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No. of Printed Pages : 3

GS-300

VI Semester B.Sc. Examination, May/June - 2019

PHYSICS - VIII

Electronics Magnetic Materials, Dielectrics & Quantum Mechanics-III

(FRESH) (CBCS) (2018-19 & Onwards)

Time : 3 Hours Max. Marks : 70

Instruction : Answer **all** Parts.

PART - A

Answer **any five** questions. Each question carries **Eight** marks. 5x8=40

1. (a) Explain the concept of virtual ground of an operational amplifier. 3+5

   (b) Derive an expression for voltage gain of a non inverting amplifier using op-amp.

2. (a) State Barkhausen criterion for sustained oscillations. 2+6

   (b) Explain with a circuit diagram working of a phase shift oscillator. Write the expression for its frequency of oscillation.

3. (a) State De Morgan's theorems. 2+6

   (b) What is a full adder ? Draw the logic diagram of full adder using two half adders and write its truth table.

4. (a) Explain the weiss domain theory of Ferromagnetism. 4+4

   (b) Distinguish between hard and soft magnetic materials.

5. What is a Lorentz field ? Derive the expression for Lorentz field. 8

6. (a) What is meant by Normalisation of a wavefunction ? 2+6

   (b) Solve Schrodinger time independent equation for a free particle in one dimension and show that the momentum of the particle is precisely defined.

7. Set up Schrodinger equation for a particle in one dimensional box and solve it to obtain the eigen values. Represent the first three wave functions graphically. 8

P.T.O.

2+3+3

8. (a) Write Schrodinger equation for a linear harmonic oscillator.

(b) What is a rigid rotator ? Write expression for energy of a rigid rotator.

(c) What is a quantum mechanical operator ? Write quantum mechanical operators for energy and momentum.

PART - B 5x4=20

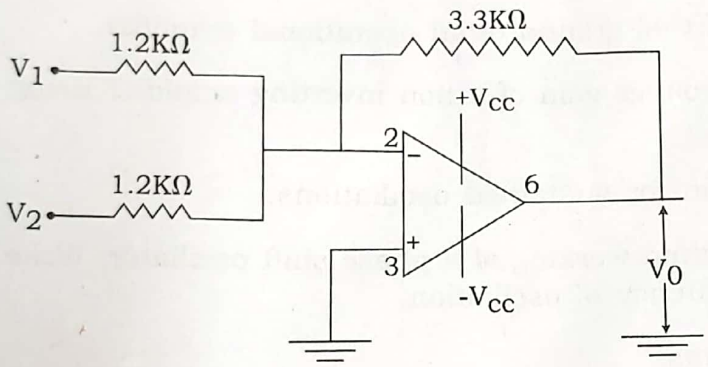
Solve **any five** problems. Each problem carries **four** marks.

[$\epsilon_0 = 8.85 \times 10^{-12}$ Fm^{-1}; $\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1}

mass of electron $= 9.1 \times 10^{-31}$ kg; $h = 6.625 \times 10^{-34}$ Js

mass of proton $= 1.67 \times 10^{-27}$ kg]

9. Find the output voltage in the given circuit if $V_1 = V_2 = 0.1V$



10. An amplifier has a gain of 800. When the feedback is applied, the gain is reduced to 150. Find the feedback fraction.

11. (a) Convert $(376)_8$ to binary number.

(b) Convert $(10110)_2$ to Gray code.

12. A paramagnetic material has magnetic field intensity of 10^4 Am^{-1}. If the susceptibility of the material at room temperature is 3.7×10^{-3}. Calculate the magnetisation and flux density of the material.

13. The dielectric constant of helium gas at NTP is 1.0000684. Calculate the electronic polarizability of atoms if the gas contains 2.7×10^{25} atoms per m^3.

14. The operator $\left(x + \frac{d}{dx}\right)$ has the eigen value λ, operating on a function.

Find the corresponding eigen function.

15. Assuming the nucleus as a cubical box with a size of 10^{-14}m, calculate the lowest energy of a proton inside it.

16. The period of a linear harmonic oscillator is 1 milli second. Find its zero point energy in e.v.

PART - C

17. Answer **any five** questions. Each question carries **two** marks. **5x2=10**

(a) Does the input resistance of op-amp decrease with negative feedback ? Explain.

(b) NAND gate is an universal gate. Explain.

(c) Is 8 an octal number ? Explain.

(d) Is BCD code a weighted code ? Explain.

(e) Is N_2 a polar dielectric ? Explain.

(f) It is easy to magnetise a soft magnetic material than a hard magnetic material. Why ?

(g) Is the ground state of a particle in three dimensional box degenerate ? Explain.

(h) $\psi = ax^2$ is not an acceptable wave function in quantum mechanics. Why ?