

**B.SC (5<sup>TH</sup> SEM) EXAMINATION 2021**

**ENGLISH**

**Paper Code: FC501**

**Time : 03 Hrs**

**MM : 70**

**Section – ‘A’**

**Short answer type questions**

Note:- Attempt **Any 04** questions.

**4\*7=28**

Q.01:-What prize is sought by the poet? Who is ‘dear father’ in the poem?

Q.02:-Why did Velan leave home?

Q.03:-What are the factor that effect soil erosion?

Q.04:-What is the urgent need of the country?

Q.05:- What was Behrman’s Masterpiece?

Q.06:- Why was Velan proud of his position?

**Section – ‘B’**

**Long answer type questions**

**03\*14=42**

Note: - Attempt **Any 03** questions.

Q.01:-Is “OCaptian! MyCaptian!” a distinctly American poem, or could it be a patriotic poem for any country.

Q. 02:-Attempt a brief note on the character of Sue.

Q.03:- Describe the status of Velan’s family in the village?

Q.04:-What are the advantage and disadvantage of flowing water?

Q.05:-Write an article in about 200 words in the local daily on why it is important to save the Earth?

**BSC (5<sup>TH</sup>SEM) Examination 2021**  
**COMPUTER FUNDAMENTALS**

**Paper-FC502**

**Time Allotted: Three Hours**

**Maximum Marks: 35**

**SECTION-A**

**Note: 1. Attempt any 5 question from 1 to 7 and each question carry equal 5 marks.**

**प्रश्न 1 से 7 तक कोई 5 प्रश्न हल करना हैं तथा प्रत्येक प्रश्न पर 5 अंक दिए जायेंगे।**

1. Explain Storage device in Computer?  
कंप्यूटर की संग्रहक क्षमता को समझाइये ?
2. What is Monitor? Define CRT and LCD monitor?  
Monitor क्या है? एवं CRT एवं LCD मॉनिटर को परिभाषित कीजिये?
3. What is the difference between hardware and software?  
हार्डवेयर और सॉफ्टवेयर में अंतर लिखो ?
4. What do you mean by LAN, MAN and WAN?  
LAN, MAN and WAN से आपका क्या तात्पर्य है?
5. Explain characteristics of Computer?  
कम्प्यूटर के गुण लिखें?
6. Explain Block Diagram of Computer?  
कंप्यूटर के ब्लॉक डायग्राम को समझाइये ?
7. Convert these:-  
बदलना है:-
  - $(10001010)_2 = ( )_8$
  - $(4DACB)_{16} = ( )_{10}$
  - $(4C9)_{16} = ( )_2$
  - $(1101010101)_2 = ( )_8$
  - $(7364)_8 = ( )_{10}$

**SECTION-B**

**Note: Attempt any 1 question from 8 to 9 and each question carry equal 10 marks.**

**प्रश्न 8 से 9 तक कोई 1 प्रश्न हल करना हैं तथा प्रत्येक प्रश्न पर 10 अंक दिए जायेंगे।**

8. Write note on (Attempt any 2):-

इनके बारे में लिखें (कोई 2 हल करना हैं):-

- a) Compiler (कंपाइलर)
- b) Interpreter (इंटरप्रेटर)
- c) Visual display unit (विजुल डिस्प्ले यूनिट)
- d) Explain different Types of Topology with diagram?

