

PURBANCHAL UNIVERSITY

2008

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

Physics

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

Figures in the margin indicate full marks.

Group A: Long-answer Questions

Answer **THREE** questions.

3×10=30

1. State and explain Kepler's laws of planetary motion. Derive an expression for escape velocity from solar system. **4+6**

2. State Bernoulli's theorem and deduce Bernoulli's equation. **2+8**

3. Write the Maxwell's equation and explain the significance of them. **2+8**

4. Obtain an expression for the path difference in the Young's double slit experiment. Also obtain the expression for fringe width. **6+4**

Group B: Short-answer Questions

Answer **FOUR** questions.

4×5=20

1. What is the highest order spectrum, which may be seen with monochromatic light of wavelength $6000\text{\AA}$ by means of a diffraction, grating with 5000 lines/cm?

2. In an experiment involving Newton's rings, the diameters of the fifth and fifteenth bright fringes formed by sodium yellow light are measured to be 2.303 and 4.134 mm respectively. Calculate the radius of curvature of the convex glass surface. ($\lambda = 5893\text{\AA}$).

3. State and explain Ampere's law.

4. State and explain Gauss's law in electrostatics.

Contd. ...

(2)

9. A simple pendulum of length 100 cm has energy equal to 2×10^6 ergs when its amplitude is 4 cm. Calculate its energy when its length is doubled.
10. Show that the theoretical limiting values of poisson's ratio are 1 and 0.5.

Group C: Very Short-answer Questions

Answer FIVE questions.

5×2=10

11. What is gravitational potential?
12. What is turbulent flow?
13. Define Lorentz force.
14. What do you mean by Haill effect?
15. State and explain Rayleigh criterion.
16. What do mean by holography?
17. What is Brewster's law?
18. What do mean by impedance in LCR circuit?

2021/2/19(07)

PURBANCHAL UNIVERSITY
2012

Bachelor of Technology in Biotechnology/First Semester/Final

Time: 03:00 hrs.

Full Marks: 60 /Pass Marks: 24

BT103SH: Physics-I

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

Figures in the margin indicate full marks.

Group A:

Answer THREE questions.

3×10=30

- 1(a) What do you mean by gravitational field and gravitational potential? Derive an expression for the gravitational potential at a point inside, out side and on the surface of the thin spherical shell. 1+6
- (b) If the displacement of particle at any time is given by $x = a \cos(wt) + b \sin(wt)$. If $a=6$, $b=8\text{cm}$ and $w=3$, find the period, max velocity and the maximum acceleration. 3
- 2(a) What is elasticity? Deduce the following relations (i) $Y = 2\eta(1 + \sigma)$ and (ii) $\frac{9}{Y} + \frac{3}{\eta} + \frac{1}{K}$ Where Y is Young's modulus of elasticity, η is shear modulus of rigidity, K is bulk modulus of elasticity and σ is Poisson's ratio. 1+6
- (b) A transverse wave is represented by $y = 4 \sin(62.8t - 0.314x + 2.5)$ where x and y are in cm, Calculate (i) amplitude, frequency, velocity of the wave, wave number and (ii) max speed of the particle. 3
- 3(a) State Gauss and prove Theorem and apply it to find the electric field at inside point of uniformly charged hollow cylinder and field due to uniformly charged wire. 2+3+2
- (b) Two long parallel wires are 8cm apart. What equal current must be in the wire if the magnetic field half way between them is to have a magnitude of $300\mu\text{T}$. Consider current in the wires are flowing in the opposite directions. 3

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Contd. ...

(2)

4(a) : What do you mean by coherent sources? Describe and explain the phenomenon of interference, in the thin films. 1+3+3

(b) Parallel beam of light is incident normally on a diffraction grating having 6000 lines/cm. Find the angular separation between the maxima for wavelengths 5890 Å and 5896 Å in the second order.

Group B:

Answer FOUR questions.

