

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2083 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	60
Programme	BCE, BME, BAG, BCH	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics (ENSH 152)

- ✓ 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. a) Why thermal resistance is important in building science? [1]
 b) Write the name of retardation plate which produces circularly polarized light. [1]
 c) Mention the importance of supercapacitor. [1]
 d) Write the equation for rise of current in an LR circuit and sketch the graph. [1]
2. a) Show that the vibrating motion of a particle given by $y = Re^{i\omega t}$ is simple harmonic. [2]
 b) If the Einstein's temperature of a solid is 100°C , calculate the Einstein's frequency. [2]
 c) Convert Maxwell equation $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ in to integral form. [2]
 d) Derive the relation between phase velocity and group velocity. [2]
3. Derive the differential equation of forced oscillation and show that the maximum amplitude at resonance varies inversely with damping coefficient. [4]

OR

Show that the point of suspension and the point of oscillation are interchangeable in bar pendulum. [4]

4. A room has dimensions of $6\text{m} \times 4\text{m} \times 5\text{m}$. Find (i) average distance travelled by the sound for two successive reflections and (ii) number of reflections made per second by the sound wave from the walls of the room. Given velocity of sound in air is 350 ms^{-1} . [4]
5. What is Pyrheliometer? How can you measure solar constant using Pyrheliometer? [4]

OR

State Stefan's- Boltzmann law of radiation and proof it using the first law of thermodynamics and Maxwell's thermodynamics relation. [4]

6. a) Explain with necessary theory to obtain the radius of n^{th} bright ring and n^{th} dark ring in Newton's ring due to reflected system. [4]
 b) A diffraction grating with 400 lines per millimeter is illuminated normally by monochromatic light of wavelength $6000 \text{ \AA}$. Calculate (i) the angle at which the first-order maxima occur (ii) the maximum number of diffraction maxima that can be observed. [4]
 c) Derive the expressions for acceptance angle and numerical aperture of an optical fiber. [4]
 d) The focal length of an achromatic combination of two lenses in contact is 120 cm . If the dispersive powers of the materials of the two lenses are 0.02 and 0.03 , calculate the focal lengths of the two individual lenses. [4]
7. a) Define electric quadruple and quadruple moment. Derive the expression for electric potential on the axis of linear quadruple. [4]

OR

- Find the electric field intensity at a distance 'z' above the center of a flat circular disk of radius 'a', which carries a uniform surface charge density ' σ '. [4]
- b) If a and b are internal and external radii of a cylindrical capacitor then show that the half of the energy lies within $r = \sqrt{ab}$. [4]
8. Derive an expression for energy stored by an inductor. Show that the energy density in magnetic field is directly proportional to the square of magnetic field. [4]
9. State and prove charge conservation theorem. [4]
10. Calculate the energy difference between ground state and first excited state for an electron in one dimensional infinite potential well of width $1\text{\AA}$. Mass of electron (m_e) = $9.1 \times 10^{-31}\text{kg}$ and Plank's constant (h) = $6.62 \times 10^{-34}\text{Js}$, $1\text{eV} = 1.6 \times 10^{-19}\text{J}$. [4]

RMR classes

RMR value

81 - 100

61 - 80

41 - 60

21 - 40

< 20

Very good

Good

Fair

Poor

Very

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Bhadra

Exam.	Regular (New Course)		
Level	BE	Full Marks	60
Programme	BCE, BME, BAG, BCH	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics (ENSH 152)

- ✓ 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. a) Define entropy. [1]
- b) What is the role of He atom in He-Ne laser? [1]
- c) Does a quadrupole have zero dipole moment? [1]
- d) What is the physical significance of displacement current? [1]
2. a) What is the angular frequency of a damped oscillator which has mass 250gm, force constant 85N/m and damping coefficient 70g/s? [2]
- b) Find the translational kinetic energy of one mole of monoatomic gas at normal temperature and pressure. What will be its value at 273°C? [2]
- c) Show that magnetic energy density is equal to electric energy density in case of electromagnetic waves. [2]
- d) Define wave particle duality and derive de-Broglie wavelength. [2]
3. Derive the time period of torsional pendulum. Explain how can you determine the modulus of rigidity of metallic wire using torsional pendulum. [4]

OR

A particle having mass 100gm is in oscillation in a medium having damping constant 0.5 kg/s. Calculate the (i) time in which the amplitude becomes half of its initial value and (ii) energy becomes half of its maximum value. [4]

4. Derive Sabine relation for reverberation time. [4]
5. Derive the Clausius latent heat equation: $C_2 - C_1 = \frac{dL}{dT} - \frac{L}{T}$, where C_1 and C_2 represent the specific heat of solid and its saturated vapor, L is latent heat of vaporization. [4]

