

**PURWANCHAL UNIVERSITY****I SEMESTER BACK PAPER EXAMINATION-2004****LEVEL** : B. E. (Computer/Electronics & Comm.)**SUBJECT:** BEG103SH, Physics**TIME:** 03:00 hrs**Full Marks:** 80**Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All question carry equal marks mark.

Attempt any Six questions, choose at least ONE questions from GROUP-A and TWO questions from GROUP-B and C.

**GROUP-A.**

- Q. [1] [a] What is elastic restoring force ? Obtain an expression for the time period of a compound pendulum and show that the centers of suspension and oscillation are interchangeable. [2+4+2]
- [b] The moment of inertia of a the disc used in a tutorial pen pendulum about the suspension wire is  $0.2\text{kg m}^2$ . It oscillates with a period of 2sec. Another disc is placed over the first one and the time period of the system becomes 2.5sec. Find the moment of inertia of the second disc about the wire. [5]
- Q. [2] [a] What are traveling and standing waves? Prove that the intensity of sound is proportional to the square of the pressure amplitude. [2+6]
- [b] The sound level at a point is increased by 30dB. By what factor is the intensity of sound increased? [5]

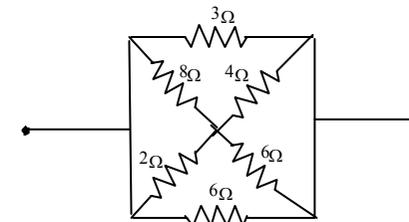
**GROUP-B**

- Q. [3] [a] What are cardinal points? Explain spherical and chromatic aberrations in optical image. Obtain condition of achromatize for two thin lenses placed co-axially in contact. [2+3+4]

- [b] Two thin convex lenses of focal lengths 20cm and 40cm are placed co-axially 20cm apart. Find the position of principal points of the lens system. [5]
- [c] Explain plane polarized, circularly polarized and elliptically polarized light. [3]
- [d] How many orders will be visible if the wavelength of the incident radiation is  $5000\text{\AA}$  and the number of lines on the grating is 2620 per inch? [5]
- Q. [5] [a] Explain how Newton's rings are formed and describe with necessary theory, the method for the determination of wavelength of monochromatic. Explain the blooming of lenses. [7+2]
- [b] Light of wavelength  $6.0 \times 10^5 \text{ cm}$  falls normally on the thin wedge shape film of refractive index 1.4, forming fringes that are 2mm apart. Find the angle of the wedge. [5]

**Group- C**

- Q. [5] [a] State and Gauss's law in electrostatics. Obtain an expression for the electric potential at a point due to an electric dipole. [4+4]
- [b] A storage capacitor has a capacitance of 55 capacitor is charged to 5.3V, how many electrons are on its negative plate?
- Q. [7] [a] State and explain Kirchhoff's Laws, Explain help of a circuit diagram, the common characteristics of p-n junction transistor ....briefly the concept of an amplifier.
- [b] In the network shown, the equivalent re....between A and B is .....



- Q. [8] [a] State and explain Lenz's Law. Does it..... principle of energy conservation? Obtain the expression for energy density of magnet.....
- [b] An inductor of 20mH, a resistor ( $R = 100 \Omega$ ) battery ( $\epsilon = 10\text{v}$ ) are connected in series. After time the circuit is short circuited and the .....disconnected. Find the current in the circuit .....sec after short circuiting.

**GROUP-D**

- Q. [9] [a] What is displacement current? Show that where terms have their usual meanings.
- [b] Obtain the differential equation that describe oscillation of a resistance less L-C circuit that the charge on the oscillator is an charge.
- [c] In an oscillating L-C circuit,  $L = 1.10\text{mH}$  and  $C = 4.0 \mu\text{F}$ . If the maximum charge on the capacitor is  $3.0 \mu\text{C}$  then find the value of maximum current. [5]
- Q. [10] [a] For traveling electromagnetic wave prove that  $C = E_m/B_m$  where the terms have, their usual meanings. [6]
- [b] Explain the pointing vector and show that 
$$\vec{S} = \frac{1}{\mu_0} (\vec{E} \times \vec{B}),$$
 Where the terms have their usual meanings. [6]
- [c] Show that  $\vec{D} = \rho$   
Where  $\vec{D}$  = electric displacement current (in  $\text{C/m}^2$ )  
 $\rho$  = free charge density ( in  $\text{C/m}^3$ ) [3]

**PURWANCHAL UNIVERSITY****I SEMESTER FINAL EXAMINATION-2005****LEVEL** : B. E. (Computer/Electronics & Comm.)**SUBJECT:** BEG103SH, Physics**TIME:** 03:00 hrs**Full Marks:** 80**Pass marks:** 32

*Candidates are required to give their answers in their own words as far as practicable.*

