K23U 2377

Reg. No. : .....

Name : .....

**V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2023**
**(2019 – 2021 Admissions)**
**CORE COURSE IN PHYSICS**
**5B09PHY : Electronics – II**

Time : 3 Hours Max. Marks : 40

PART – A

Short answer questions. Answer **all** questions. **Each** question carries **1** mark. **(6×1=6)**

1. What are the consequences of no or faulty biasing of a transistor ?
2. What is an oscillator ? What type of feedback is applied for oscillator ?
3. Why a power amplifier is called a large signal amplifier ?
4. Write an example of a Boolean function in POS form.
5. Draw a logic diagram to implement the Boolean expression $F = x(y\Theta z) + \bar{v}$.
6. What are encoders ?

PART – B

Short essay questions. Answer **any six** questions. **Each** question carries **2** marks. **(6×2=12)**

7. What do you mean by decibel system ? Write down the expression for power gain in decibel.
8. Mention the essential conditions to be satisfied by an oscillator circuit.
9. Explain the difference between voltage and power amplifier.
10. With negative feedback, voltage gain reduces. Explain why ?

P.T.O.

11. Explain a magnitude comparator.

12. Draw and explain a binary half adder.

13. What are the characteristics of an ideal op-amp ?

14. Define CMRR and slew rate of an op-amp.

PART – C

Problems. Answer **any four** questions. **Each** question carries **3** marks. **(4×3=12)**

15. Draw and explain briefly the working of a capacitor coupled two stage amplifier.

16. Distinguish between coupling and bypass capacitors.

17. Briefly explain the operation of a transformer coupled Class A power amplifier.

18. Find the voltage gain and output voltage of a non-inverting amplifier with $R_f = 10K\Omega$, $R_1 = 1K\Omega$ and input voltage = +1v.

19. Minimize the Boolean function $f = \overline{A}BC + \overline{A}B\overline{C} + A\overline{B}\overline{C} + AB\overline{C} = \sum(0, 2, 4, 6)$.

20. Draw and explain a decimal to BCD encoder.

PART – D

Long essay questions. Answer **any two** questions. **Each** question carries **5** marks. **(2×5=10)**

21. What are h-parameters ? Obtain an expression for current gain, input impedance, output impedance and voltage gain of a transistor amplifier in terms of h-parameters.

22. With the circuit diagram, explain the working of an op-amp as an inverting and non-inverting amplifier.

23. Discuss in detail about Hartley oscillator.

24. What is a full adder ? Draw and explain a binary full adder. How it can be realised using two half adders ?

K23U 2376

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**(2019-2021 Admissions)**

**CORE COURSE IN PHYSICS**

**5B08PHY : Thermodynamics and Statistical Mechanics**

Time : 3 Hours Max. Marks : 40

PART – A

(**Short answer** questions. Answer **all** questions. **Each** carries **1** mark.)

1. Give the Rankine and Fahrenheit temperature corresponding to 373.15 K.
2. A quasi static isothermal expansion of ideal $N_2$ gas enclosed in a cylinder fitted with a frictionless movable piston is a reversible process or not ? Why ?
3. State the significance and limitations of first law of thermodynamics.
4. What are the merits of a diesel engine ?
5. State the physical sense of Helmholtz free energy.
6. Define RMS speed of molecules. **(6×1=6)**

PART – B

(**Short essay** questions. Answer **any six** questions. **Each** carries **2** marks.)

7. State and explain Zeroth law of thermodynamics with one fundamental application.

**P.T.O.**

8. The pressure on 300 gm of copper is increased quasistatically and isothermally from 0 to 500 atm at 300K. (Take the density $\rho = 8.96 \times 10^3 \frac{kg}{m}$ and isothermal compressibility, $k = 6.18 \times 10^{-12} Pa^{-1}$). How much work is done during compression ?

9. Explain molar heat capacity at constant volume and prove that $dU = C_V dT$.

10. a) Define coefficient of thermal conductivity

    b) Prove that $C_p - C_v = R$ for one mole of an ideal gas using the first law of thermodynamics.

11. Explain Carnot's theorem.

12. State Kelvin-Planck statement of second law of thermodynamics. Can we propel a ship across ocean by utilizing the internal energy of the ocean ?