4×5=20

5. Neglecting gravitational attraction, establish the equation for the acceleration of the rocket. Then establish the following relation

$$\vec{V} = \vec{V}_0 + \vec{V} \log_e \frac{M_0}{M} \quad \text{Where the symbols have their usual meanings.}$$

6. State Maxwell's equation for Electromagnetic wave. Transfer the

$$\text{given relation } \oint \vec{B} \cdot d\vec{S} = \mu_0 \epsilon_0 \frac{\partial \phi_E}{\partial t} \text{ into differential form.}$$

7. Discuss the basic principle of production of LASER.

8. In giving patient a blood transfusion, the bottle is set up so that the level of blood is 1.3 m above the needle which has an internal diameter of 0.36 mm and 3 cm in length. If 4.5 cm³ of blood passes through the needle in one min, calculate the viscosity of blood. $\rho_{\text{blood}} = 1020 \text{ kg/m}^3$.

9. A 10H coil has a resistance of 180Ω. What value of capacitor must be put in series with it if the combination is to resonate when connected to a.c. source of frequency of 60Hz?

10. In Newton's rings experiment if a drop of water of refractive index 4/3 be placed in between the lens and the plate, the diameter of the 10th ring is found to be 0.6 cm. Obtain the radius of curvature of the face of the lens in contact with the plate if wavelength of, the light used is 6000 Å.

Contd. ...

(3)

Group C:

Explain briefly (any FIVE):

11. Interchangeability of point of suspension and point of oscillation in the compound.

12. Kepler's laws of planetary motion.

13. Particle velocity and wave velocity. What is Resonance in LCR circuit.

14. Self and mutual induction.

15. Rayleigh's criterion for resolving power.

16. Hall Effect.

17. Optical path

18. Lorentz force.

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PURBANCHAL UNIVERSITY

2013

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT103SH: Physics-I

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

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

- a
- 1(a) Suppose the rate of ejection of mass by the rocket is constant and equal to βM_0 , where β is constant and M_0 is initial mass of the rocket. Show that the mass at any time is $M=M_0(1-\beta t)$ and

acceleration at any time is $\vec{a} = \frac{\beta \vec{v}}{(1-\beta t)}$ 5+2

- (b) Show that the gravitational potential at the centre of a solid sphere is $3/2$ times the potential at the surface. 3

- 2(a) Write down necessary assumptions made by Poiseuille then deduce Poiseuille's formula for liquid flow through uniform narrow tube. 2+5

- ✓(b) A circular rod of $Y=2.04 \times 10^6$ Kg wt. per sq cm, $\sigma=0.4$, length 1m and cross-sectional area of 0.25 sq mm is stretched by wt. of 10 Kg. Find the extension and diminution produce in cross-section. 3

- 3(a) What do you mean by self induction? Define coefficient of self induction and state its unit. Calculate self inductance for rectangular toroid. 1+2+4

- ✓(b) Two point charges of magnitude $+2 \times 10^{-7}$ C and $+8.5 \times 10^{-8}$ C are 10cm apart. Calculate the force acts between them. What electric field intensity does each produce at the site of the other? 3

- ✓4(a) Differentiate between Fresnel and Fraunhofer diffraction. Discuss the intensity distribution in the diffraction pattern due to single slit. 2+5

Contd. ...

(5)

- (b) A plano-convex lens of radius 300cm is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of the 8th dark ring in the transmitted system is 0.72 cm. Calculate the wave length of the light used. 3

Group B

Answer FOUR questions.

4×5=20

5. What is compound pendulum? Obtain an expression for its time period.
6. State and prove Ampere's law.
7. What are Newton's rings? Derive the relation for the diameters of the rings in case of transmitted light.
8. A thin uniform bar of length 120cm is made to oscillate about an axis through its end. Find the period of oscillation and other point about which it can oscillate with same time period.
9. An electron with kinetic energy 1.2 KeV circle in a plane perpendicular to a uniform magnetic field. The radius of the orbit is 25cm. Calculate speed of the electron, the flux density magnetic field, the frequency and time period of motion.
10. Parallel beam of light is incident normally on a diffraction grating having 6000 lines/cm. Find the angular separation between the maxima for wavelengths $5890 \text{ \AA}$ and $5896 \text{ \AA}$ in the second order.

