is 66°, calculate the quantity of sugar contained in the tube in the form of solution.

7. Prove that the condition for achromatism for the combination of two lenses of focal length f_1 and f_2 having dispersive power ω_1 and ω_2 placed at a separate distance x is $(\omega_1/f_1)+(\omega_2/f_2)=(x/f_1f_2)(\omega_1+\omega_2)$.

8. Differentiate between spontaneous and stimulated emission of radiation. Explain the construction and working of He-Ne laser with a suitable energy level diagram.

9. Derive an expression for the electric field at a point P at a distance X from a circular plastic disc of radius a along its central axis. Does this expression for E reduces to an expected result for x>>a?

10. A capacitor of capacitance 'C' is discharged through a resistor of resistance 'R'. After how many time constants is the energy stored becomes one fourth of initial value?

11. Calculate the electric field due to a uniformly charged rod of length l at a point along its long axis at a distance 'a' from its nearest end.

12. Explain the principle and working of cyclotron. Show that the time spent by the particle in a Dee is independent of its speed and radius of its circular path.

OR

Use Biot- Savart Law to calculate magnetic field on the axial line of a current carrying circular loop. Explain how the coil behaves for a large distance point.

13. A cooper strip 150μm thick is placed in a magnetic field of strength 0.65T perpendicular to the plane of the strip and current of 23Amp is set up in the strip. Calculate: (i) the Hall voltage (ii) Hall coefficient and (iii) Hall mobility, if the number of electrons per unit volume is $8.5\times10^{28}/m^3$ and resistivity is 1.72×10^{-8} Ohm-m.

14. A parallel plate capacitor with circular plates of 10cm radius is charged producing uniform displacement current of magnitude $20A/m^2$. Calculate (i) dE/dt in the region (ii) Displacement current density and (iii) Induced magnetic field.

15. Obtain an expression for energy transfer rate by electromagnetic wave. From your result show that $I \alpha E^2_{rms}$. Where I is the intensity em wave and E_{rms} is root mean square value of electric field.

16. Derive the schrodinger time independent wave equation. Also what do you mean by a potential barrier?

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics

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

1. Show that there are four collinear points within compound pendulum having same time period. Give their physical significance.

   OR

   Derive the differential equation of damped harmonic oscillation in LCR circuit. Solving the equation find the damped frequency of the oscillation and explain its significance.

2. A uniform circular disk whose radius R is 12.6cm is suspended as a physical pendulum from a point on its rim. (a) What is its period? (b) At what radial distance $r < R$. Is there a pivot point that gives the same period?

3. Define absorption coefficient of sound. Derive a relation between reverberation time and absorption coefficient for acoustically good hall.

4. Explain how interference fringes are formed by a thin wedge shaped film, when examined by normally reflected light. How will you estimate the difference of film thickness between two points?

   OR

   Show that the intensity of second order maxima of Fraunhoffer's single slit diffraction is $\frac{2}{5\pi}$ times the intensity of central maxima.

5. In Newton's ring arrangement a source emitting two wavelengths 6×10^{-7}m and 5.9×10^{-7}m is used. It is found that n^{th} dark ring due to one wavelength coincides with $(n+1)^{th}$ dark ring due to other. Find the diameter of the n^{th} dark ring if radius of curvature of lens is 0.9m.

6. Calculate the thickness of quarter wave plate for light of wavelength 5893Å. Given refractive indices of ordinary and extraordinary ray are 1.544 and 1.553 respectively.

7. Define acceptance angle of an optical fiber. Derive the relation for Numerical Aperture (NA) of the optical fiber. Also write down its significance.

8. Two thin converging lenses of focal lengths 0.2m and 0.3m are placed coaxially 0.10m apart in air. An object is located 0.6m in front of the lens of smaller focal length. Find the position of the two principal points and that of image.

9. Derive an expression for the electric potential at any point on the axis of the uniformly charged disk. Extend your result to calculate electric field.

   OR

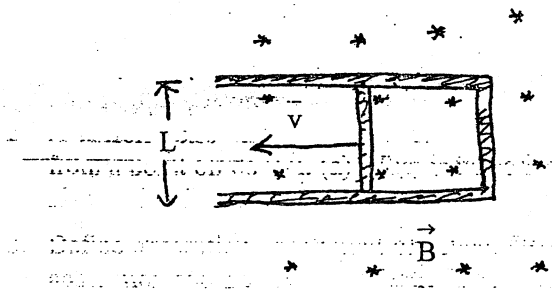
   Derive an expression for the electric field at any point on the axis of the short linear quadrupole.