विभिन्न प्रकार की टोपोलोजी को चित्रके द्वारा समझाएँ।

9. Write the Classification of Computer?

कम्प्यूटर के वर्गीकरण को विस्तार से लिखें।

**B.Sc (5<sup>th</sup>SEM) Examination, 2021**  
**ORGANIC CHEMISTRY (CHEMISTRY)**  
**PAPER CODE: BSC401**

ALLOTTED TIME: THREE HOURS

TOTAL MARKS :70

**Section A**

5X5=25

**Short Answer type Questions****Note: Attempt any five questions. Each question carries equal marks.**

किन्हीं पाँच प्रश्नों के उत्तर दीजिये। सभी प्रश्नों के अंक समान हैं।

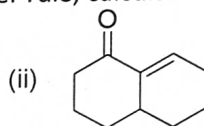
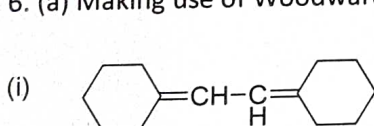
- (a) What is mutarotation? How mutarotation occurs in D-glucose?  
(b) Draw the structure of D-deoxyribose.
- (a) State and explain Stark-Einstein law of photochemical equivalence.  
(b) What is meant by quantum yield of a photochemical reaction?
- Write reagents to convert bromobenzene to aniline. Show mechanism. Give evidence of this mechanism.
- (a) Explain the role of iron in Haemoglobin.  
(b) Explain the importance of Porphyrin as ligand.
- Discuss the applications of UV spectroscopy.
- What are phase transfer catalysts? Explain the role of quaternary ammonium salts as phase transfer catalyst.
- Discuss the gravimetric analysis of Barium.

**Section B**

3x15=45

**Long Answer type Questions****Note: Attempt any three questions. Each question carries equal marks**

- (a) How do you transfer D-Arabinose to D-Glucose by Kiliani Fischer synthesis?  
(b) Show the steps of osazone formation from D-mannose.  
(c) What are reducing and non-reducing sugars? Give examples.  
(d) What are epimers? Draw the structure of C-2 epimer of D-glucose.
- (a) Making use of Woodward-Fieser rule, calculate  $\lambda_{max}$  of the following compounds.



- (b) What are different types of electronic excitations? Arrange them in decreasing order of their energies.
- (c) Discuss Norrish type II reaction.
- (d) How would you differentiate between  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}_2$  and  $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}_3$  by UV spectroscopy?
- (a) How will you synthesize *m*-nitroaniline from benzene?  
(b) Show preparation of primary amine by Gabriel phthalimide synthesis.  
(c) Complete the following reaction and describe use of this reaction. 3  
 $\text{RNH}_2 + \text{CHCl}_3 + 3\text{KOH} \rightarrow$   
 (d) Account for the fact that 2,6-dimethyl-N,N-dimethylaniline is much more basic than 2,6-dimethylaniline.  
 (e) Account for the high acidity of picric acid.
- (a) State Lambert-Beer's law and write the mathematical expression.  
(b) State whether the following reactions move to forward direction or backward direction and give reasons. (i)  $\text{HgI} + \text{LiF} \rightarrow \text{HgF} + \text{LiI}$  (ii)  $\text{Fe}_2\text{S}_3 + 3\text{O}^{2-} \rightarrow \text{Fe}_2\text{O}_3 + 3\text{S}^{2-}$  3  
(c) How are errors classified? How are they minimized?  
(d) Explain the bonding in silicones. What are the uses of silicones?
- (a) How does the treatment with  $\text{HIO}_4$  confirm that glucose is an aldohexose?  
(b) Draw the chair form of  $\alpha$ -D-mannopyranose.  
(c) How does benzene diazonium chloride react with aniline? Give mechanism.  
(d) What is the role of ferredoxin in biology?  
(e)  $[\text{AgI}_2]^-$  is stable but  $[\text{AgF}_2]^-$  does not exist. Justify.

**Section A**

5X5=25

Short Answer type Questions

*Note: Attempt any five questions. Each question carries equal marks.*

किन्हीं पाँच प्रश्नों के उत्तर दीजिये। सभी प्रश्नों के अंक समान हैं।

1. Consider the one dimensional time independent Schrodinger equation for some arbitrary potential  $V(x)$ . Prove that if a solution  $\psi(x)$  has the property that  $\psi(x) \rightarrow 0$  as  $x \rightarrow \pm\infty$ , then the solution must be non-degenerate and therefore real, apart from a possible overall phase factor.

