PURBANCHAL UNIVERSITY

2010 A

B.E. (Computer/Electronics & Communication)/First Semester/Final

Time: 03:00 hrs. Full Marks: 80 /Pass Marks: 32

BEG103HS: Physics

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

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) Define angular harmonic motion. Find an expression for the time period of a torsional pendulum. 1+4

(b) Show that, in case of compound pendulum, the points of suspension and oscillation are interchangeable. 3

(c) A small body of mass 0.1kg is undergoing a SHM of amplitude 0.1m and period 2 sec (i) What is the maximum force on body? (ii) If the oscillation are produced in the spring, what should be the force constant? 5

2(a) What are beats? Show that frequency of minima is same as the of maxima. 1+4

(b) What are ultrasonic waves? Discuss briefing the application of ultrasonic waves in medical field. 1+2

(c) A police man on duty detects a drop of 10% in the pitch of the horn of a motor car as it crosses him. If the velocity of sound is 340m/s, calculate the speed of the car. 5

Group B

3(a) What is optical fibre? Discuss its working principle. 1+3

(b) Explain the basic principle for the production of laser rays and give its four important applications. 3+2

Contd. ...

(c) A diffraction grating 2cm wide has 2400 lines and used in first order. What is the diffraction angle for light of wavelength $6000\,\text{Å}$. 5

4(a) What do you mean by the optical separation? Two lens of focal length f1 and f2 are placed coaxially at a certain distance d apart in air. Derive an expression for the equivalent focal length of the combination and find the position of two principle planes. 1+5+3

(b) A 30cm long tube containing sugar solutions of volume 205cc rotates the plane of polarization by 13.20. If the specific rotation of the sugar is 68^0, calculate the mass of the sugar. 5

5(a) Explain interference of light prove that the fringe widths of dark and bright are equal. 3+6

(b) A convex lens of focal length 20cm has the refractive index 1.5. Calculate the focal length of the convex lens when it is entirely immerged in water of refractive index 1.33. 5

Group C

6(a) Define electric dipole. Derive electric field intensity at any point in the equatorial line of very short dipole. 2+6

(b) A wire has a resistance of 16Ω. It is melted and drawn into a wire of half its original length. Calculate the resistance of the new wire. What is the percentage change in its resistance? 5

7(a) Define semiconductor. Explain intrinsic and extrinsic semiconductor. 1+3

(b) State Joule's law of heating. How can you verify it experimentally? 1+3

(c) A solenoid has an inductance of 53 mlt and a resistance of 0.37Ω. If it is connected to a battery, how long will it take for a current to reach one half its final equilibrium values? 7

8(a) Prove that magnetic energy density is directly proportional to the square of magnetic flux density. 4

Contd. ....

(b) State Ampere's theorem. Derive an expression for the field due to solenoid carrying current.

(c) If $C_1 = 3pF$ and $C_2 = 2pF$, calculate the equivalent capac the given network between points A and B.

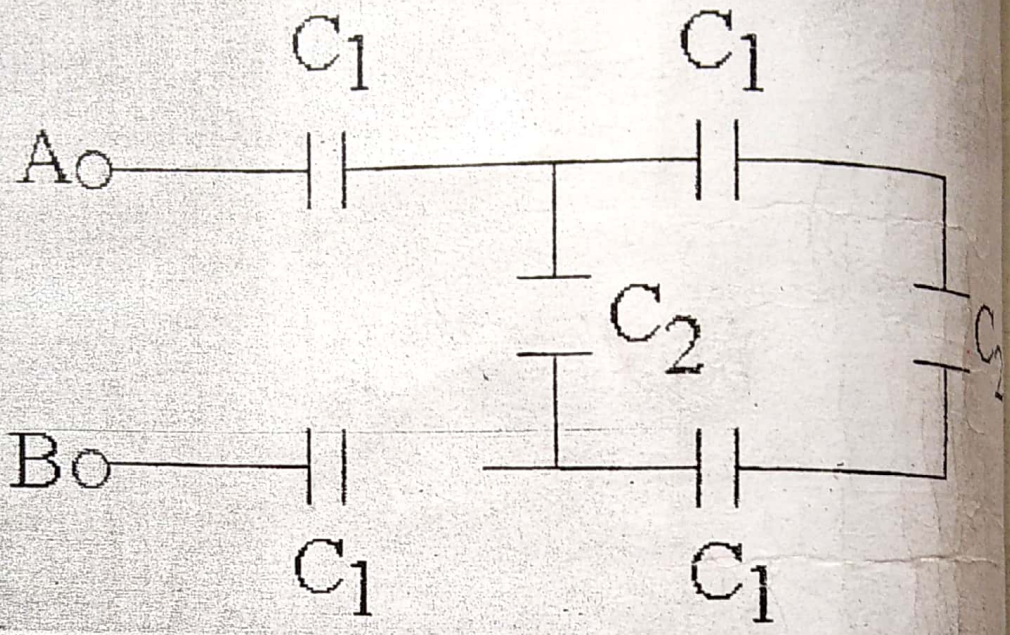

Fig. 8(c)