*All question carry equal marks mark.*

**Attempt any Six questions, selecting ONE questions from GROUP-A and D and TWO questions from GROUP-B and C.**

**GROUP-A.**

- Q. [1] [a]** Define angular harmonic motion, elastic restoring force and Hook's law. Find an expression for the time period of a torsional pendulum. [1+1+1+5]
- [b]** An ambulance emitting a whine at 1600 Hz overtakes and passes a cyclist pedaling the bike at 18km/hr. After being passed, the cyclist hears a frequency of 1590 Hz. How fast is ambulance moving? [5]
- Q. [2] [a]** What are beats? Show that freq. of minima is same as that of maxima. Derive the expression for velocity of wave is stretched string? [1+4+3]
- [b]** A small body of masses 0.1kg is undergoing a SHM of amplitude 0.1m and period 2sec. [i] What is the maximum force on body? [ii] If the oscillations are produced in the spring, what should be the force constant? [5]

**GROUP-B**

- Q. [3] [a]** Explain the phenomenon of interference of light. Give the theory of the Newton's rings. How fringes can be used to find the wavelength of light? [2+5+2]
- [b]** A monochromatic light of wavelength 5890 Å is incident normally on a diffraction grating which has 6000 lines per centimeter.
- [i]** At what angle will the second order image be seen?

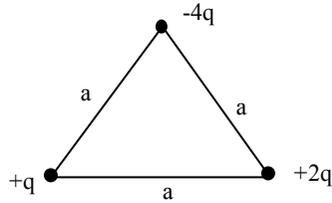
**[ii]** Can you obtain the third order image with this grating?

- Q. [4] [a]** What do you understand by double refraction? Describe the construction and action of Nicol prism. [3+6]
- [b]** Two thin focal lengths  $f_1$  and  $f_2$  and separated by a certain distance  $d$  have an equivalent focal length  $f$ . The combination satisfies the condition for no chromatic aberration and minimum spherical aberration. Find the values of  $f_1$ ,  $f_2$  and  $d$ . Assume that both the lines are of the same materials. [5]
- Q. [5] [a]** What is an optical fiber? Explain the physics behind its functioning. What are their types and explain the application of optical fiber in communications. [9]
- [b]** A soap film of refractive index 1.33 and of thickness  $1.5 \times 10^{-4}$  cm is illuminated by white light incident at an angle of  $45^\circ$ . The light reflected by it is found to be a dark band corresponding to a wavelength  $5.63 \times 10^{-5}$  cm. Find the order of interference of the dark band. [5]

**GROUP-C**

- Q. [6] [a]** Define electric field and field intensity. Show that the field due to a short electric dipole at an axial point is inversely proportional to the cube of its distance from the dipole. [1+1.5+5.5]
- [b]** A rectangular carbon block has dimensions  $1\text{cm} \times 1\text{cm} \times 5\text{cm}$ . [i] What is the resistance measured between the two square ends? [ii] Between two opposing rectangular faces? The resistivity of carbon at  $20^\circ\text{C}$  is  $3.5 \times 10^{-5}$  ohm<sup>-m</sup>. [5]
- Q. [7] [a]** Define resistivity. Explain the atomic view of resistivity and show that  $\rho = \frac{m\bar{V}}{ne^2\lambda}$ . Where each symbol carries its usual meanings. [2+6]
- [b]** A solenoid has a inductance of 53mH and a resistance of  $0.37 \Omega$ . If it is connected to a battery, how long will it take for a current to reach one half its equilibrium values? [5]

- Q. [8] [a] State and explain Ampere's theorem. Derive an expression for the magnetic field due to solenoid carrying current. [3+5]
- [b] Three charges are arranged as in Fig. What is their mutual potential energy? Assume that  $q = 1.0 \times 10^{-7}$  coulomb and  $a = 10$ cm. [5]



**GROUP-D**

- Q. [9] [a] Compare electromagnetic oscillation with mass-spring system performing simple harmonic motion. Develop a differential equation of damped oscillation on LCR circuit and find an expression for the frequency of oscillation. [2+6]
- [b] An observer is at a distance of 1m from the point source of light, whose power output is 1kw. Calculate the maximum electric field and magnetic field. [5]
- Q. [10] [a] Derive Maxwell's equations in differential form. [8]
- [b] In an oscillating LC circuit, what value of charge expressed in terms of maximum charge is present on the capacitor when the energy is shared equally between the electric and magnetic field? At what time  $t$  with this oscillation occur, assuming the capacitor to be fully charged initially? Assume that  $L = 10$ mH and  $C = \mu$ F.