10. A copper slab of thickness b is inserted into a parallel plate capacitor exactly half way between the plates. If the separation of the plate is d and the area of each plate is A, show that the change in capacitance is equal to $\frac{\epsilon_0 Ab}{(d-b)d}$.

11. What is the drift speed of the conduction electrons in a copper wire (molecular mass = 63.54 g/mol, density 8.96 g/cm^3) with radius 900 μm when it has a uniform current 17mA flowing in the wire?

12. A long straight wire of radius R carries a uniformly distributed current I. Calculate magnetic fields at any points inside and outside the wire.

13. The conducting rod shown in figure has length L and is being pulled along horizontal, frictionless conducting rails at a constant velocity $\vec{v}$. The rails are connected at one end with a metal strip. A uniform magnetic field $\vec{B}$, directed out of the page, fills the region in which the rod moves. Derive an expression for the rate of thermal energy being generated in the rod.



14. A coil has an inductance of 53 mH and a resistance of 0.35Ω. If a 12V emf is applied across the coil, how much energy is stored in the magnetic field after the current has built up to its equilibrium value? After how many time constants will half this equilibrium be stored in the magnetic field?

OR

In a certain cyclotron a proton moves in a circle of radius 0.5m. The magnitude of the magnetic field is 1.20T. What is the oscillator frequency? What is the kinetic energy of the proton in eV?

15. Define poynting vector. Prove that $\vec{S} = \frac{1}{\mu_0}(\vec{E} \times \vec{B})$, where the symbols have their usual meanings.

16. An electron is trapped in an one dimensional infinite potential well of width 'a' such that

$V = \infty$ for $0 \le x$ and $x \ge a$
$V = 0$ for $0 < x < a$

Using boundary condition, prove that the total energy of the system is

$$E = \frac{\Pi^2 n^2 \hbar^2}{2ma^2}$$

Where symbols carry their usual meanings.

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2067 Ashwin

Exam.	New Back (2066 Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics

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

1. Define forced oscillation. Show that the total energy of the damped oscillation decreases with increasing time.

OR

Derive a differential equation for LC oscillation. Solve the equation and show that the maximum value of electric and magnetic energies stored in L.C. circuit are equal.

2. A meter stick swings about pivot point at one end, at distance 'h' from the stick's center of mass. Calculate the period of oscillation using parallel axis theorem.

3. Give an account of bad acoustic properties of a hall. Derive the expression for reverberation time in a good acoustics of a hall.

4. What are coherent sources? Describe a method for determining the refractive index of transparent liquid film using the interference phenomenon.

OR

Describe the construction of Nicol Prism. Explain how it can be used as polarizer and analyzer.

5. A diffraction grating is used at normal incidence. In such arrangement a green line (λ = 5400Å) of certain order is superimposed on the violet line (λ = 4050Å) of the next order. If the angle of diffraction is 30°, how many lines are there in 1 centimeter?

6. A light source emits light of two wavelengths 4300Å and 5100Å. The source is used in a double slit experiment. The distance between the sources and the screen is 1.5m and the distance between the slits is 0.025mm. Calculate the separation between the third order bright fringes due to these two wavelengths.

7. A thin convex and thin concave lens, each of focal length 50cm, are coaxially situated and separated by 10cm. Find the position and nature of the final image formed of an object placed 20cm from the convex lens.

8. What is population inversion? Explain the lasing action of a gas laser with necessary energy level diagram.

9. Consider a circular plastic disk of radius R that has a positive surface charge of uniform density on its upper surface. Find the electric field at any point at a distance x from the centre of the disk along its central axis.

OR

Define electric quadrupole. Calculate the electric potential of linear quadrupole of separation 2a at an axial distance r from its centre.

10. As a parallel plate capacitor with circular plates 20cm in diameter is being charged, the current density of the displacement current in the region between the plates is uniform and has a magnitude of $20A/m^2$. Calculate the magnitude of magnetic field (B) at a distance r = 50mm from the axis of symmetry of this region. Also calculate $\frac{dE}{dt}$ in this region.

11. Assuming that each atom of copper contributes one free electrons, calculate the drift velocity of free electrons in copper conductor of cross sectional area $10^{-4}m^2$ carrying a current of 200A. Given:

    Atomic weight of copper = 63.5 g/mol
    Density of copper = $8.94\times10^3 kg/m^3$
    Charge of an electron = $1.6\times10^{-19}C$

12. State Ampere's law. Use this law to find magnetic field that a current produces inside and outside a long straight wire of circular cross section.