Group D

9(a) Discuss the oscillations of LC circuit. Point out the simila LC oscillator with oscillating mass-spring system without Calculate frequency of LC-oscillation.

(b) 2μF capacitor is charged upto 50V. The charger ba disconnected and 10mH coil is connected across capa that LC oscillations will occur. Calculate the maximum current.

10(a) What are Maxwell's equations in differential form and them in integral form.

(b) Derive the velocity of electromagnetic wave from M equation.

PURBANCHAL UNIVERSITY

2010 B

B.E. (Civil) / Second Semester / Final

Time: 03:00 hrs. Full Marks: 80 / Pass Marks: 32

BEG103HS: Physics

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

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) Define elastic restoring force. Derive an expression for the time period of a compound pendulum and prove that the centers of oscillation and suspension are interchangeable. 1+4+3

(b) The shortest distances traveled by the particles executing S. H.M. from the mean position in two second is equal to $\frac{\sqrt{3}}{2}$ times its amplitude, determine its time period. 5

2(a) What do you mean by Doppler's effect? Derive an expression for the change in frequency of a note due to relative motions of the observer and source. 2+6

(b) Two sources of intensities 4 I and I produce interference. Find the intensity at the points where phase difference be (i) zero (ii) $\pi/2$ (iii) π. 5

Group B

3(a) Two lenses of focal lengths f_1, and f_2 are placed coaxially at a certain distance d apart is air. Prove that $F = \frac{f_1 f_2}{\Delta}$ Where the meaning have their usual meaning. 9

(b) A glass dumbbell of length 50 cm and refractive index 1.50 has ends of 5 cm radius of curvature. Find the position of the image formed due to refraction at one end only, when a point object is situated in air at a distance of 20cm from the end of the dumbbell along the axis. 5

Contd. ...

4(a) What do you mean by coherent sources of light? Write down the analytical treatment of interference and show that the distance between two consecutive bright and dark fringes is equal. 2+7

(b) A diffraction grating used at normal incidence gives a line λ_1=6000 A^0 in a certain order superimposed on another line λ_2=4500 A^0 of the next higher order. If the angle of diffraction is 30^0, how many lines are there in a cm in the grating? 5

5(a) What is meant by polarized and unpolarized light? Describe the construction of a Nicol prism and show how it can be used as a polarizer and as an analyzer. 2+7

(b) A shop film 5×10^{-5}cm thick is viewed at an angle of 35° to the normal. Find the wavelengths of light in the visible spectrum which will be absent from the reflected light (μ=1.33). 5

Group C

6(a) Define the electric field intensity. Prove that the electric potential is inversely proportional to the cube of distance. 1+7

(b) A civil engineering student kept his 9.OV, 7.0 W radio turned on to listen the live program at full volume from 9.00 p.m. until 2.00 a.m. How much charge went through it? 5

7(a) State Gauss's law in free space. How the law is modified if dielectric materials are present. Prove the relation $q^1 = q\left(1-\frac{1}{k}\right)$ where the symbols carry usual meaning. 2+2+4

(b) The resistance of a 240-volt and 200 watt electric bulb when hot is 10 times the' resistance when cold. Find its resistance at room temperature. If the working temperature of the filament is 2000°C. Find the temperature coefficient of the filament. 5

8(a) State Ampere's law and use it to determine the magnetic flux density set up by a long straight current carrying conductor. Calculate force between two parallel conductors carrying current in the same direction. 1+4+3

Contd. ...

(b) In an LC circuit having L=10mH and C=2μF, what maximum value of current in the inductance if the cond initially charged to 50 volts?

Group D

9(a) What is meant by forced oscillation? Compare electron oscillation with the mass spring system. Obtain the diff equation of LC oscillation and also calculate the frequenc LC oscillation.

(b) For a 50kw Kantipur FM radio, find the maximum magni electric field and magnetic field at a distance of 100km fr antenna. Assume that the antenna radiates equally direction.

10(a) What is displacement current? Write down significa displacement currents.

