P – 2505

Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Physics

Core Course

PY 1543 : ELECTRONICS

(2018 Admission onwards)

Time : 3 Hours   Max. Marks : 80

PART – A

Answer **all** questions in one or two sentence; each question carries **1** mark.

1.   State Norton's theorem.
2.   What do you mean by depletion layer?
3.   What do you mean by peak inverse voltage?
4.   Define current amplification factor α.
5.   What do you meant by quiescent point?
6.   What do you meant by multistage amplifier?
7.   Explain Barkhausen criterion for oscillations.
8.   Define the term modulation.
9.   What is an operational amplifier?
10. What are the difference between BJT and FET?

(10 × 1 = 10 Marks)

P.T.O.

PART – B

Answer **any eight** questions, not exceeding a paragraph; each question carries **2 marks.**

11. Explain maximum power transfer theorem.

12. What is load line in transistor biasing? What is its significance?

13. How zener diode maintains constant voltage across the load?

14. Explain how transistor works as an amplifier.

15. What is stability factor of fixed bias transistor? Explain the significance of stability factor.

16. Show that $\gamma = \dfrac{1}{1-\alpha}$.

17. Explain the circuit operation of a push pull amplifier.

18. What are the advantages of negative feedback amplifier?

19. Why modulation is necessary in communication?

20. What are the advantages and disadvantages of frequency modulation?

21. Describe the working principle of a MOSFET.

22. Discuss the operation of a summing amplifiers.

23. What is the role of coupling capacitors in an amplifier circuit?

24. Why dual power supply is used in Op-Amp?

25. What is the difference between open loop gain and (Av) and closed loop gain (Avf)?

26. Draw the frequency spectrum of FM wave.

(8 × 2 = 16 Marks)

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PART – C

Answer **any six,** each questions carries **4** marks.

27. A crystal diode having internal resistance $r_f = 20\Omega$ is used for half wave rectification. If the input voltage $v = \sin \omega$ t and load resistance $RL = 800\Omega$. Find

   (a) Im, Idc, Irms

   (b) ac power input and dc power output

   (c) dc output voltage.

28. A half wave rectifier uses two diodes, the internal resistance of each may be assumed constant at 20Ω. The transformer r.m.s secondary voltage from center tap to each end of secondary is 50V and load resistance is 980 Ω Find

   (a) the mean load current

   (b) the r.m.s value of load current.

29. A Germanium transistor is to be operated at zero signal $I_c = 1mA$. If the collector supply Vcc = 12 V, what is the value of R_B in the base resistor method. Given $\beta = 100$.

30. The overall gain of a multistage amplifier is 140. When negative voltage feedback is applied, the gain is reduced to 17.5. Find the fraction of the output that is fed back to the input.

31. In a phase shift oscillator $R_1 = R_2 = R_3 = 1M\Omega$ and $C_1 = C_2 = C_3 = 68\,pF$. At what frequency does the circuit oscillate?

32. The maximum peak to peak voltage of an AM wave is 16 mV and the minimum peak to peak voltage is 4 mV. Calculate the modulation factor.

33. A carrier wave of 500 watts is subjected to 100% amplitude modulation. Determine the power in side bands and the power of modulated wave.

34. A JFET has a drain current of 5mA. If $I_{DSS} = 10\,mA$ and $V_{GS(off)} = -6V$. Find the value of V_{GS} and V_P.

35. Calculate the output voltage from the noninverting amplifier circuit shown in the following figure for an input of 120 μV.
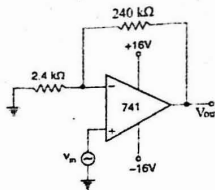
36. If β of the transistor circuit in figure is 50, find the value of Ic using both α and β.
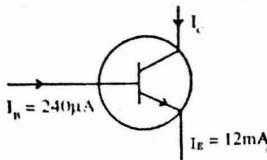
37. The first stage voltage gain of a two stage amplifier is 100 and its second voltage gain is 160. Find the total gain in dB.

38. An amplifier has a voltage gain of 50. To reduce the distortion present in it, 10% negative feedback is employed. Calculate voltage gain with feedback.

(6 × 4 = 24 Marks)

PART – D

Answer **any two** questions; each questions carries **15** marks.

39. Explain with circuit diagram, the action of a full wave rectifier using centre tap transformer. Derive an expression for rectification efficiency and ripple factor.

40. What are filter circuits? Explain the working of a capacitor filter and inductor filer?

41. What is the need of transistor biasing? Discuss the potential divider bias method for transistor biasing.

42. Discuss the characteristics of CB and CE transistor configurations with neat diagrams.

43. With circuit diagram explain the working of Hartley and Colpitt's oscillators.

44. With necessary diagrams, explain how OP-Amp works as an inverting and non-inverting amplifier.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Physics

Core Course VI

PY 1542 – STATISTICAL MECHANICS, RESEARCH METHODOLOGY AND DISASTER MANAGEMENT

(2018 Admission onwards)

Time : 3 Hours

Max. Marks : 80

SECTION A

Answer **all** questions in a sentence or two, each carries **1** mark.

1. Define statistical probability.

2. Define bosons.

3. What is the meaning of research?

4. Explain the quantitative approach of research.

5. Define the term *sample* in research.

6. Define, error in the measurement of a physical quantity.

7. What are significant figures?

8. Name any three types of natural disasters.

9. What is a communicable decease?

10. What is an epidemic?

(10 × 1 = 10 Marks)

Answer any **eight** questions, in a paragraph. Each question carries **2** marks.