OR

Define calorific value. Explain the construction and working principle of bomb calorimeter. [4]

6. a) Why do we observe fringes in a wedge-shaped film? Derive an expression for the fringe width formed due to interference in a wedge-shaped thin film. [4]
- b) What is double refraction? Show that the plane polarized light and circularly polarized light are the special case of elliptically polarized light. [4]
- c) What is the smallest Bragg angle for x-ray of wavelength 30pm to reflecting planes spaced 0.3nm apart in a calcite crystal? [4]
- d) Two lenses of focal lengths 15 cm and 20 cm are placed at a distance of 10 cm co-axially in air. Calculate the equivalent focal length of the combination and principal points. Also, find the position of the image when the object is at 40 cm in front of first lens. [4]

7. a) Derive the electric potential due to short dipole at distance r from the center of dipole making angle θ with the axis of dipole. Extend your result to find the electric potential at axial and equatorial line. [4]

OR

Find an expression for electric field due to uniformly charged ring of radius ' R ' at distance ' y ' from the center of the ring. [4]

- b) How many time constants must elapse before a capacitor in an RC - circuit is charged 99 % of its maximum charge? [4]
8. Deuterons in a cyclotron describe a circle of radius 0.32m just before emerging from dees. The frequency of the applied emf is 10MHz. Find the flux density of the magnetic field and the velocity of deuterons emerging out of the cyclotron. Given, mass of deuteron is $3.32 \times 10^{-27} \text{ Kg}$ and charge is $1.6 \times 10^{-19} \text{ C}$. [4]
9. An observer is 1.8m from a light source whose power output is 250W. Calculate the maximum values of electric and magnetic fields at the position of observer. [4]
10. Show that energy levels are quantized when an electron is confined in infinite potential well of width ' a '. [4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	60
Programme	BCE, BME, BAG, BCH	Pass Marks	24
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics (SH 152)

- ✓ 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. a) Define critical coefficient. What is its value? [1]
 b) Define angle of acceptance with expression. [1]
 c) Write down the relation between electric field intensity and potential gradient. [1]
 d) What types of particles can be accelerated by a cyclotron? [1]
2. a) A stick of length 1 m oscillates as a physical pendulum. What is the length of pendulum that gives the least time period? [2]
 b) Calculate the increase in boiling point of water at 100°C when the pressure is increased by one atmosphere, latent heat of vaporization is 540 cal/gm and 1 gm of steam occupies a volume of 1677 cm^3 . [2]
 c) Explain the normalization of wave function. [2]
 d) Using Maxwell's equations, prove charge conservation theorem. [2]
3. Show that motion of torsional pendulum is simple harmonic and describe the method to determine modulus of rigidity of suspension wire by using torsional pendulum. [4]

OR

Derive the expression for time period of torsional pendulum and use it to determine the moment of inertia of an unknown body about the axis of rotation. [4]

4. The reverberation time for an empty hall is 1.5 sec. With 500 audiences, the reverberation time falls to 1.4 sec. Find the number of persons present in the hall if the reverberation time falls down to 1.312 sec. [4]
5. Explain with assumption the Einstein's quantum theory of specific heat capacity of solid and mention how this theory agrees with the experimental results at low temperature. [3+1]

OR

Derive the Vander Waal equation for a real gas in terms of critical constants a and b with the reason for pressure and volume correction. [4]

6. a) What is achromatism? Prove that the combination of two lenses of similar nature, made by same material is achromatic if the distance between them is equal to arithmetic mean of their focal length. [1+3]
 b) A thin equi-convex lens of focal length 100 cm and refractive index 1.5 rests on an optically flat glass plate. Newton's rings are viewed normally by reflection using light of wavelength $5890 \times 10^{-10} \text{ m}$. What is the diameter of 5th bright ring? [4]

- c) Light is incident normally on the grating 0.5 cm wide with 2500 lines. Find the angles of diffraction for the principal maxima of the sodium lines ($\lambda_1 = 5890 \text{ \AA}$ and $\lambda_2 = 5896 \text{ \AA}$) in the first order spectrum. [4]
- d) What is stimulated emission? Describe the construction and working of He-Ne laser with energy level diagram. [4]
7. a) Show that the magnitude of electric field intensity due to a very short dipole at a point on axial line is twice that on equatorial line. [4]