(b) State and prove the equation of continuity.

(c) With the help electromagnetic waves equation, Prov

$$C = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$ Where c is the velocity of light.

PURBANCHAL UNIVERSITY

2011

B.E. Civil/Geomatic/Second Semester/*Back*

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BEG103HS: Physics

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All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) What is the torsional pendulum? Derive the expression for time period for mass spring system and torsional pendulum. [1+4+3]

(b) 10 g stone is tied to a nylon thread of length 0.5 m and diameter 2.0 mm and is rotated in a horizontal circle. If the maximum perssible strain is not to exceed 0.5%, what is the maximum permissible angular velocity of the stone? (Young's modulus of the nylon = 2.0×10^9 Nm^{-2}) 5

2(a) What is attenuation of sound? Explain the characteristics of attenuation. [2+6]

(b) A radio wave of frequency 840 MHz is sent towards an aeroplane. The frequency of the radio echo has a frequency of 2.8 KHz more than the original frequency. Estimate the velocity of the aero plane,

Group B

3(a) Define coma, curvature of the field, astigmatism and distorsion. Derive the condition for acromatism of two thin lens placed in contact. [4+4]

(b) Two thin convex lenses of focal lengths 20 cm and 5 cm are placed 10 cm apart. Calculate the positions of the principle points of this combination and equivalent focal length. [5]

4(a) What is blooming of lens? Explain with necessary theory the Newton's rings method of measuring the wavelength of monochromatic light. [1+7=8]

(b) How wide is the central diffraction peak on a screen 3.5 m behind a 0.01mm slit illuminate by 500 nm light? [5]

Contd. ...

5(a) What is principle of generation of laser? Explain the production of He-Ne laser. Discuss the application of laser in fields. [3+4+1=8]

(b) In an experiment using Young's slits, the distance between the centre of the interference pattern and tenth bright fringe on either side of it is 3.44 cm and the distance between the slits and the screen is 2.0 m. If the wavelength of light used is 5.89 X 10-7 m, determine the slits separation. [5]

Group C

6(a) Define electric dipole? Derive electric field intensity at the equatorial line of the very short dipole. [1+7=8]

(b) Find the equivalent capacitance of the circuit as shown in fig.(1). What will be the equivalent capacitance of the circuit is broke at the right of X.

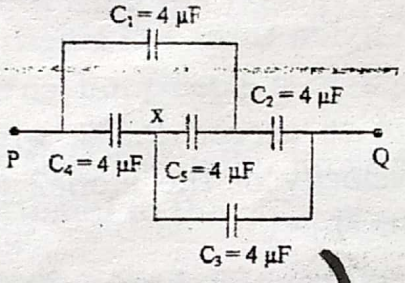

Fig.(1)

7(a) Define current density and specific resistance. Derive the relation for the resistivity.

$$\rho = \frac{mV}{nc^2\lambda}$$

State and explain the kirchhoff's law. [2+2+4]

(b) Find the equivalent resistance of the network shown in fig.(2) between the points A and D. [5]

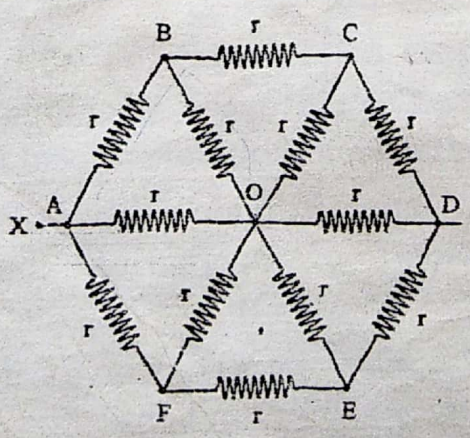

Fig. (2)

Ans: 0.8 r

Contd. ...

8(a) State and explain the Biot-Savart's law. Derive an expressi the magnetic field due to solenoid, using this law. [4+4=8]

(b) The electric current in a circular coil of two turns produ magnetic intensity of 0.2 T at its centre. The coil is unw and is rewound into a circular coil of 4 turns. What magnetic intensity at the centre of the circular coil?

Group D

9(a) Write differential equation in integral form and convert them differential form. [3+3

(b) A 20 Watts, 110 volts lamp is to be used on A.C. mains of 2 50 Hz. Calculate the inductance to be put in series to bu lamp at is its rated voltage.

10(a) What is displacement current? Write down maxwell's equat differential form and convert them in integral form.

(b) With the help of electromagnetic wave equation prove that

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

Where c = velocity of light.