Group C

Explain briefly (any FIVE):

5×2=10

11. Gravitational potential and gravitational potential energy
12. Bending moments
13. Poisson ration
14. Write down Maxwell's equation
15. Holography
16. Rayleigh criterion for resolving power
17. Optical pumping
18. Double refraction

PURBANCHAL UNIVERSITY

2015

Bachelor of Technology in Biotechnology/First Semester / Final

Full Marks: 60 / Pass Marks: 24

Time: 03:00 hrs.

3T103SH: Physics-I (New/Old Course)

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

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

(a) Derive an expression for the impedance of an LCR series. State and explain Ampere's circuital law. Using this find the magnetic field due to a long solenoid and straight conductor. 5

(b) When the displacement in S.H.M. is half of the amplitude, what fraction of the total energy is kinetic energy? 5

(c) State and prove Bernoulli's principle. Also state the Kepler's law of planetary motion. 4+2

(d) Calculate the energy in eV and the velocity in m/s of an electron starting from the rest and accelerated by a potential difference of 1.3kv. 4

(e) Explain Brewster's law and discuss the theory of diffraction of light at single slit. Also explain the Newton's rings. 1+3+2

(f) What will be the Poisson's ratio for a hypothetical substance whose volume cannot be changed by any pressure? 4

(g) State Faraday's law of electromagnetic induction. Also define the coefficients of self and mutual inductance and write the relation between them. 5

(h) Define hall voltage and find its expression. 5

Group B

Answer FOUR questions.

4×5=20

(a) Explain the construction and working of He-Ne laser.

(b) Find change in velocity of rocket system with varying mass

Contd. ...

(2)

7. A horizontal pipe of a non-uniform bore has water flowing through it such that the velocity of flow is 40cm/sec at a point where the pressure is 2cm of mercury column. What is the pressure at a point, where the velocity of flow is 60cm/sec? (Take $g=980\text{cm/sec}^2$ and density of, water = 1gm/cc .)

8. Two point charges of magnitude $1\times 10^{-8}\text{C}$ and $2\times 10^{-8}\text{C}$ are 30cm apart in air. Find the electric field at a point midway between them.

9. In a Young's double slit experiment, the width of the fringes obtained with light of wavelength $6000\text{\AA}$ is 3mm. What will be the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33?

10. Find the relation between Y , K and η .

Group C

Explain briefly (any FIVE):

5×2=10

11. Define interference and diffraction.

12. State Poisson's law.

13. Find the equation of continuity.

14. Write the properties of electric lines, of force.

15. Define Rayleigh criterion.

16. Explain resolving power.

17. Explain polarization.

18. Explain principle of laser.

First Semester

2016

Physics-I

Answer three questions: $3 \times 10 = 30$

1.a) State and explain the Gauss theorem. By using it find the electric field intensity outside and inside of the hollow charged sphere. Also describe the properties of electric lines of force. $5+2$

b) What will be the Poisson's ratio for a hypothetical substance whose volume cannot be changed by any pressure? 3

2.a) Find the time period of simple and compound pendulum. Also, state the Kepler's law of planetary motion. $5+2$

b) In a Young's double slit experiment, the width of the fringe's obtained with light of wavelength $= 6000 \text{ \AA}$ is 3 mm. What will be the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33? 3

3.a) Explain the Young's double slit experiment and show that the fringe width of bright and dark fringes are equal. ~~Exp~~ Explain what happens if white light is used instead of monochromatic light. $5+2$

b) Two point charges of magnitude $1 \times 10^{-8} \text{ C}$ and $2 \times 10^{-8} \text{ C}$ are 30 cm apart in air. Find the electric field at a point midway between them. 3

4.a) State Faraday's law of electromagnetic induction. Also,

define the coefficients of self and mutual inductance. 2+5

b) find the impedance of L.C.R. series resonant circuit. 3

Group - 'B'

Answer four questions:

