



KATHMANDU

DON BOSCO COLLEGE

Pre-board Examination - 2061

Class: XII
Time: 3 Hrs

Subject: Physics (I)

F.M: 75
P.M: 30

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate the full marks. All answers of numerical problems should be expressed in SI System.

1. Attempt all questions:

[8×2 = 16]

- It is said that detergents enhance the cleansing effect of water, how?
- What is the science behind the “sipping” of hot tea or coffee rather than drinking in “gulps”? Explain on the basis of adiabatic change.
- Sounds from a distance are heard clearly at nights rather than daytimes, why?
- It is said that direct electric current can not be “transformed”, why?
- What do you mean by “Avalanche” effect in a semiconductor diode?
- Nuclear bombs and Nuclear reactors both release energy from the atoms, what is the difference between them?
- From the Discharge Tube Experiment, explain what are the conditions required for the conduction of electric current through air (or gas) though it is an insulator otherwise?
- What do you mean by a Unit Cell?

2. Attempt any four questions:

[4×2 = 8]

- Skyscrapers like “The World Trade Center” used a lot of steel structures in addition to concrete, why?
- It is claimed that sound waves can not be polarized, is it true?
- Why are 100% efficient engines not possible?
- Why is interference patterns not observed with white light?
- What is the reason for colored discharges in a Discharge Tube Experiment?
- How is the behavior of a capacitor different towards direct current and alternating current?
- Define a “Black Hole”, how does it originate?
- What are the green house gases and how do they contribute to the greenhouse effect?

3. a) Describe an experiment to determine the Coefficient of Viscosity in the lab.

[4]

Or

Derive an expression for determining the surface tension of a liquid.

[4]

- b) The rubber cord of a catapult has a cross sectional area 1.0 mm^2 and a total unstretched length 10 cm. It is stretched to 12 cm and then released to project a missile of mass 5.0 gm. Calculate the velocity of projection, considering Young's Modulus for rubber as $5.0 \times 10^8 \text{ N/m}^2$. [3]

4. a) Derive an expression for the work done during an adiabatic change of one mole of a gas.

[4]

Or

Explain the structure and function of a Carnot Engine (derivation of efficiency is not required).

[4]

- b) Given that the volume of a gas at STP is $2.24 \times 10^{-2} \text{ m}^3/\text{mole}$ and that standard pressure is $1.0 \times 10^5 \text{ N/m}^2$, calculate the value for the Molar Gas Constant ‘R’ and use it to find the difference between the quantities of heat required to raise the temperature of 0.1 kg of oxygen from 0°C to 50°C when

i) The pressure is allowed to remain constant, and

ii) The volume is allowed to remain constant. [Relative molecular mass of oxygen = 32]

[3]

5. a) Derive an expression for the determination of frequency modes in a vibrating stretched string.

[4]

Or

Describe the assumption and method used by Laplace to determine the velocity of sound in air.

[4]

- b) An observer, traveling with a constant velocity of 20 m/sec., passes close to a stationary source of sound and notices that there is a change of frequency of 50 Hz as he/she passes the source. What is the frequency of the source? [3]
6. a) Derive the expression of Snell's law by the use of Huygen's Wave Theory of Light. [4]
Or
Determine with necessary theory the expression for the fringe width when light from two monochromatic coherent sources undergo interference under ideal conditions. [4]
- b) A telescope constructed from two converging lenses, one of focal length 250 cm and the other of focal length 2 cm, is used to observe a planet which subtends an angle of 5×10^{-5} radian. If the two lenses are placed to form the image at normal adjustment, calculate the angle subtended at the eye of the observer by the final image. [3]
7. a) Derive an expression for the magnetic field inside a long solenoid carrying a current "I". [4]
Or
Derive an expression for the emf resulting due to the supply of alternating current through a series arrangement of a capacitor and a resistor. [4]
- b) A circular metal disc of area $3 \times 10^{-3} \text{ m}^2$ is rotated at the rate of 50 rev/sec about an axle through its center perpendicular to its plane. The disk is in a uniform magnetic field of flux density $5 \times 10^{-5} \text{ T}$ in the direction of the axle. What is the value of the emf induced? [3]
8. a) Derive an expression for the energy of an electron in the first orbit of hydrogen atom according to Bohr's theory. [4]
- b) The initial number of atoms in a radioactive element is 6.0×10^{20} and its half life is 10 hours. Calculate the number of atoms which have decayed in 30 hours and the amount of energy liberated if the energy liberated per atom decay is $4.0 \times 10^{-13} \text{ J}$. [4]
Or
A UV radiation of wavelength 400 nm strikes a surface of a metal of work function 1.9 eV. Find the velocity of electrons emitted from the surface of the metal ($m_e = 9.1 \times 10^{-31} \text{ kg}$, $c = 3 \times 10^8 \text{ m/sec.}$, $h = 6.62 \times 10^{-34} \text{ Jsec.}$). [4]
9. How can Vacuum Tube Diodes be used as full wave rectifiers? [4]
Or
Explain the Millikan's Oil Drop Experiment to determine the charge of an electron. [4]
10. What is water pollution? What is the level of water pollution that exists in Kathmandu Valley? [4]
Or
Write an essay on major sources of energy in Nepal. [4]

"Failure doesn't mean you've wasted your life . . . it does mean you've a chance to start again."