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Group A

1(a) What is compound pendulum? Derive its time period and in which condition time period is maximum and minimum? 2+4+2

(b) A steel wire 60cm long and 0.05cm diameter gives a note 240 vibrations per second when stretched with a certain weight. Another steel wire 40cm long and 0.06cm diameter is stretched with the same force. Find the frequency of the fundamental note. 5

2(a) What are beats? Name the basic phenomenon due to which beats are produced. Two sources of sound are producing waves of frequency f_1 and f_2, where (f_1-f_2) is small. Show mathematically that the beat frequency is (f_1-f_2). 1+2+5

(b) A meter stick suspended from one end swings as a physical pendulum, (i) what is the period of oscillation? and (ii) what would be the length of the simple pendulum that would have the same period? 3.5+1.5

Group B

3(a) Explain the formation of Newton's rings. Show that fringe width decreases with no. of order of the rings. How Newton's rings are used to determine the wavelength of monochromatic light? 2+3+4

(b) A plane diffraction grating has 1500 lines per inch. Find the angles of separation of the 5058Å and 2016Å lines of helium in the second order spectrum. 5

Contd. ...

4(a) What is optical activity and specific rotation? Give construction and working of Nicol prism. 2+2+5

(b) Two lenses of focal lengths 8cm and 4cm are placed at a certain distance apart. Calculate the positions of principal points if they form an achromatic combination. 5

5(a) What is chromatic aberration in a lens? Derive condition of achromatism when two lenses are separated by finite distance apart. 2+4

(b) Explain the basic principle of generation of lasers light. 3

(c) Calculate the thickness of half wave plate for sodium light (λ=5893Å) Given μ_0=1.54 and the ratio of velocity of ordinary and extra-ordinary component is 1.007. Is the crystal positive? 4+1

Group C

6(a) What are polar and non-polar dielectrics? Show that $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$ where symbols carry their usual meanings. 2+6

(b) A battery of e.m.f. 24V and internal resistance r is connected to a circuit having two parallel resistors of 3Ω and 6Ω in series with an 8Ω resistor. The current following in the 3Ω resistor is then 0.8A. Calculate (i) the current in the 6Ω resistor, (ii) r and (iii) the terminal p.d. of the battery. 5

7(a) What is current density? Derive relation between conductivity and mobility. Explain atomic view of resistivity and show that $\varsigma = \frac{m}{ne^2\tau}$, where symbols carry their usual meanings. 1+3+4

(b) A 50 volt potential difference is suddenly applied to a coil of 50mH inductance and 180Ω resistance. Calculate (i) the final current and (ii) the time in which the current reaches 99.9% of its final value. 5

8(a) Calculate the magnetic field due to a long straight conductor using Biot-Savart's law. What is self inductance? Derive an expression for self inductance of a Solenoid. 5+1+2

Contd. ...

(b) Two charges q_1 and q_2 of $0.1\mu\mu c$ (micro-micro coul
$(-0.1)\mu\mu c$ respectively are 10Å apart. What is the electr
a point on the line joining them at a distance of 10cm f
midpoint?

Group D

9(a) Compare electromagnetic oscillation with mass-spring
Develop differential equation for LCR damped oscill
derive its frequency.

(b) Prove charge conservation theorem $\nabla.\vec{J} + \frac{\partial \varsigma}{\partial t} = 0$.

10(a) Write Maxwell's equations in differential form. Using
equations, derive wave equations in conduction mediu

(b) An observer is at a distance of 1m from the point sour
whose power output is 1kW. Calculate the magnitud
and magnetic field.

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PURBANCHAL UNIVERSITY

2011

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Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) What is meant by compound pendulum? Derive the expression for time period of a compound pendulum. In Which condition time period is maximum and minimum. [1+5+1+1]

(b) A 1 m length of brass wire is joined end to end to 1m length of steel wire of same diameter. The total extension of two wires is 1.5mm.What are the extensions produced in each wire. [Young's modulus for brass is $1x10^{11}NM^{-2}$ and that for steel is $2x10^{11}NM^{-2}$] [5]

2(a) What is superposition of- waves? Describe the interference of wave. [2+6]

(b) A 40 kg boy jumps from a height of 4 m on to a platform mounted on the springs. As the spring compress the platform is pushed down a maximum distance of 0.2 m below its initial position and it then rebounds. What is the boy's speed at the instant the platform is depressed 0.1m. [5]

Group B

3(a) Define the cardinal points. Derive the expression for combined focal length of two thin lenses placed at certain distance apart.[1+7]

(b) It is desired to make a converging achromatic lens of mean focal length 40 cm by using two lens of materials A and B. If the dispersive powers of A and B are in the ratio 1:3, find the focal length of each lens. [5]

Contd. ...

