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SEAT No. _____

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SARDAR PATEL UNIVERSITY
S.Y.B.Sc. Examination, FOURTH Semester
Wednesday, 10TH April 2019

Time : 10.00 am To 1.00 pm

Applied Physics Course Code : US04CAPH02

Course Title : Electricity, Magnetism and Solid State Electronics

Total Marks : 70

Q-1 Write answers to the following multiple choice questions in your answer book by [10] selecting the proper option.

- (1) The value of permittivity of free space (ϵ_0) is _____ $C^2/N \cdot m^2$
(a) 0.85×10^{-12} (b) 88.5×10^{-12} (c) 8.85×10^{-12} (d) 885.0×10^{-12}
- (2) The tangent to the electric line of force at a point indicates _____ of electric field.
(a) direction (b) angle (c) velocity (d) divergence
- (3) Two parallel current carrying wires placed close to each other will produce a repulsive magnetic force if currents through them are _____
(a) equal (b) not equal (c) in same direction (d) in opposite direction
- (4) Coulomb force is an example of _____ law.
(a) inverse cube (b) inverse square (c) exponential (d) logarithmic
- (5) Force on a test charge due to the presence of a unit charge is known as _____.
(a) electric field (b) magnetic field (c) gravitational field (d) nuclear field
- (6) Transistors are generally used in _____.
(a) Amplifiers (b) Zener diodes (c) power diodes (d) signal diodes
- (7) The transistor parameters are _____ dependent.
(a) Temperature (b) Pressure (c) humidity (d) force
- (8) The transistors are usually specified by their _____ parameters.
(a) control (b) regulating (c) hybrid (d) quiescent
- (9) When the biasing arrangements are such that the base emitter junction is forward biased and the collector base junction is reverse biased the transistor operates in _____ region.
(a) runaway (b) Active (c) cutoff (d) saturation
- (10) The voltage gain of an amplifier is given by
(a) $A_v = V_o/V_i$ (b) $A_v = V_i/V_o$ (c) $A_v = V_o/I_o$ (d) $A_v = V_i/V_o$

Q-2 Answer the following questions in brief. (Answer any Ten Questions)

[20]

- (1) State and explain Coulomb's law for electric field.
- (2) Write a short note on flux due to an electric field.
- (3) Enlist properties of lines of force.
- (4) State the Lorentz Force Law for magnetic forces.
- (5) Define the surface current density.
- (6) Write the equation for the total force on a charge Q due to electric and magnetic fields.
- (7) Discuss briefly the simplest biasing circuit.

(PTO)

(1)

- (8) Draw the diagram showing the thermal runaway.
- (9) What is biasing? Why do we need to bias a transistor?
- (10) State the name of the four h parameters for a transistor in CE configuration.
- (11) Why do we require multi-stage amplifier?
- (12) Explain gain of multi-stage amplifier in dB.

Q-3 What is electric flux? Discuss about the divergence of electric field and obtain the integral and differential forms of Gauss law. Also discuss applications of Gauss law. [10]

OR

- Q-3 (a) Write a note on Poisson's equation and Laplace's equation. [5]
 (b) Prove that the curl of electric field is always zero and it obeys the superposition principal. [5]

- Q-4 (a) Obtain the formula for the magnetic force produced by a line charge distribution. [5]
 (b) Calculate the work required to be done in moving a charge in an electric field. [5]

OR

- Q-4 (a) Deduce the expression for the energy of a point charge distribution in terms of work done. [5]
 (b) Calculate the magnetic force produced by a current carrying wire on the other wire and hence prove that magnetic forces do no work. [5]

- Q-5 (a) What is Thermal Runaway? Using the necessary equations and diagram explain the need for bias stabilization in a transistor circuit. [5]
 (b) Discuss the approximate analysis of voltage divider biasing circuit in detail. [5]

OR

- Q-5 (a) Discuss the emitter bias circuit in detail and derive the necessary equations [5]
 (b) Draw the circuit diagram of the fixed bias circuit and derive the necessary equations which govern it. [5]

- Q-6 (a) Derive the formula necessary to calculate the gain of a multi-stage amplifier. [5]
 (b) Write a note on h-parameter equivalent circuit. [5]

OR

- Q-6 (a) Give reasons why decibel(dB) unit of measurement is used in the calculation of gain in multi-stage amplifiers. [5]
 (b) Discuss the single-stage transistor amplifier in detail. Also explain the voltage gain for this amplifier. [5]

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