**DD**

**PURWANCHAL UNIVERSITY**

**I SEMESTER FINAL EXAMINATION-2002**

**LEVEL** : B. E. (Computer/Electronics & Comm.)

**SUBJECT:** BEG103SH, Physics

**TIME:** 03:00 hrs

**Full Marks:** 80

**Pass marks:** 32

*Candidates are required to give their answers in their own words as far as practicable.*

*All question carry equal marks mark.*

**Attempt any Six questions, selecting ONE questions from GROUP-A and D and TWO questions from GROUP-B and C.**

**GROUP-A.**

- Q. [1] [a] What is meant by superposition of waves? Point out the difference between traveling wave and mechanical wave and derive an expression for the speed traveling wave in a stretched string. [1+1+6]
- [b] A spiral spring 3 meter longs from the ceiling. When a mass of 1kg is suspended from the spring it lengthens by 40cm. The mass is then pulled and released. Compute the frequency of oscillation. [5]
- Q. [2] [a] Define the term intensity level of sound and loudness. Show that the intensity of sound varies directly as the square of the excess of pressure. [2+6]
- [b] Two observer A and B carry identical sound sources of frequency 500 Hz. If the observer A is stationary and B moves away from A at a speed of 3.6 km/hr. how many beats per second are heard by A and B respectively. Velocity of sound in air =  $350 \text{ ms}^{-1}$ . [5]

**GROUP-B**

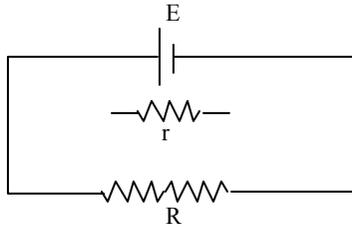
- Q. [3] [a] What as cardinal points? Describe with suitable ray diagrams the cause and minimization process of aberrations. [1+7]
- [b] Two identical thin convex lenses of focal length 8 cm each are coaxial and 4cm apart. Find the equivalent

focal length and the positions of the principal points. Also find the positions of the object for which the image is formed at infinity. [5]

- Q. [4] [a] What is meant by blooming of lenses? Derive an expression for the interference in thin films and wedge shape. [1+7]
- [b] A plane transmission grating has 15000 lines per inch. Find the angle of separation of the  $5048 \text{ \AA}$  and  $5016 \text{ \AA}$  lines of helium in the second order spectrum. [5]
- Q. [5] [a] Define Firesnel's assumption of diffraction. Discuss the Fraunhofer diffraction pattern at two slits. [2+6]
- [b] A 200mm long tube containing  $52 \text{ cm}^3$  of sugar solution produces an optical rotation of  $13^\circ$  when placed in a saccharimeter. If the specific rotation of sugar solution is  $66^\circ$ , calculate the quantity of sugar contained in the tube in the form of a solution. [5]

**GROUP-C**

- Q. [6] [a] State and prove Gauss' law in electrostatics. Derive an expression for the electric field at a point at perpendicular distance due to linear symmetric distribution of charge. [4+5]
- [b] What is the potential gradient in volts/meter at a distance of  $10^{-12} \text{ m}$  from the center of the gold nucleus? What is the gradient at the nuclear surface of radius  $R = 5 \times 10^{-15} \text{ m}$ ? [ Atomic weight of gold = 79] [5]
- Q. [7] [a] What is the effect of temperature on semiconductor? Explain the nature of intrinsic and extrinsic semiconductor. [3+6]
- [b] In the given circuit [Fig- 7(b)], show that the power delivered to R, is maximum when load resistance R is equal to the internal resistance r of the battery and this maximum power is  $P = E^2 / 4r$ . [5]



- Q. [8] [a]** State and prove Ampere's circuital law. Find an expression for the magnetic field on the axis of a solenoid carrying current. [4+5]
- [b]** An LR series circuit with an inductance of 2.0 Henry and resistance of 2 ohm is connected to an external battery of 6 volt. How long does it take the current to reach half its maximum value? [5]

**GROUP-D**

- Q. [5] [a]** What is electromagnetic oscillation? Developer a differential equation of damped oscillations in an LCR circuit and find an expression for the frequency of the oscillation. [2+6]
- [b]** A radio can tune over the frequency range of a portion of MW broadcast band 800 KHz to 1200 KHz. If its LC circuit has an effective inductance of 200  $\mu\text{H}$ , what must be the range of its variable capacitor? [5]

- Q. [6] [a]** Write Maxwell equations in integral and differential form. Show that  $\Delta \times \mathbf{E} = \frac{-\delta^2 \mathbf{B}}{\delta^2 t}$ . [3+3]

- [b]** Prove the relation  $\frac{E_m}{B_m} = c$  Where  $E_m$  and  $B_m$  are the amplitudes of the electromagnetic wave and C is the velocity of light. [3]

- [c]** Show that the charge conservation theorem  $\frac{\partial \rho}{\partial t} + \Delta \cdot \mathbf{r} = 0$