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Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) – Physics and Computer Applications

Core Course VII

PC 1541 : ELECTRONICS

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in one or two sentences. Each question carries **1** mark.

1. The potential barrier at a PN-junction is due to the charges on either side of the junction. These charges are _____
   (a) Minority carriers
   (b) Majority carriers
   (c) Both majority and minority carriers
   (d) fixed donor and acceptor ions

2. Write down truth table for NAND gate.

3. What is the collector current for a CE configuration with $\beta = 100$ and a base current of 50 μA?

4. Define modulation index.

5. What is a rectifier?

6. A two stage amplifier has first stage voltage gain of 20 and second stage voltage gain of 400. What is the overall gain of the amplifier in decibel (dB)?

7. The main disadvantages of transformer coupled amplifier is _____.

8. Sketch the output wave forms of class A and class B amplifiers.

9. An amplifier has a bandwidth of 30 kHz and voltage gain of 100. When negative feedback is applied, its gain is reduced to 20, what will be the new bandwidth.

10. Convert 1101.110_2 to decimal.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. Each carries **2** marks.
(Not to exceed one paragraph)

11. Sketch the VI characteristics of a PN junction diode under forward and reverse bias. How dynamic and static resistance were calculated from the curve?

12. How zener breakdown is different from avalanche breakdown?

13. Define Peak inverse voltage. What is peak inverse voltage for a diode in a full wave bridge rectifier?

14. Negative feedback reduces the gain of an amplifier, but why is it used in an amplifier design?

15. Write down laws of Boolean Algebra.

16. What are the different current components of a n-p-n transistor when the emitter junction is forward-biased and the collector junction is reverse-biased. What is the source of the leakage current in a transistor?

17. Why are NAND and NOR gates called universal gates? Justify your answer with the help of examples.

18. What do you mean by the term load line? Explain its significance.

19. What do you understand class A, class B and class C power amplifier?

20. Explain collector efficiency and distortion of a power amplifier.

21. With the help of circuit symbol and truth table explain how does the XOR gate differ from the OR gate?

22. What is an emitter follower? Where it is used. Mention its characteristics.

23. Using 1's complement subtract 100101 from 111101.

24. Explain frequency modulation.

25. What is meant by CMRR? Explain the significance of a relatively large value of CMRR.

26. Explain phase reversal in a CE amplifier.

(8 × 2 = 16 Marks)

SECTION – C

Short essay questions (Not to exceed 120 words). Answer any **six** questions.
Each question carries **4** marks.

27. Explain how Zener diode can be used as voltage regulator.

28. A centre-tap transformer has 230 V primary winding rated at 12-0-12 volts. This transformer is used in the FW rectifier circuit with a load resistance of 100. What are the dc output voltages, dc load current and the rms voltage developed across the diode? Assume the diodes and the transformer to be ideal.

29. A transistor with α = 0.98 carries a base current of 50 μA. It produces a collector to base leakage current of 5 μA. Determine the values of emitter current and collector current of the transistor.

30. Draw circuit diagram of common emitter transistor configuration. Sketch the static output characteristics of common-emitter transistor and indicate the active, saturation and cut-off regions.

31. Sketch the single stage CE transistor amplifier circuit. Draw its frequency response curve. Mark different regions.

32. In a phase shift oscillator $R_1=R_2=R_3=$ 1 MΩ and $C_1=C_2=C_3=$ 50 pF. At what frequency the circuit will oscillate. What will be the resistance R used to produce frequency of 10 kHz for the same capacitors?

33. Explain the working principle of a Hartley oscillator with a neat sketch.

34. The signal and output voltages of an amplifier are 5 mV and 1 V, respectively. If the gain with negative feedback is 50 and the input resistance without feedback (voltage-series) is 2 kΩ, find the feedback fraction and input resistance with the feedback.

35. (a) Design an inverting amplifier with a gain of 5 and input resistance of 10 kΩ.

    (b) Design an noninverting amplifier with a gain of 22.

