15/11/19

VCD/ ./ Physics-Ii SEM-II Marks: 100 Duration: (3 Hours)

Note: (1) All questions are compulsory.
(2) All questions have internal choice.
(3) Figure to the right indicates full marks.

Q1.A. Select the correct option. (12M)

1) The NAND gate is AND gate followed by ----------.

i) NOT ii) AND iii) OR iv) None of these

2) The magnetic field outside a solenoid is ----------.

i) uniform ii) non-uniform iii) zero iv) none of these

3) A proton, deuterium and alpha particle are accelerated through the same potential difference their kinetic energy will be in the ratio of ----------.

i) 2:1:1 ii) 2:2:1 iii) 1:1:2 iv) 1:2:2

4) Diode can be used as ----------.

i) an oscillator ii) a rectifier iii) Voltage regulator iv) an amplifier

5) Electrostatic energy is stored in ----------.

i) medium ii) electric field iii) charge iv) all of these

6) The universal gate is ----------.

i) OR iii) AND iii) NAND iv) EX-OR

Q1.B. Answer in one sentence. (3M)

1) Define magnetic field and state its unit.

2) What is Zener diode?

3) Define Electric potential and state its unit.

Q1.C. Fill in the blanks. (5M)

1) Rectifier is a device which converts.....

2) The potential is constant in a certain region of space. The value of E in that region is.....

3) For a solenoid of finite length, the magnetic field inside it is uniform, except near the ends, which is.....the midpoint value of magnetic field.

4) The magnitude of electric field intensity E is such that an electron placed in it would experience an electric force equal to its weight is given by.....

5) Without a d.c source, a clipper circuit acts like.....

Q.2.A. Attempt ANY ONE. (8M)

i) An alternating e.m.f. $E=E_0 \sin \omega t$ is applied to a resistance R and inductance L in series. What will be the impedance, the current and the phase difference between applied e.m.f. and the current?

ii) What is an A.C bridge? Obtain the conditions required to balance an A.C bridge.

B. Attempt ANY ONE. (8M)

i) Derive an expression for resonant frequency for parallel LCR circuit. Why is it called a rejector circuit?

ii) Find the conditions of balance for Wien Bridge. How would you determine the frequency of the supply?

C. Attempt ANY ONE. (4M)

i) In a De Sauty's bridge, the balance condition is obtained when $R_1=800\Omega$, $R_2=1200\Omega$ and $C_1=0.47\ \mu F$. Find the value of the other capacitor.

ii) Find the reactance of capacitor of capacitance 0.1 μF and 50HZ frequency.

3. A. Attempt ANY ONE. (8M)

i) State Thevenin's theorem and write basic steps for solving a network using it.

ii) What is rectifier? Explain with neat diagram the working of half wave rectifier.

B. Attempt ANY ONE. (8M)

i) State and explain De-Morgan's theorem using NAND gates also tabulate its truth table.

ii) State superposition theorem and write basic steps for solving a network using it.

C. Attempt ANY ONE. (4M)

i) Explain half adder and write its truth table.

ii) Find the value of series resistance connected in series with 6V zener diode produces 140 mA zener current when connected to 20 volt input supply.

Q.4. A. Attempt ANY ONE. (8M)

i) Show that energy stored in continuous charge distribution is, $W=(\varepsilon_0/2)\int E^2 dv$.

ii) Find the magnetic field due to a long solenoid by using Biot-Savart's law.

B. Attempt ANY ONE. (8M)

i) What is electric potential? Show that electric field intensity between any two points A and B depends only on the position of these points and is independent of the actual path followed between A and B.

ii) What are the Helmholtz coils? Find an expression for the magnetic field at the mid-point of the line joining the centres of Helmholtz coil.

C. Attempt ANY ONE. (4M)

i) A straight long conductor carries a current of 10 A. Calculate the magnetic field at a distance 10 cm from the conductor.

ii) Calculate the force between two charges of 1C each separated by 1 m in vacuum.

Q.5. A. Attempt ANY FOUR. (20M)

i) What are the limitations of Coulomb's law?

Ii) The electric potential V at any point (x,y,z) in space is given by $V=4x^2$ volt. Calculate electric intensity at the point (1,0,2)m.

iii) A wire is shaped to form a regular hexagon of side l. If a current I flows through the wire, calculate the magnetic field at the centre of the hexagon.

iv) In a Wien's bridge, if $R_1=1\ K\Omega$, $R_2=2\ K\Omega$, $R_4=1\ K\Omega$, $C_1=0.1\ \mu F$ and $C_2=0.2\ \mu F$. Find the value of R_3 and the frequency of the applied voltage required to balance the bridge.

v) A coil of 20 Ω resistance has an inductance of 0.2 H is connected in parallel with a condenser of 100 μF capacitance. Calculate the resonant frequency.

vi) Obtain the condition of balance for Hay's bridge and obtain the expression for unknown inductance.

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