2. Consider the one dimensional problem of a particle of mass  $m$  in a potential

$$V = \infty, \quad x \leq 0,$$

$$V = 0, \quad 0 \leq x \leq a,$$

$$V = V_0, \quad x > a$$

Show that the bound state energies ( $E < V_0$ ) are given by the equation

$$\tan\left(\frac{\sqrt{2mE}a}{h}\right) = -\sqrt{\frac{E}{V_0 - E}}$$

. Here  $h = \hbar$ .

3. A certain observable in quantum mechanics has a  $3 \times 3$  matrix representation as follows:

$$\frac{1}{\sqrt{2}} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

Find the normalized eigenvectors of this observable and the corresponding eigenvalues. Is there any degeneracy?

4. If one interchanges the spatial coordinates of two electrons in a state of total spin 0 then what will be the change in the wave function? An electron is confined to the interior of a hollow spherical cavity of radius  $R$  with impenetrable walls. Find an expression for the pressure exerted on the walls of the cavity by the electron in its ground state.

5. Derive from Coulomb's law and the simple quantization of angular momentum, the energy levels of the hydrogen atom.

7. The "plum pudding" model of the atom proposed by J. J. Thomson in the early days of atomic theory consisted of a sphere of radius  $a$  of positive charge of total value  $Ze$ .  $Z$  is an integer and  $e$  is the fundamental unit of charge. The electrons, of charge  $-e$ , were considered to be point charges embedded in the positive charge. (a) Find the force acting on an electron as a function of its distance  $r$  from the center of the sphere for the element hydrogen. (b) What type of motion does the electron execute?

8. Describe briefly each of the following effects or, in the case of rules, state the rule: (a) Anomalous Zeeman Effect and (b) Lamb shift.

## Section B

3x15=45

## Long Answer type Questions

Note: Attempt any three questions. Each question carries equal marks

1. A beam of particles of spin  $\frac{1}{2}$  is sent through a Stern Gerlach apparatus, which divides the incident beam into two spatially separated components depending on the quantum number  $m$  of the particles. One of the resulting beams is removed and the other beam is sent through another similar apparatus, the magnetic field of which has an inclination  $\alpha$  with respect to that of the first apparatus. What are the relative numbers of particles that appear in the two beams leaving the second apparatus? Derive the result using Pauli spin formalism.
2. Compute

$$\langle (\Delta S_x)^2 \rangle = \langle S_x^2 \rangle - \langle S_x \rangle^2. \text{ Here the expectation value is taken}$$

for the  $S_z = +$  state. Using your result, check the generalized uncertainty relation

$$\langle (\Delta A)^2 \rangle \langle (\Delta B)^2 \rangle \geq \frac{1}{4} | \langle [A, B] \rangle |^2 \text{ with } A \rightarrow S_x, B \rightarrow S_y.$$

3. Consider the following high-energy reactions or particle decays:

- (1)  $\pi^- + p \rightarrow \pi^0 + n$
- (2)  $\pi^0 \rightarrow \gamma + \gamma + \gamma$
- (3)  $\pi^0 \rightarrow \gamma + \gamma$
- (4)  $\pi^+ \rightarrow \mu^+ + \nu_\mu$
- (5)  $\pi^+ \rightarrow \mu^+ + \bar{\nu}_\mu$
- (6)  $p + \bar{p} \rightarrow \Lambda^0 + \Lambda^0$
- (7)  $p + \bar{p} \rightarrow \gamma$

Indicate for each case:

- (a) Allowed or forbidden, (b) reason if forbidden, (c) type of interaction if allowed (i.e., strong, weak, electro-magnetic, etc.)

4. An accelerator under study at SLAC has as output bunches of electrons and positrons which are made to collide head-on. The particles have 50 GeV in the laboratory. Each bunch contains  $10^{10}$  particles, and may be taken to be a cylinder of uniform charge density with a radius of 1 micron and a length of 2 mm as measured in the laboratory.