- Robert Schuller



KATHMANDU
DON BOSCO COLLEGE

Pre-board Examination - 2061

Class: XII
Time: 3 Hrs

Subject: Physics (II)

F.M: 75
P.M: 30

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate the full marks. All answers of numerical problems should be expressed in SI System.

1. Attempt all questions: [8×2 = 16]
- Rubbers are used as vibration absorbers, why?
 - State the requirements of an adiabatic process. Also explain what would happen if they are not fulfilled?
 - What are the differences between progressive and stationary waves?
 - Why are astronomical telescopes not suitable to view terrestrial objects, and what should be done to remedy the situation?
 - Can light metals as aluminium be used as a target of X-ray tube?
 - Why is a current carrying solenoid considered as a replacement for a bar magnet?
 - For equal concentration of doped impurities, compare the conductivities of n-type and p-type semiconductor.
 - What is an ozone hole?
2. Attempt any four questions: [4×2 = 8]
- Ploughing the field helps retain the moisture of the soil, why?
 - Why is the sound of an approaching train more irritating than the outgoing train?
 - What is the major reason behind the less efficiency of steam engines than petrol or diesel engines?
 - What are the advantages of having two eyes over single eye?
 - What is the main advantage of a Choke coil over a resistor in case of AC?
 - What are the major differences between the electrons and β particles?
 - What do you mean by the Balmer Series? What is the special property of Balmer series?
 - What led scientists to believe that the universe is expanding?
3. a) How is energy stored in a wire that has been extended? Derive an expression for the energy stored in a stretched wire. [4]
- Or
- Derive Bernoulli's Equation for steady, nonviscous and an incompressible fluid. [4]
- b) Two spherical raindrops of equal sizes are falling vertically through air with a terminal velocity of 0.15 m/sec. What would be the terminal velocity if the two drops coalesce and form a single larger drop? [3]
4. a) Derive the relation, $C_p - C_v = R$ for a mole of an ideal gas, where the symbols have their usual meanings. [4]
- Or
- Explain the structure and function of a Petrol engine (derivation of efficiency is not required). [4]
- b) A mass of air occupying initially a volume of $2 \times 10^{-3} \text{ m}^3$ at a pressure of 760 mm of mercury and at a temperature of 20°C is expanded adiabatically and reversibly to twice its volume, and then compressed isothermally and reversibly to a volume of $3 \times 10^{-3} \text{ m}^3$. Find the final pressure and temperature, assuming the ratio of specific heat capacities to be 1.40. [3]
5. a) What are beats? Derive an expression for the frequency of beats produced from two waves of equal amplitudes. [4]
- Or
- Define Doppler's Effect. Derive an expression to show how the frequency varies when a source of sound at moves towards a listener at rest. [4]

- b) A steel wire of length 40 cm and diameter 0.025 cm vibrates transversely in unison with a tube open at each end and of effective length 60.0 cm, when each sounding at the fundamental modes. If the air temperature is given at 27 °C, find the tension in the wire (Velocity of sound in air at 0 °C = 331 m/sec, and the density of steel = 7800 kg/m³). [3]
6. a) Describe the Fizeau's method of determining the speed of light. [4]
Or
What do you mean by Polarization of Light? Show that $\tan \theta_p = \mu$, where θ_p is the angle of polarization and μ is the refractive index of the medium. [4]
- b) In a Young's Double Slit Experiment, two slits are 0.3 mm apart and are 50 cm from the screen. What is the distance between the second and third dark lines of the interference pattern when the slits are illuminated with light radiation of 600 nm wavelength? [3]
7. a) Derive an expression for the emf induced in a rectangular coil rotated with a particular frequency and exposed to a uniform magnetic field of given value. [4]
Or
Derive an expression for the emf resulting due to the supply of alternating current through a series arrangement of an inductor and a resistor. [4]
- b) A rectangular coil of 50 turns hangs vertically in a uniform magnetic field of magnitude 10^{-2} T so that the plane of the coil is parallel to the magnetic field. The mean height of the coil is 5 cm and the mean width 2 cm. Calculate the current that must be passed through the coil in order to deflect it 30° if the torsional constant of the suspension is 10^{-9} Newton meter per degree. [3]
8. a) Derive the decay equation for a typical radioactive disintegration. Also relate the half life and decay constant from the equation. [4]
- b) Calculate the potential difference in volts necessary to be maintained between two horizontal conducting plates, one above the other, so that a small oil drop of mass 1.3×10^{-14} kg with two electrons attached to it remains in equilibrium ($g = 9.8 \text{ m/sec}^2$, charge of an electron = 1.6×10^{-19} C.). [4]
Or
An X-ray tube works at a dc potential difference of 50 kV. Only 0.4 % of the energy of the cathode is converted to X-radiation and heat is generated in the target at the rate of 600 W. Estimate the current passed into the tube and the velocity of the electrons striking the target. ($m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C).
9. How can semiconductor diodes be used as full wave rectifiers? [4]
Or
Describe a method used to determine the value of e/m by Thompson's method. [4]
10. What are the main causes of air pollution? Mention its effects and ways to minimize it. [4]
Or
What are the hazards created posed by radiation? What are the safety measures? [4]

"Failure doesn't mean you'll never make it . . . it does mean it will take a little longer."

- Robert Schuller