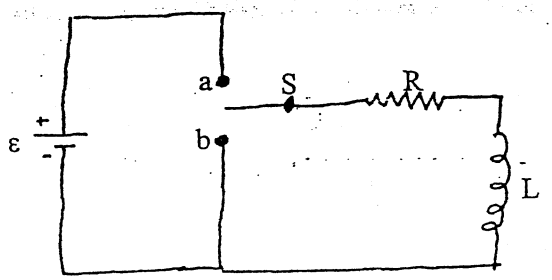
OR

Derive an expression for energy stared in an inductor. Show that the magnetic energy density is directly proportional to the square of the magnetic flux density. How can you compare electric energy density with this result?

13. A cyclotron which has the dees of radius 42cm and magnetic field of flux density 0.5 weber/m^2 is employed to accelerate protons. If the final velocity of the proton is 2.02×10^7m/sec, calculate the charge to mass ratio for the proton and the frequency of the alternating potential between the dees.

14. In the given figure, when switch S is closed on a, the current rises and approaches a limiting value $\frac{\varepsilon}{R}$.

    a) Find the current through the inductor as a function of time.
    b) When the switch is closed on b, the current reduces to zero. Find the rate of decay of current through the inductor.



15. State Maxwell equations in integral form. Convert them into differential form. Explain each of these equations.

16. Discuss the significance of the wave function and deduce the time independent Schrodinger equation.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Model Question

Exam	Regular		
Level	B.E.	Full Marks	80
Programme	All	Pass Marks	32
Year / Part	I / I	Time	3 hrs

Subject: Physics

Attempt ALL questions .Each question carries equal mark.

1. Define physical pendulum show that point of Suspension and point of oscillation are interchangeable.

OR

Define damped harmonic oscillator; find time period and frequency for under damping oscillation.

2. Define interference. Show that interference in thin film due to reflected and transmitted light are complementary.

OR

What is double refraction? Obtain the mathematical relation for linearly, circularly and elliptically polarized light.

3. Define diffraction. Derive the intensity distribution pattern of single slit due to diffraction.

4. What is the importance of laser? Discuss the laser action of He-Ne laser with labeled diagram.

5. The maximum Pressure Variation that the car can tolerate in loud Sound is about 20 N/m^2. If normal atmospheric pressure is about 10^5 Pascal what is the corresponding maximum displacement for sound wave in air of frequency 1000Hz. (density of air 1.3 $kg/m^3$and velocity of sound in air is 343 m/sec).

6. Two thin converging lenses of focal length 20 cm and 40 cm respectively are placed Coaxially 10 cm apart. An object is located at a distance 48 cm from the first lens. Find (a) Position of image (b) Position of principal point and (c) position of focal points.

7. Light is incident normally on a grating 0.5 cm wide having 2500 lines? Find the angle of diffraction for the principal maxima of two sodium line in first order spectrum. (λ_1 = 5890 Å, λ_2 = 5896Å). Are the two lines resolved?

8. A circuit has L = 10mH and C = 1μF, How much resistance must be inserted in the circuit to reduce the (undampeped) resonance frequency by 0.01%?

9. Design an electric- quadrupole. Derive the electric field intensity at point on the axial line of the quadrupole.

OR

Derive an expression for the potential at any point due to an electric dipole.

10. An air filled parallel plates Capacitor has a Capacitance of 1.3 pF. The separation of the plates is doubled and wax is inserted between them. The new Capacitance is 2.6 pF. Find the dielectric constant of the wax.

11. Define resistivity. Discuss Atomic view of resistivity and show that $\sigma = m/ne^2\tau$. Where symbols carry to their usual meaning.

12. What is the magnitude of magnetic field needed to be accelerated in the cyclotron? ($m_d = 3.34 \times 10^{-27}$kg)

13. State & explain Hall Effect. Derive an expression for Hall coefficient for an Electron.

14. A circular loop of wire 10 cm in radius carries a current 100 Amp. What is the energy density at the center of the loop?

15. Prove that the speed of electromagnetic wave is equal to velocity of light in free space.

16. Derive an expression for one dimensional time independent Schrodinger wave equation.

OR

Define tunneling effect and derive the expression for transmission coefficient for a barrier of width a and potential of height V_0.