(a) To an observer travelling with a bunch, what are the radius and length of its bunch and also the one of opposite sign? (b) How long will it take the two bunches to pass completely through each other as seen by an observer travelling with a bunch? (c) Draw a sketch of the radial dependence of the magnetic field as measured in the laboratory when the two bunches overlap. What is the value of B in gauss at a radius of 1 micron? (d) Estimate in the impulse approximation the angle in the laboratory by which an electron at the surface of the bunch will be deflected in passing through the other bunch. (Ignore particle-particle interaction.)

5. State whether the following processes are possible or impossible and prove your statement: (a) A single photon strikes a stationary electron and gives up all its energy to the electron. (b) A single photon in empty space is transformed into an electron and a positron. (c) A fast positron and a stationary electron annihilate, producing only one photon.

## Section A

5X5=25

Short Answer type Questions

*Note: Attempt any five questions. Each question carries equal marks.*

किन्हीं पाँच प्रश्नों के उत्तर दीजिये। सभी प्रश्नों के अंक समान हैं।

1. Let  $V = \{(a_1, a_2) \mid a_1, a_2 \in F\}$ , where  $F$  is a field. Define addition of elements of  $V$  coordinate wise, and for  $c \in F$  and  $(a_1, a_2) \in V$ , define

$$c(a_1, a_2) = (a_1, 0)$$

Is  $V$  a vector space over  $F$  with these operations? Justify your answer.

2. Evaluate the dimension of the vector space of all symmetric matrices of order  $n \times n$  ( $n \geq 2$ ) with real entries and trace equal to zero.

3. (a) Can we say that the vector spaces  $F^3$  and  $P_3(F)$  are isomorphic? Justify. (b) Let  $\beta$  &  $\gamma$  be the standard ordered bases for  $R^n$  and  $R^m$  respectively. The linear transformation  $T: R^n \rightarrow R^m$  is defined as  $T(a_1, a_2, \dots, a_n) = (a_n, a_{n-1}, \dots, a_1)$ . Compute  $[T]_{\beta}^{\gamma}$ .

4. Find a basis and dimension of the subspace  $W$  of  $R^3$  where  $W = \{(x, y, z) \in R^3 \mid x + y + z = 0\}$ .

5. Derive rate of convergence of the bisection method to obtain a root of  $f(x) = 0$ . Hence determine the minimum number of iterations  $n$  required by the Bisection method to converge within an absolute error tolerance of 0.01, starting with initial interval of (2, 3).

6. Obtain Newton's formula to determine  $\frac{1}{n}$ , where  $n$  is a natural number. Use it to obtain  $\frac{1}{37}$ , starting with a suitable initial approximation. Do 3 iterations.

7. Define a lower and upper triangular matrix. Solve the system of equations:

$$x_1 + x_2 + 2x_3 = 3$$

$$-x_1 + 2x_3 = -1$$

$$3x_1 + 2x_2 - x_3 = 4$$

by obtaining LU decomposition of the coefficient matrix  $A$  of the above system.

8. Define backward difference operator  $\nabla$ , central difference operator  $\delta$  and averaging operator  $\mu$ . (a) Prove that  $\mu = \sqrt{1 + \frac{1}{4}\delta^2}$  (b)  $\nabla = -\frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{1}{4}\delta^2}$ .

## Section B

3x15=45

Long Answer type Questions.

Note: Attempt any three questions. Each question carries equal marks

किन्हीं 3 प्रश्नों के उत्तर दीजिये। सभी प्रश्नों के अंक समान हैं।

1. (a) For a positive integer  $n$ , let  $P_n$  denote the space of all polynomials  $p(x)$  with coefficients in  $R$  such that  $\deg(p(x)) \leq n$  and let  $B_n$  denote the standard basis of  $P_n$  given by  $B_n = \{1, x, x^2, \dots, x^n\}$ . If  $T: P_3 \rightarrow P_4$  is the linear transformation defined by  $T(p(x)) = x^2 p'(x) + \int_0^x p(t) dt$ . Construct the matrix representation of the above linear transformation which is denoted by  $[T]_{B_4}^{B_3}$ .