4(a) Explain the Fraunhofer diffraction pattern obtained with a narrow slit and illuminated by a parallel beam of monochromatic light. [8]

(b) A soap film of refractive index 4/3 and of thickness 1.5x10-4 cm is illuminated by white light incident at an angle of 60°. The light reflected by it is examined by a spectroscope in which is found a dark band corresponding to wavelength of 5x 10-5 cm. Calculate the order of interference of dark band. [5]

5(a) What is optical fibre? Discuss briefly its applications in (i) communication and (ii) medical instrument. [2+3+3]

(b) A monochromatic light of wavelength 5890Ais incident normally on a diffraction grating which has 6000 lines per centimeter. (a) At what angle will the second order image be seen? (b) Can you obtain the third order image with this grating? [2.5+2.5]

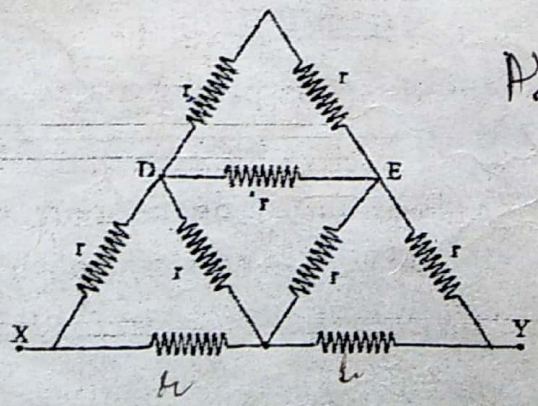
Group C

6(a) What is electric dipole? Derive the expressions for electric potential due to dipole and quadrupole. [1+3+4]

(b) Three small balls each of mass 10 gm are suspended separately from a common point by silk threads each 1m long. The balls are equally charged and hang at the corners of equilateral triangle of side 0.1 metre long on side. What is the charge on each ball.

7(a) Define resistivity. Discuss the atomic view of resistivity and show that $p \alpha \frac{1}{n\varsigma}$ where p the resistivity and n is the number of nT electrons per unit volume and Γ is the mean time between collisions. [1+2+5]

(b) Find the resistance between points X and Y of the network of resistors shown in fig.(1), if each resistor is of resistance r. [5]



Ans 10r/9

Contd. ...

8(a) State and explain the Biot-Savart's law. Derive an expressi the magnetic field due to straight conductor, using this law.

(b) Two long straight parallel wires in which there are curre 2.0 A and 3.0 A respectively in the same direction are a apart. Calculate the magnetic field at a point mid-way be them.

9(a) Compare electromagnetic oscillation with the oscillation of spring system. Obtain differential equation for LCR cl oscillation. Write and explain the solution of the equation. [

(b) A radio can tune over the frequency of a portion of MW bro band: (880 kHz to 1200 kHz). If its LC circuit has an e inductance of 200pH, what must be the range of its v capacitor?

10(a) What is displacement current? Write down maxwell's equa differential form and convert them in integral form.

(b) Prove the differential equation in conducting medium.

$$\nabla^2\vec{E} = \mu\sigma\frac{\partial\vec{E}}{\partial t} + \mu\varepsilon\frac{\partial^2\vec{E}}{\partial t^2}$$

(c) Prove the pointing vector telation $\vec{S} = \vec{E} \times \vec{H}$ where the s have their usual meanings.

PURBANCHAL UNIVERSITY

2011

B.E. Civil/Geomatic/Second Semester / *Final*

Time: 03:00 hrs. Full Marks: 80 /Pass Marks: 32

BEG103HS: Physics

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Group A

1(a) Define angular harmonic motion. Derive an expression for the time period of a bar pendulum and show that the point of oscillation and centre of suspension are interchangeable. 1+4+3

(b) A mass 'm' is suspended from a light vertical spring of force constant k. The period of oscillation is 0.50 second. The spring is cut into four equal parts. The same mass m is suspended from one of the parts and set into oscillations. Calculate the new period of oscillation. 5

2(a) What are beats? Show that frequency of minima is same as that of maxima? 1+4

(b) Derive an expression of velocity of transverse wave in stretched string. 3

(c) An ambulance with a siren emitting a whine at 1600 Hz overtakes and passes a cyclist pedaling a bike at 2.44m/s. After being passed, the cyclist hears a frequency of 1590 Hz. How fast is the ambulance moving? 5

Group B

3(a) What is interference of light? Give the theory of Newton's rings in the case of reflected system and describe how the refractive index of liquid is determined by Newton's ring method. 2+4+3

(b) In Young's two slit experiment, the separation of four bright fringes is 2.4mm when the wavelength of light is 6×10^{-7}m. The distance from the slit to the screen is 1.0m. Calculate the separation of the slits. 5

Contd. ...