13. Explain the term 'entropy'. How will you relate entropy and disorder for a system which is making a transition from ferromagnetic to paramagnetic behaviour ?

14. Distinguish between bosons and fermions. **(6×2=12)**

## PART – C

(**Problems**. Answer **any four** questions. **Each** carries **3** marks.)

15. Compute the bulk modulus of petrol from the following data. Initial volume = 200 liters, Pressure change = 100 atm and final volume = 201 liters.

16. A tyre filled with Nitrogen gas at a pressure of 1 atm is compressed to $(1/10)^{th}$ of its volume

    a) Very slowly

    b) Suddenly. Find the pressure difference of the compressed air between the two cases.

17. Obtain the value of Stefan's constant if the temperature of the filament of a 25 W lamp is 2000°C and the effective area of the filament is $0.60 \times 10^{-4} m^2$. The relative emittance of the filament is 0.29.

18. Calculate the change in entropy in MKS system when 10 kg of ice at its melting point is converted into water by heating to 283K. [Latent heat of ice = 80 cal/gm. Specific heat of water = 1 cal/gm°C].

19. Calculate under what pressure ice freezes at 270 K if the change in specific volume when 1 kg of water freezes is $80 \times 10^{-6} m^3$. Given the latent heat of ice = $3.36 \times 10^5$ J/kg.

20. In how many ways can two particles be distributed in five quantum states. The particles are indistinguishable following B-E statistics. **(4×3=12)**

## PART – D

(**Long Essay**. Answer **any two** questions. **Each** carries **5** marks.)

21. Deduce thermodynamic potentials and derive Maxwell's relation.

22. Describe Carnot engine and obtain expression for its efficiency.

23. Explain with examples

    a) Reversible and irreversible process.

    b) Quasistatic process.

    c) Intensive and extensive variables.

    d) Thermodynamic equilibrium.

24. Derive Maxwell-Boltzmann distribution law. **(2×5=10)**

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**V Semester B.Sc. Degree (C.B.C.S.S.-O.B.E.-Regular/Supplementary/ Improvement) Examination, November 2023**
**(2019 – 2021 Admissions)**
**CORE COURSE IN PHYSICS**
**5B07 PHY : Electrostatics and Magnetostatics**

Time : 3 Hours Max. Marks : 40

PART – A

Short answer questions. Answer **all** questions. **Each** carries **1** mark.

1. Write the mathematical definition of the one-dimensional Dirac delta function.
2. Will the electrostatic energy obey a superposition principle ? Justify your answer.
3. What do you mean by the linear dielectric ?
4. Explain the term “induced dipoles.”
5. Express the vector potential of a magnetic dipole in terms of magnetic dipole moment.
6. How is the magnetic susceptibility related to the magnetization and permeability of the material ? **(6×1=6)**

PART – B

Short essay questions. Answer **any six** questions. **Each** carries **2** marks.

7. Discuss the electrostatic boundary conditions.
8. With the help of the superposition principle, obtain the expression for force on a test charge Q due to a collection of discrete point charges.

**P.T.O.**

9. Derive an expression for how much work it takes to charge the capacitor up to a final amount of charge Q.

10. The presence of a charge inside a cavity in a solid conductor will communicate its presence to the outside world. Explain.

11. Derive an expression for the force acting on a polar molecule when it is placed in a non-uniform electric field.

12. Explain the terms surface current density, K and volume current density, J.

13. How does the Ampere's law apply to magnetized materials ?

14. What do you mean by the term bound surface current ? **(6×2=12)**

PART – C

Problems. Answer **any four** questions. **Each** carries **3** marks.

15. Find the potential inside a uniformly charged solid sphere whose radius is R and whose total charge is q. Use infinity as your reference point.

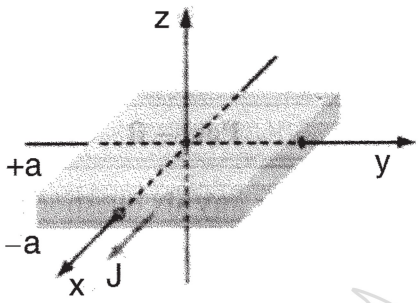
16. Find the electric field of a distance z above the midpoint of a straight-line segment of length 2L that carries a uniform line charge $\lambda$.