(b) The set of solutions to the system of the following linear equations is a subspace of  $R^3$ . Find a basis for this subspace.

$$x_1 - 2x_2 + x_3 = 0$$

$$2x_1 - 3x_2 + x_3 = 0$$

2. Let  $V$  and  $W$  be vector spaces over a field  $F$ . Let  $Z = \{(v, w) \mid v \in V \text{ \& } w \in W\}$ . Prove that  $Z$  is a vector space over  $F$  with the operations

$$(v_1, w_1) + (v_2, w_2) = (v_1 + v_2, w_1 + w_2)$$

$$c(v_1, w_1) = (cv_1, cw_1)$$

How many matrices are there in the vector space  $M_{m \times n}(Z_2)$ ?

3. (a) A function  $T: V \rightarrow W$  between vector spaces  $V$  &  $W$  is called additive if  $T(x+y) = T(x) + T(y)$  for all  $x, y \in V$ . Prove that if  $V$  and  $W$  are vector spaces over the field of rational numbers, then any additive function from  $V$  into  $W$  is a linear transformation. (b) Let  $T: C \rightarrow C$  be the function defined by  $T(z) = \bar{z}$ . Prove that  $T$  is additive but not linear.

4. A scalar matrix is a square matrix of the form  $\lambda I$  for some scalar  $\lambda$ ; that is, a scalar matrix is a diagonal matrix in which all the diagonal entries are equal. (a) Prove that if a square matrix  $A$  is similar to a scalar matrix  $\lambda I$ , then  $A = \lambda I$ . (b) Prove that  $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$  is not diagonalizable.

5. Use Gaussian elimination to solve the following systems of linear equations

$$x_1 + 2x_2 - x_3 = -1$$

$$2x_1 + 2x_2 + x_3 = 1$$

$$3x_1 + 5x_2 - 2x_3 = -1$$

**B.SC (5<sup>TH</sup> SEM) EXAMINATION 2021**

**(ZOOLOGY)Genetics**  
**PAPER CODE: BSCB502**

**TIME: 3 HOURS**

**MAX MARKS: 70**

**SECTION A      5X14=70**

**(Each question carries 14 marks)**

**Answer all of the following questions**

Q1 Describe the structure, organization and function of DNA and RNA & write the types of RNA?

Q2 Explain the following:-

- (A) Genetic code
- (B) Split gene
- (C) Overlapping gene
- (D) Pseudo gene

Q3 Explain sex determination? Write the Chromosomal and genetic balance Theory?

Q4 Explain the genetic diseases in humans:-

- (A) Sickle cell anaemia
- (B) Albinism
- (C) Thalassemia

Q5 Explain in detail blotting:- southern, northern & western?



**B.SC (5<sup>TH</sup> SEM) EXAMINATION 2021**  
**BOTANY (Plant physiology & biochemistry)**  
**PAPER CODE: BSCB501**

**TIME: 3 HOURS**

**MAX MARKS: 70**

**SECTION A**

**5X14=70**

**(Each question carries 14 marks)**

**Answer all of the following questions**

- Q1 Write the properties of water and also write the importance of water in Plant life?
- Q2 Explain the essential macro and micro nutrients and their role in plants?
- Q3 Define photosynthesis with reactions and also write the factors affecting the rate of photosynthesis?
- Q4 Write short notes on any two:-
- (a) Glycolysis
  - (b) Krebs's cycle
  - (c) Electron transport system
  - (d) Redox potential
- Q5 Write the classification, nomenclature and characteristics of enzymes?