11. Define a macro state.

12. Explain the concept of phases space.

13. What are Fermions?

14. What are the components of a good research thesis?

15. What is delibrate sampling?

16. What is systematic sampling?

17. Explain the scientific methods of research.

18. What is random error? How it can be estimated?

19. Distinguish between absolute error and relative error.

20. Briefly explain any four natural disasters.

21. Write a note on earths climatic variations.

22. With the help of an example, explain the spread of health disasters.

23. Write a note on the control of communicable deceases.

24. Explain the causes of Chernobyl accident.

25. Explain the methods to prevent sudden medical emergencies due to nuclear hazards.

26. Explain the measurement of the intensity of earthquakes.

(8 × 2 = 16 Marks)

SECTION C

Answer any **six** questions. Each question carries **4** marks.

27. Calculate the fermi energy of an electron in metal whose fermi temperature is 50000 K.

28. A cubic meter of atomic hydrogen is at 273K contains 2.7×10^{25} atoms at atmospheric pressure. Calculate the number of atoms in its first excited state $n = 2$. Given that for atomic hydrogen degeneracy at $n = 1$ $g\,(\varepsilon 1) = 2$ and for $n = 2$, $g\,(\varepsilon 2) = 8$ and $\varepsilon 1 = -13.6$ eV, $\varepsilon 2 = -3.4$ eV.

29. Calculate the rms speed of oxygen molecule at 273 K. Compare it with the speed of N_2 gas at same temperature. Given that mass of an oxygen molecule is 32 amu and mass of N_2 is 28 amu. 1 amu is 1.66×10^{-27} kg.

30. What are the criteria for good research?

31. Explain different methods of research.

32. What are the different motivations to undertake research?

33. The length of a rod measured in different persons are 2.51 m, 2.56 m, 2.49 m, 2.58 m, 2.48 m and 2.55 m respectively. Find the mean length, the absolute error, mean absolute error and the percentage error.

34. Explain different climatic regions of earth and the climatic conditions of that regions.

35. Explain seismic micro-zonation.

36. What are the methods of Tsunami forecasting?

37. Explain the significance protecting large scale water supply schemes.

38. Explain the medical diagnosis and therapy of nuclear radiations.

(6 × 4 = 24 Marks)

SECTION D

Answer any **two** questions. Each question carries **15** marks.

39. Derive Maxwell-Boltzmann distribution function.

40. Explain the layout and essential parts of a research report or a thesis.

41. Write a detailed note on the process of research.

42. Explain the classification of errors and their causes.

43. Write a detailed note on the impact of Global climate change and natural disaster.

44. Name and explain the disasters caused and their management in recent years in India.

(2 × 15 = 30 Marks)

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Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Physics

Core Course V

PY 1541 – QUANTUM MECHANICS

(2018 Admission onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions, each question carries **1** mark.

1. What is 'Ether'?

2. Write down Planck's expression for quantized energy.

3. Explain dual nature.

4. What is threshold frequency?

5. Write down the expression for quantized angular momentum.

6. Write down the expressions for operators of energy and momentum.

P.T.O.

7.   Define wave function.

8.   What is Hermitian operator?

9.   What is Hilbert space?

10. What are Eigen values of an operator?

<div align="right">**(10 × 1 = 10 Marks)**</div>

SECTION – B

Answer any **eight** questions, each question carries **2** marks.

11. How black body radiation spectra lead to quantum mechanics?

12. Explain photo electric effect and its features.

13. Explain Dulong and Petit's law of specific heats.

14. What are matter waves?

15. Explain Compton Effect?

16. Explain admissibility conditions of the wave function.

17. What are the major inadequacies in quantum theory?

18. Explain about position momentum uncertainty.

19. Briefly explain about the uncertainty in energy and time.

20. Explain the principle of superposition in quantum mechanics.

21. Give a brief explanation about wave packets.

22. Explain about expectation values of an operator.

23. Write a brief note on linear vector space.

24. Give the expressions for nature of potentials in different regions of square well potential with finite walls.

25. Explain quantum mechanical tunnelling.

26. Does the concept of Bohr radius violate the uncertainty principle.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions, each question carries **4** marks.

27. Explain correspondence principle.

28. The work function of barium and tungsten are 2.5 eV and 4.2 eV respectively. Check whether these materials are useful in photocells which is to be used to detect visible light.

29. Calculate the De Broglie wavelength of an electron having kinetic energy of 1000 eV. Compare the result with the wavelength of X rays having same energy.

30. Evaluate the ratio of De Broglie wavelength of an electron and proton if both have same kinetic energy.

31. Calculate the separation between two lowest energy levels of an electron in a one dimensional infinite potential well of width $1A^0$.

32. Find the value of maximum probability density for a one dimensional harmonic oscillator in its ground state.

33. Obtain the energy Eigen values for a particle in infinite square well potential with rigid walls.

34. Obtain the expression for position operator in momentum representation.

35. Prove that Eigen values of Hermitian operators are real.

36. Obtain the equation of motion for interaction picture.

37. If the position of a 5 KeV electron is located in $2A^0$, then what is its uncertainty in momentum?

38. Calculate the velocity and frequency of revolution of the electron of the Bohr hydrogen atom in its ground state.

$(6 \times 4 = 24$ **Marks**$)$

SECTION – D

Answer any **two** questions, each question carries **15** marks.

39. Explain Bohr model of hydrogen atom and derive necessary equations.

40. Obtain time independent Schrodinger equation and explain stationary states.

41. Explain the interpretation for the wave function and derive equation of continuity by defining probability current density.

42. Explain all postulates of quantum mechanics.

43. Obtain equations of motion by Schrodinger and Heisenberg representations.

44. Explain the square potential barrier and obtain relationship for transmission probability.

$(2 \times 15 = 30$ **Marks**$)$

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