OR

- Define electric quadrupole and quadrupole moment. Derive the expression for electric potential on the axis of linear quadrupole. [1+3]
- b) Write down the steps to calculate the capacitance of a capacitor and derive the capacitance of a cylindrical capacitor. [1+3]
8. Calculate the displacement current density between the capacitor of area $2.3 \times 10^{-2} \text{ m}^2$ and rate of electric field change $2 \times 10^{12} \text{ V/ms}$. Also, calculate induced magnetic field of this region. [4]
9. An electromagnetic wave travels through the medium with a relative permittivity 4 and relative permeability 1. If wavelength of electromagnetic wave in the medium is 400 nm, calculate (i) The speed of the wave in medium (ii) The frequency of the wave. [2+2]
10. Starting with Schrodinger wave equation, discuss the quantum theory of barrier tunneling of a particle or wave. Also define the terms transmission coefficient and reflection coefficient. [3+1]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Ashwin

Exam. Level	Regular (New Course-2080 Batch)		
	BE	Full Marks	60
Programme	BCE, BME, BAG,	Pass Marks	24
	BCH	Time	3 hrs.
Year / Part	I / II		

Subject: - Engineering Physics (SH 152)

- ✓ 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. a) Define degree of freedom. What is its value for monoatomic gas due to translatory motion? [1]
- b) As the laser light is produced from neon atom, what is the purpose of helium atom in He-Ne laser? [1]
- c) What is electric dipole and dipole moment? [1]
- d) Write the basic concept of eddy current production. [1]
2. a) A thin uniform rod of length 1m hangs from a pivot fitted at one end. Calculate the time period if amplitude is small. [2]
- b) Calculate the kinetic energy of one mole of diatomic gas at 273°C. Take $R=8.31 \text{ Jmol}^{-1}\text{K}^{-1}$. [2]
- c) Calculate the kinetic energy of a neutron having de-Broglie wavelength of 0.1 nm. [2]
- d) Mention the Maxwell's electromagnetic equation in integral and differential form. [2]
3. Show that the radius of gyration in a bar pendulum is equal to half of the distance between point of suspension and oscillation when the time period is minimum. [4]

OR

Using the expression for time period in physical pendulum, prove that the point of suspension and oscillation are at equal distance from C. G. when the time period is minimum.

4. The volume of auditorium hall is 600 m^3 , wall area is 200 m^2 , the floor area is 120 m^2 and ceiling area is 120 m^2 . The average coefficient of absorption for wall, ceiling and floor are 0.03, 0.80 and 0.06 respectively. Calculate the average absorption coefficient and reverberation time. [2+2]
5. Present the assumptions in Einstein's quantum theory of specific heat and derive the expression for specific heat of solids. Explain the results for low temperature and high temperature regions. [1+2+1]

OR

Discuss with reason for correction in pressure and volume of real gas and derive Vander-Waal's equation of real gas. [3+1]

6. a) What is circle of least confusion? Prove that the diameter of circle of least confusion for a lens is independent with its focal length when the object is taken at large distance. [1+3]
- b) Newton's rings arrangement is used with a source emitting two wavelength $\lambda_1 = 6 \times 10^{-5} \text{ cm}$ and $\lambda_2 = 5.9 \times 10^{-5} \text{ cm}$. It is found that n^{th} dark ring due to λ_1 coincides with $(n+1)^{\text{th}}$ dark ring due to λ_2 . Find the diameter of n^{th} dark ring if the radius of curvature of the used lens is 90 cm. [4]
- c) A diffraction grating 3 cm wide produces the second order at 33° with light of wavelength 600 nm. What is the total no. of lines in the grating? [4]
- d) What is double refraction? Explain mathematically, how you can produce linearly, circularly and elliptically polarized light? [4]
7. a) Derive an expression for the electric field intensity at any point on the axial line at a distance 'r' from the center of a short quadrupole. [4]

OR

Derive an expression for electric field intensity due to a ring of charge along the axis. Also, find the position at which the field is maximum.

- b) A Capacitor is discharged through resistor R. After how many time constant does its (i) charge drop to half of its initial value? (ii) energy stored fall to half of its initial value? [2+2]
8. Calculate the displacement current between the circular plates of area $1.5 \times 10^{-2} \text{ m}^2$ and rate of electric field change $1.5 \times 10^{12} \text{ Vm}^{-1}\text{s}^{-1}$. Also calculate the displacement current density and induced magnetic field for $r = R = 69 \text{ mm}$. [4]
9. The electromagnetic wave is travelling through a vacuum with a frequency of $5 \times 10^{14} \text{ Hz}$. The amplitude of electric field is 3 V/m, Calculate [2+2]
- a) The amplitude of magnetic field
- b) The intensity of wave.
10. Using Schrodinger wave equation, calculate the values of energy of a particle in one-dimensional infinitely deep potential well. Indicate graphically the first three wave functions for such a particle. [3+1]