$4 \times 5 = 20$

5. Explain the construction and working of He-Ne laser.

6. Find the change in velocity of rocket system with varying mass without considering the weight of the rocket.

7. A horizontal pipe of a non-uniform bore has water flowing through it such that the velocity of flow is 40 cm/sec at a point where the pressure is 2 cm of mercury column. What is the pressure at a point, where the velocity of flow is 60 cm/sec ? (Take $g = 980 \text{ cm/sec}^2$ and density of water = 1 gm/cc)

8. An electron of energy 2000 eV describes a circle in a field of magnetic induction 0.01 wb/m^2 . Calculate the radius of the circle ($e/m = 1.76 \times 10^{-11} \text{ C/kg m}$)

9. How many orders will be observed by a grating having 5000 lines/cm , if it is stimulated by visible light in

the range $3000 \text{ \AA}$ to $6000 \text{ \AA}$.

10. Find the relation between V , K and η .

Group - 'C'

Explain briefly (any five):

$5 \times 2 = 10$

11. Define streamline and turbulent flow.
12. Write the Maxwell equation.
13. Find the equation of continuity.
14. Write the condition for coherent source.
15. Define Rayleigh criterion.
16. What is population inversion.
17. Explain polarization.
18. Describe the Hall Effect.

PURBANCHAL UNIVERSITY

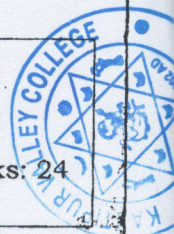
2017

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT103PY: Physics-I (New/Old Course)



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

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

1(a) What is compound pendulum? Obtain an expression for its time period. Also show that the time period of the pendulum is a minimum when its length is equal to its radius of gyration. 1+3+3

(b) What is potential energy of 3 kg mass (i) at surface of the earth. (ii) at a distance 3×10^5 km. (Mass of the earth = 5.98×10^{27} gm, radius of the earth = 6.67×10^8 cm). 3

2(a) Define Young's modulus, bulk modulus; modulus of rigidity and Poisson's ratio. Deduce the following relations. 1+3+3

(i) $y = 3K(1 - 2\sigma)$ and (ii) $Y = 2\eta(1 + \sigma)$

Where the symbols have their usual meanings.

(b) A particle of mass 4gm lies in a potential field given by $V = 200x^2 + 150$ ergs/gm. Deduce the frequency of vibration? 3

3(a) State and prove Gauss's theorem. Use it to calculate electric field due to a solid sphere when point lies inside of the charged sphere. 4+3

(b) A solenoid having a core of 4cm² in cross-section, half air ($\mu = 1$) and half iron ($\mu = 500$) is 20cm long. If the numbers of turns on it is 1000, calculate the coefficient of self induction. 3

4(a) Give mathematical explanation of linearly, circularly and elliptically polarized light. 5

(b) What are positive and negative crystals? 2

(c) A parallel beam of light of wave length 5890×10^{-8} cm is incident on a thin glass plate having refractive index of 1.5 making angle of refraction in the plate of 60° . Calculate the smallest thickness of the glass plate which will appear dark by reflection. 3

Contd. ...

(2)

Group B

4×5=20

Answer FOUR questions.

5. State Kepler's laws of planetary motion. Deduce its second and third law.
6. What is Hall Effect? Derive an expression for Hall voltage $V_H = \frac{BI}{net.}$. Define Hall coefficient and also show that the Hall coefficient $R_H = \frac{B}{net.}$. Where, the symbols have their usual meanings.
7. Show that the diameters of Newton's dark rings are proportional to square roots of natural numbers in reflected light.
8. The stages of two stages rocket separately weigh 100kg and 10kg and contains 800kg and 90kg of fuel respectively. What is the final velocity that can be achieved with an exhaust velocity of 1.5m/s?
9. An electron of energy 1000eV describes a circle in a field of magnetic induction 0.02Wb/m². Calculate the radius of the circle. ($e/m = 1.76 \times 10^{-14} \text{C/kg m}$).
10. How many orders will be observed by a grating having 4000 lines/cm, if it is stimulated by visible light is the range 4000 Å to 7000 Å.