36. Determine the output voltage of an op-amp for input voltages of V_{i1} = 150 μV, V_{i2} = 140 μV. The amplifier has a differential gain of A_d = 4000 and the value of CMRR is:

(a) 100

(b) 10^5

37. With a neat circuit diagram explain action of full adder. Construct its truth table.

38. Simplify the given equations and implement the results with logic gates:

(a) $Y = A + \bar{A}B$

(b) $Y = AB + \bar{A}C + BC$

(6 × 4 = 24 Marks)

SECTION – D

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

39. With neat circuit diagram explain construction and working of transformer coupled Class A amplifier and Class B push pull amplifier.

40. (a) Describe the operation of SR flip flop with the help of schematic diagram and truth table.

(b) Explain the action of D flip flop with block diagram and truth table.

41. What is an operational amplifier? List the characteristics of an ideal op-amp with equivalent circuit. Explain common mode and differential operation of op-amp. Explain action of summing amplifier.

42. Describe the operating principle of npn transistor under biased condition. Explain the current amplification factors α, β and γ for common base, common emitter and common collector configuration respectively of a transistor. Obtain relation between them.

43. What is modulation? Explain amplitude modulation. Derive the expression for modulated wave. Draw the frequency spectrum of modulated wave.

44. (a) Draw the circuit diagram of a full-wave bridge rectifier using junction diodes and explain clearly its action.

(b) Why is a filter used in a rectifier? Enumerate the different types of filters used at the output of a rectifier.

(2 × 15 = 30 Marks)

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Fifth Semester B.Sc. Degree Examination, December 2022

Career related First Degree Programme Under CBCSS

Group 2 (a) : Physics and Computer Applications

Core Course VIII

PC 1542 : ATOMIC AND NUCLEAR PHYSICS

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Very short answer type questions. Answer **all ten** questions of **1** mark each.

1. $L - S$ coupling is mainly observed in lighter atoms. Why?
2. Define Stark effect.
3. What is the importance of selection rules in atomic spectra?
4. In which region of electromagnetic spectrum do most of the pure vibrational spectra of molecules fall?
5. What are relative values of the three principal moments of inertia of a linear molecule?
6. What is meant by the saturation of nuclear forces?
7. Define half-life of a radioactive isotope.
8. Nuclear fusion is known as thermonuclear reactions. Why?

9. What are the four fundamental interactions in physics?

10. What are fermions and bosons?

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions. Answer any **eight** questions. **Each** question carries **2** marks.

11. What is meant by space quantization?

12. State Pauli's exclusion principle. Give the electronic configuration of Silicon (Z = 14).

13. Normal Zeeman effect applies to transitions between singlet states only. Why?

14. Write a note on Paschen-Back effect.

15. Give the different quantized energies possessed by a molecule. Mention their regions in electromagnetic spectrum.

16. Homonuclear diatomic molecules like H_2 will not give pure vibrational spectra. Why?

17. What are the conditions for a pure rotation of a molecule to be microwave active?

18. What is meant by binding energy of a nucleus? Write the equation for binding energy.

19. Discuss the nuclear magnetic moment.

20. What is meant by a radioactive series? Name four radioactive series.

21. Explain radiocarbon dating.

22. What is meant by electron capture? Give an example.

23. Explain the breeder reactor.

24. Explain proton-proton cycle happening inside sun.

25. Write a note on resonance particles.

26. What are the field bosons?

(8 × 2 = 16 Marks)

SECTION – C

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

27. Why is it impossible for $2^2P_{5/2}$ state to exist?

28. Find the possible values of angles between the z- axis and the direction of the spin angular momentum vector S of an electron.

29. Calculate the precessional frequency of an electron orbit when placed in a magnetic field of 4T. $(e = 1.6 \times 10^{-19} C, m = 9.1 \times 10^{-31} kg)$.

30. Calculate the wavelength separation between the unmodified line of wavelength 6000A° and the modified lines in normal Zeeman effect when a magnetic field of 2T is applied. $(e = 1.6 \times 10^{-19} C, m = 9.1 \times 10^{-31} kg, c = 3 \times 10^8 m/s)$.

31. Calculate the frequency, wave number and energy of radiation of wavelength 5000A°. $(c = 3 \times 10^8 m/s, h = 6.624 \times 10^{-34} Js)$.

32. The fundamental and first overtone frequencies of NO molecule are centered at 1876.06 cm^{-1} and 3724.2 cm^{-1} respectively. Evaluate the equilibrium vibration frequency and zero point energy.