17. Consider two concentric spherical shells, of radii a and b. Suppose the inner one carries a charge q and the outer one carries a charge – q (both of them uniformly distributed over the surface). Calculate the energy of this configuration.

18. Suppose the field inside a large piece of dielectric is $E_0$, so that the electric displacement is $D_0 = \in_0 E_0 + P$. Now a small spherical cavity is hollowed out of the material. Find the field at the center of the cavity in terms of $E_0$ and P. Also find the displacement at the center of the cavity in terms of $D_0$ and P . Assume the polarization is "frozen in," so it doesn't change when the cavity is excavated.

19. Derive the continuity equation.

20. A thick slab extending from z = – a to z = +a (and infinite in the x and y directions) carries a uniform volume current $J = J\hat{x}$: (as shown in the figure). Find the magnetic field, as a function of z, both inside and outside the slab.




**(4×3=12)**

## PART – D

Long Essay. Answer **any two** questions. **Each** carries **5** marks.

21. State Gauss's law in electrostatic and express it is in differential form. Find the electric field produced by an infinite plane sheet carrying a uniform surface charge density $\sigma$. Also find the direction and magnitude of the electric field in between two such sheets having equal and opposite uniform charge densities $\pm\sigma$.

22. Explain the term polarization. Derive an expression for the electric potential of a polarized object in terms of the bound surface and volume charge densities.

23. Discuss the motion of charged particles in a uniform electric field at right angles to the magnetic field.

24. Derive the relation for the change in orbital dipole moment of an atomic orbit due to a magnetic field. **(2×5=10)**

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K23U 2374

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**V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2023**
**(2019 – 2021 Admissions)**
**CORE COURSE IN PHYSICS**
**5B06 PHY : Quantum Mechanics**

Time : 3 Hours Max. Marks : 40

PART – A

(Short answer questions. Answer **all** questions. **Each** carries **1** mark.) **(6×1=6)**

1. What is pair production ?
2. Discuss the Bohr's correspondence principle.
3. Write down the energy-time uncertainty principle and explain the terms involved.
4. What does the amplitude of the de Broglie wave represent ?
5. Explain the term degeneracy of eigen states.
6. What is Pauli's exclusion principle ?

PART – B

(Short essay questions. Answer **any 6** questions. **Each** carries **2** marks.) **(6×2=12)**

7. Draw the spectrum of a blackbody for two different temperatures. Explain Wien's displacement law.
8. Using a suitable schematic, explain the Bragg's law.
9. Discuss the assumptions of Thomson's model. Explain the failures of this model.
10. What do you mean by a wavepacket ? Explain the terms phase and group velocities.
11. Discuss the schematic and the results of the Davisson-Germer experiment.

P.T.O.

12. Explain the concept of normalizing a wave function.
13. Using a suitable figure, explain qualitatively the phenomenon of quantum mechanical tunneling.
14. Explain normal Zeeman effect.

## PART – C

(Problems. Answer **any 4** questions. **Each** carries **3** marks.) **(4×3=12)**

15. X-rays of wavelength 0.24 nm are Compton-scattered and the scattered beam is observed at an angle 60 degree relative to the incident beam. Determine (a) the wavelength of the scattered X-rays and (b) energy of the scattered X-rays.
16. Calculate the two longest wavelengths of the Balmer series of triply ionized beryllium (Z = 4).
17. Calculate the de Broglie wavelength of an electron having a kinetic energy 1000 eV.
18. A particle is confined to a box of width 40Å. Determine the probability that the particle is found in an interval of 4Å at the centre of the box. Assume that the particle is in its lowest energy state.
19. What are the possible z components of the angular momentum vector L which represents the orbital angular momentum of a state with orbital angular momentum quantum number $l = 2$ ? What is the length of the angular momentum vector ?
20. What are the possible values of the total angular momentum quantum number under LS coupling of two atomic electrons whose orbital quantum numbers are $l_1 = 1$ and $l_2 = 2$ ?

## PART – D

(Long essay. Answer **any 2** questions. **Each** carries **5** marks.) **(2×5=10)**

21. List the experimental results of photoelectric effect. Give Einstein's explanations for the same.
22. Explain Franck-Hertz experiment. Discuss the result of the experiment.
23. Setup the time-independent Schrödinger equation for a particle moving in a potential in one dimension.
24. Explain the fine structure splitting in hydrogen.

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