Group C

5×2=10

Explain briefly (any FIVE):

11. Why do we need multistage rocket?
12. Why do we prefer to Bar Pendulum than Simple pendulum?
13. Stress and strain.
14. Electromagnetic induction.
15. Resonance in LCR circuit.
16. Plane transmission grating.
17. Double refraction
18. Half wave plate and quarter wave plate

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PURBANCHAL UNIVERSITY

2018

Bachelor of Technology in Biotechnology/First Semester/Final

Time: 03:00 hrs.

Full Marks: 60 /Pass Marks: 24

BT103PY: Physics-I (New/Old Course)

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

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

- 1(a) What do you mean by escape velocity? Establish an expression for velocity of rocket considering its weight. Discuss why we need multistage rocket. 1+4+2
- (b) What is potential energy of 2 kg mass (i) at surface of the earth. (ii) at a distance $2 \times 10^5 \text{ km}$ from the centre of the earth and (iii) What is the amount of work required to move body from the surface of the earth to this distance. $M_e = 5.98 \times 10^{27} \text{ gm}$, $R_e = 6.37 \times 10^8 \text{ cm}$. 3
- 2(a) Define coefficient of viscosity and state its unit. Write down necessary assumptions made by Poiseuille then deduce Poiseuille's formula for liquid flow through uniform narrow tube. 1+2+4
- (b) A steel wire of 2mm diameter is stretched between two fixed points at 20°C temperature. If the temperature falls to 10°C , calculate the tension: 3
($\alpha = 11 \times 10^{-6} / ^\circ \text{C}$, $Y = 2.1 \times 10^{12} \text{ dynes/cm}^2$).
- 3(a) State and prove the Gauss's law of electrostatics. Apply the law to calculate field due to two concentric spherical conductors. 4+3
- (b) An air cored toroidal coil has 500 turns and a mean diameter of 32 cm with a cross-sectional area of 2 cm^2 . Calculate the self inductance of the coil and average e.m.f. induced when a current of 2A is reversed in a time of 0.02 sec. 3
($\mu_0 = 4\pi \times 10^{-7} \text{ Weber/amp m}$)
- 4(a) What is Newton's ring? Give the necessary theory of Newton's rings in terms of reflected light. Also explain why compactness of rings increases with increase in numbers of orders of rings. 1+4+2

Contd. ...

-6
(2)

- (b) Parallel beam of light is incident normally on a diffraction grating having 6000 lines/cm. Find the angular separation between the maxima for wavelengths 5890 Å and 5896 Å in the second order. 3

Group B

Answer FOUR questions.

4×5=20

5. What do you mean by compound pendulum? Obtain an expression for its time period.
6. Show that if the two coils having coefficient of self inductances L_1 and L_2 are mutually coupled together so that the whole of the flux from one coil links with other, then the mutual inductance between the two coils is given by $M = \sqrt{L_1 L_2}$.
7. What is double refraction? Discuss Huygens' explanation for double refraction.
8. A 4 kg block is suspended from a spring with a spring constant of 500N/m. A 50 gm bullet is fired into the block from directly below with a speed of 150m/s and becomes embedded in the block (a) Find the amplitude of the resulting S.H.M. (b) What fraction of original K.E. of the bullet is transferred to the mechanical energy of the harmonic oscillator?
9. A current of 30A flows in a long wire, a rectangular loop ABCD carrying current 20A is situated 1 cm away from this wire. If the side of loop facing the wire is 30cm and the other side is 8cm, calculate the magnitude and direction of the resultant force acting on the loop due to magnetic field of the current in the straight wire.
10. A soap film of thickness 5×10^{-5} cm & refractive index 1.33 is viewed at an angle of 35° to the normal. Find the wave length of light in visible spectrum which will be absent from the reflected light.

Group C

Explain briefly (any FIVE):

5×2=10

11. Gravitational self energy.
 12. Hooke's law
 13. Critical velocity and Reynold's number
 14. Rayleigh's criterion for resolving power
 15. Self and mutual induction
 16. Optical activity and specific rotation.
 17. Polarization by reflection
 18. Write down Maxwell's equations in integral and differential forms
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