4(a) What is the basic difference between laser light and ordinary light? Explain the principle for the production of laser light and write any four uses of laser. 1+3+2

(b) What is optical fibre? Discuss its working principle. 1+2

(c) A plane transmission grating has 1500 lines per inch. Find the angle of separation of the 5048Å and 5016Å lines of helium in the second order spectrum. 5

5(a) What are the cardinal points? Derive the expression for the combined focal length when two lenses are placed at a certain distance apart. 3+4

(b) What is 'double refraction'? 2

(c) Two thin lenses (same material) of focal lengths f_1 and f_2, separated by a certain distance d have an equivalent focal length of 50cm. The Combination satisfies the condition for no chromatic aberration and minimum spherical aberration. Find the values of f_1, f_2 and d. 5

Group C

6(a) What is electric dipole? Obtain an expression for the electric potential at any point, due to a dipole. 1+5

(b) Use Gauss's law to find the electric intensity outside a changed sphere. 3

(c) An air-filled parallel plate capacitor has a capacitance of 1.1pF. The separation of the plates is halved and wax is inserted between them. The new capacitance is 8.8pF. Find the dielectric constant of the wax. 5

7(a) Discuss the transient current in L-R circuit and hence derive Helmholtz equation for the growth of current in it. Derive 'time constant' of L-R circuit. 1+5

(b) Explain the domain theory of ferromagnetism. 3

(c) A solenoid has length L=1.23m and inner diameter d=3.55cm, and it carries a current I=2.57A. It consists of five close-packed layers, each with 850 turns along length L. What is the magnetic induction B at its centre? 5

Contd. ...

8(a) What are intrinsic and extrinsic semiconductors? Descri construction of a transistor stating the relative sizes and of doping in different regions of it.

(b) State and prove maximum power theorem.

(c) Three charges +q, +2q and -4q are placed at the three ver a n equilateral triangle of side 10cm. What is the potential energy of the system of the charges?

Group D

9(a) Develop a differential equation of undamped L-C oscillat find an expression for the frequency of oscillation.

(b) Compose e.m. oscillation with mass-spring system perf S.H.M.

(c) What is displacement current for the capacitor of circular of radius 5cm if the electric field is changing at the r 8.9×10^{12} volt/m.s.? ($\varepsilon_0=8.9\times10^{-12}$ C^2 N^{-1} m^{-2}).

10(a) Write Maxwell's equations both in integral and differentia and point out the physical significance of each of the eq

(b) In an oscillating LC circuit, what value of charge, expres terms of maximum charge is present on the capacitor wh energy is shared equally between the electric and ma fields? At what time 't' will this condition occur, assumi capacitor to be fully charged initially? Assume that L=10m C=1.0μF.

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$\Rightarrow$ i) $U_E = \frac{1}{2}(U_E)_{max} = \frac{1}{2}\frac{q_m^2}{2C}$

$\Rightarrow q^2/2C = \frac{1}{2} q_m^2/2C \Rightarrow q = q_m/\sqrt{2}$

ii) when $t=0$, $q=q_m \Rightarrow \phi=0$

Then $q = q_m \cos\omega t$

$\frac{q_m}{\sqrt{2}} = q_m \cos\omega t$ and $t = \frac{\pi}{4}$

PURBANCHAL UNIVERSITY

2012

B.E. (Computer/Electronics & Communication)/ First Semester/Final

Time: 03:00 hrs. Full Marks: 80 /Pass Marks: 32

BEG103SH: Physics

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All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) What is compound pendulum? Derive its time period and show that the points of suspension and oscillation are interchangeable. 1+5+2=8

(b) Two cars traveling in opposite direction at 60km/hr cross each other while one of them is sounding its horn. If the frequency of horn is 1000Hz, find the apparent frequency heard by observer in the other car before the crossing (velocity of sound = 332 m/s. 5

2(a) Distinguish between particle velocity and wave velocity. Also obtain the relation between them. 1+3

(b) What are ultrasonic? Discuss a method for the production of ultrasonic waves. 1+5

(c) A linear spring whose force constant is 0.2N/m hangs vertically supporting a 1kg mass at rest. The mass is pulled down a distance 0.2m and then released. What will be its maximum velocity? Also find the frequency of vibration. 5

Group B

3(a) What is meant by interference of light? Discuss the formation of Newton's rings by reflected light. Show that fringe width decreases with the order of rings. 1+6+2

(b) In a plane transmission grating the angle of diffraction for second order maxima for wavelength 5×10^{-5}cm is 30^{o}. Calculate the no. of lines in one centimeter of the grating surface. 5

Contd

4(a) What is double refraction? Give construction and working of a Nicol prism.