33. The average spacing between adjacent rotational lines of CN radical is 3.798 cm^{-1}. Calculate the length of CN bond ($h = 6.626 \times 10^{-34} Js$, $c = 3 \times 10^8 m/s$, mass of $C = 12u$, mass of N = 14.003 u, 1 u = 1.67 × 10^{-27} kg).

34. Calculate the binding energy of the last neutron in m $^{23}_{11}Na$. Mass of $^{23}_{11}Na = 22.989767u$, mass of $^{22}_{11}Na = 21.9944u$, mass of neutron = 1.008665 u.

35. Find the density of $^{20}_{10}Ne$ nucleus. Given 1 u = 1.66 × 10^{-27} kg and $R_0 = 1.2 \times 10^{-15} m$.

36. The half-life of ^{198}Au is 2.7 days. Calculate the activity of 1.50 *mg* of *Au* – 198 if its atomic weight is 198 g/mol. Given Avogadro number, $N_A = 6.02 \times 10^{23}$ atoms/mol.

37. Calculate the energy released in the following nuclear fission reaction

$n + {}^{235}_{92}U \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3n$.

The rest masses of *n* is 1.0087 u and atomic masses of $^{235}_{92}U$, $^{142}_{56}Ba$ and $^{91}_{36}Kr$ are 235.0439 u, 141.9164 u and 90.9234 u respectively.

38. The neutral pion at rest decays by $\pi^0 \rightarrow \gamma + \gamma$. Calculate the wavelength of gamma ray photon. Rest mass of $\pi^0 = 264 m_e$, where m_e is the mass of the electron.

(6 × 4 = 24 Marks)

SECTION – D

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

39. (a) Explain Stern-Gerlach experiment and give the significance of the result.

(b) Write a note on electron spin.

40. Describe the optical spectra in vector atom model giving spectral notation. Explain the selection rules, intensity rule and interval rule.

41. Explain the vibrational spectra of a diatomic molecule. Give its selection rules. What are fundamental and first overtones in vibrational transition?

42. Explain liquid drop model of a nucleus and arrive at the semi-empirical mass formula.

43. Explain the Gamow's theory of alpha decay and derive an expression for decay constant.

44. Explain the elementary particle quantum numbers and their conservation laws with examples.

(2 × 15 = 30 Marks)

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Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Physics and Computer Applications

Vocational Course

PC 1571 : DATABASE MANAGEMENT SYSTEM

(2018 Admission Onwards)

Time : Three Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What do you mean by tuple?
2. What is primary key?
3. Define DBMS
4. Expand BCNF
5. What is functional dependency?
6. Define relational algebra.
7. Expand DML
8. What is a query?
9. Write the use of INSERT query
10. DBA stands for?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions. **Each** carries **2** marks.

11. How to create a table in DBMS?

12. What do you mean by many-many relationship?

13. What is the difference between primary key and candidate key?

14. Write short note on database schema

15. List any four types of normalization

16. What is the use of SELECT query? Write the syntax

17. What is lossless decomposition?

18. What do you mean by attribute inheritance?

19. What is a relationship?

20. When we identify an attribute as derived attribute?

21. How to change an attribute value in SQL?

22. List any four mathematical functions used in SQL.

23. What is participation?

24. What are weak entity sets?

25. What is equi join?

26. What is transitive dependency?

(8 × 2 = 16 Marks)

SECTION – C

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

27. What are the four types of relationships? Explain in detail

28. Write a note on data types supported by SQL

29. What is an attribute? Write briefly about different types of attributes

30. Write a note on BCNF

31. How to check integrity in databases?

32. Discuss about specialization and generalization in E-R model

33. What is the difference between ORDER BY and GROUP BY clause?

34. Write a note on lossy decomposition

35. Write about the role of DBA

36. Discuss about domain relational calculus

37. What are the constraints used while creating a table?

38. Write a note on database security

(6 × 4 = 24 Marks)

SECTION – D

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

39. Explain key constraints in detail

40. What is E-R diagram? Explain the symbols used in E-R diagrams. Illustrate with examples

41. Explain all DML commands in SQL

42. Discuss the various types of JOIN used in SQL

43. What is relational algebra? Explain select and project operations with proper examples

44. Compare 2NF and 3NF

(2 × 15 = 30 Marks)