(b) Two lenses of focal lengths 8cm and 4cm are placed at a certain distance apart. Calculate the positions of principal points if they form an achromatic combination. Assume both the lenses are same material. 3+3+3=9

5(a) Derive an expression for the condition of a achoromatism of two thin lenses in contact. 5

(b) Describe the construction and working principle of He-Ne laser. 4

(c) An unpolarized beam of light is incident on a group of four polarizing sheets which are lined up so that the characteristic direction of each is rotated by 30^o clockwise with respect to the proceding sheet. What fraction of the incident intensity is transmitted? 5

Group C

6(a) What is electric quadrupole? Calculate the electric potential of a linear quadrupole of separation '2a' at an axial distance 'r' from its centre. 1+3

(b) Define capacitance. Calculate the capacitance of a cylindrical capacitor of length 'ℓ'. 1+3

(c) If a typical copper wire of household wiring has a crosssectional area 3.31×10^{-6} m^2 and carries a current of 10A, what is the drift speed of electrons? Density of copper is 8.95 gm/cm^3 and Avogadro's number is 6.02×1023 mol^{-1}. 5

7(a) On the basis of mechanism of electrical conduction in metal and considering electron as electron-gas, show that the resistivity of metal is inversely proportional to number of free electrons per unit volume. 5

(b) State and expansion Krichoff's laws. 3

(c) A circular loop of wire 5 cm. in radius cames a current of 100 A. What is the energy density at the centre of the loop?

8(a) What is self induction? Derive self inductance of a solenoid. Derive the expression for the growth of current in an LR circuit with a steady source of emf. 1+3+4

(b) Two similar balls of mass 'm' are hung from silk thread
'l' and similar charges. Prove that the separation of t

$$x = \left[\frac{q^2 l}{2\pi\varepsilon_0 mg}\right]^{1/3}$$ assuming θ is very small.

Group D

9(a) Define electromagnetic oscillation and compare it with up differential equation of LC oscillation and find the of oscillation.

(b) A certain plane electromagnetic wave emitted by a antenna has a wavelength of 3cm and a maximum ma electric field of 2×10^{-4} v/m.

(i) What is the frequency of the wave?

(ii) What is the maximum magnetic field?

(iii) What is the maximum energy density?

(iv) What is the intensity of the wave?

10(a) Write Maxwell's equations in integral and differen Derive wave equations in a conducting medium for ele magnetic field.

(b) What is displacement current? Prove that the dis current in a parallel plate capacitor can be written on

PURBANCHAL UNIVERSITY

2012

B.E. (Computer/Electronics & Communication)/First Semester/Back

Time: 03:00 hrs. Full Marks: 80 /Pass Marks: 32

BEG103HS: Physics

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

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) Discuss the theory of a simple spring mass system and derive an expression for its frequency. 4

(b) Obtain an expression for the time period of a torsion pendulum. 4

(c) A loud speaker produces sound level of 8 dB above a certain reference level at a point 40 in from it. Find the intensity level at a point 30 in from the source. 5

2(a) What do you mean by Doppler's effect? Derive an expression for the change in frequency of a note due to relative motion of the observer and source. 2+6

(b) A meter stick suspended from one end swings as a physical pendulum. Calculate the frequency of oscillation. Take g = 9.8 m/s^2. 5

Group B

3(a) Define the term cardinal points. Derive the expression for the combined focal length when two lenses are placed in a certain distance apart. 3+6

(b) A diffraction grating used at normal incidence gives a green line, $\lambda = 5400\ \mathring{A}$ in a certain order superimposed on the violet line, $\lambda = 4500\ \mathring{A}$ of the next higher order. If the angle of diffraction is 30°, how many lines are there per centimeter in the grating? 5

Contd. ...

4(a) What is double refraction? Give construction and working of a Nicol prism.

(b) Two lenses of focal lengths 8cm and 4cm are placed at a certain distance apart. Calculate the positions of principal points if they form an achromatic combination. Assume both the lenses are same material. 3+3+3=9

5(a) Derive an expression for the condition of a achoromatism of two thin lenses in contact. 5

(b) Describe the construction and working principle of He-Ne laser. 4

(c) An unpolarized beam of light is incident on a group of four polarizing sheets which are lined up so that the characteristic direction of each is rotated by 30^{o} clockwise with respect to the proceding sheet. What fraction of the incident intensity is transmitted? 5

Group C

6(a) What is electric quadrupole? Calculate the electric potential of a linear quadrupole of separation '2a' at an axial distance 'r' from its centre. 1+3

(b) Define capacitance. Calculate the capacitance of a cylindrical capacitor of length 'ℓ'. 1+3

(c) If a typical copper wire of household wiring has a crosssectional area $3.31 \times 10^{-6}\ m^2$ and carries a current of 10A, what is the drift speed of electrons? Density of copper is 8.95 gm/cm^3 and Avogadro's number is $6.02 \times 1023\ mol^{-1}$. 5

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4(a) What is meant by superposition of waves? Explain the phenomenon of interference in thin film due to reflected and transmitted light. 1+4+4

(b) A 20 cm long tube containing sugar solution rotates the plane of polarization by 11°. If the specific rotation of sugar is 66°, calculate the strength of the solution. 5

5(a) What is optical fiber? Explain the physics behind its functioning. 1+2

(b) Define spontaneous and stimulated emissions. Explain the principle of generation of laser light.

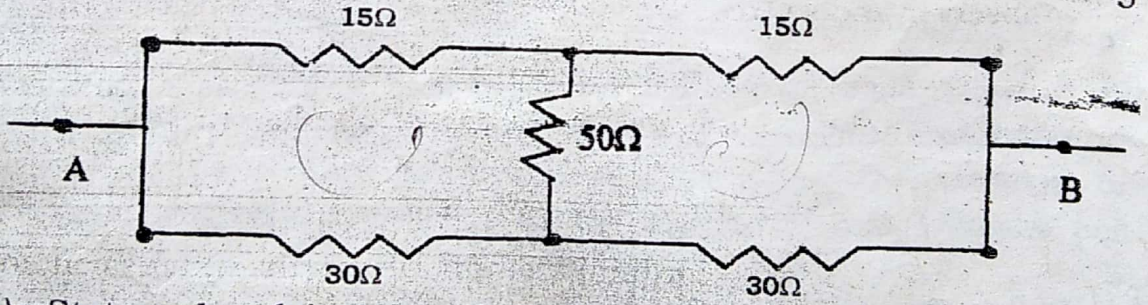
(c) In Newton's ring experiment, the diameter of the 10^{th} ring changes from 1.4cm to 1.27 cm when a liquid is introduced between the lens and the plate, calculate the refractive index of the liquid. 5

Group C

6(a) Show that the electric field due a short electric dipole at an axial point is inversely proportional to the cube of its distance from the dipole. 4

(b) Calculate the capacitance of a cylindrical capacitor of length 1. 4

(c) Find the equivalent resistance of the network shown in figure between the points A and B. 5



7(a) State and explain Ampere's theorem. Derive an expression for the magnetic field due to a solenoid carrying current. 2+4

(b) Use Ohm's law to show $\vec{I} = \sigma \vec{E}$, where each symbol carries its usual meaning. 4

(c) If a copper wire is stretched to make 0.1 % longer, what is the percentage change in its resistance? 3

Contd. ...

8(a) What is meant by self induction? Obtain an expression for inductance of a solenoid.

(b) Prove that magnetic energy density is directly proportional to square of the magnetic flux density.

(c) An electron with kinetic energy 1.2 keV circles in a plane perpendicular to a uniform magnetic field. The radius of the circle is 25 cm. Calculate flux density of magnetic field.

$\frac{1}{2}mv^2 = 1.2\times10^3\times1.6\times10^{-19}$ J $\quad Bev = mv^2/r$

Group D

9(a) Write down Maxwell's equations in integral form. Using necessary theory derive Maxwell's equations in differential form.

(b) In an oscillating LC circuit, what charge q, expressed in terms of maximum charge Q, is present in the capacitor when the energy is shared equally between electric and magnetic fields. Given L=12 mH and C = 1.7 μF.

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 out the expression for the frequency of oscillation.

(b) Show that the Poyinting vector of electromagnetic field can be written as

$$\vec{S} = \frac{1}{\mu_0}\vec{E}\times\vec{B}$$

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