



বিদ্যাসাগর বিশ্ববিদ্যালয়  
**VIDYASAGAR UNIVERSITY**

**Question Paper**

**B.Sc. Honours Examinations 2020**

(Under CBCS Pattern)

**Semester - VI**

**Subject: MATHEMATICS**

**Paper: CC - 14 (Ring Theory and Linear Algebra II – Theory)**

**Full Marks: 60 (Theory)**

**Time: 3 Hours (Theory)**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer any **one question**

from the following:

1. (a) State Eisenstein criterion. Prove that this is a sufficient criterion for irreducibility of a polynomial over  $\mathbb{Z}$  (the set of all integers).
- (b) Check whether the polynomial  $x^4 - 5x^2 + x + 1$  is irreducible or not over  $\mathbb{Z}$ .
- (c) In an integral domain, prove that any prime element is irreducible. Show that the converse of this result is not true in an integral domain.
2. (a) Consider the integral domain  $\mathbb{Z}[\sqrt{-3}]$ . Then Show that
  - (i) 1 and  $-1$  are the only units in this integral domain.
  - (ii)  $1 + \sqrt{-3}$ , 2 are irreducible elements in this integral domain.



- (iii) But none of  $1 + \sqrt{-3}$  and 2 is prime there.
- (b) Prove that the ring of Gaussian integers is a Euclidean domain.
3. (a) Give example of an integral domain which is not a factorization domain with justification.
- (b) If  $K$  is a field then prove that  $K[x]$  is a Euclidean domain.
- (c) Let  $R$  be a commutative ring with identity such that  $R[x]$  is a PID (Principal Ideal Domain). Then prove that  $R$  is a field.
- (d) Check the irreducibility of a cyclotomic polynomial over  $\mathbb{Z}$ .
- (e) Show that  $R[x]/(x) \cong R$  where  $R$  is a commutative ring with identity.
4. (a) Define diagonalizability of a linear operator on a finite dimensional vector space. Let  $T$  be a linear operator on a vector space  $V$  over  $F$  such that  $T^2 = T$ . Prove that  $T$  is diagonalizable.
- (b) Find all possible invariant factors and hence write down all possible Jordan canonical forms of a matrix over  $\mathbb{R}$  (the field of all real numbers) whose characteristic polynomial is
- $$(x-4)^4(x-1)(x-5)^5$$
- and the minimal polynomial is
- $$(x-4)^2(x-1)(x-5)^2.$$
5. (a) Let  $V$  be the vector space of all polynomial functions  $p$  from  $\mathbb{R}$  to  $\mathbb{R}$  which have degree two or less:  $p(x) = c_0 + c_1x + c_2x^2$ . Let us define the following three linear functionals on  $V$  by
- $$f_1(p) = \int_0^1 p(x) dx \text{ for all } p \in V,$$
- $$f_2(p) = \int_0^2 p(x) dx \text{ for all } p \in V,$$
- $$f_3(p) = \int_0^{-1} p(x) dx \text{ for all } p \in V.$$



Show that  $\{f_1, f_2, f_3\}$  forms a basis for  $V^*$  by exhibiting the basis for  $V$  of which it is the dual.

(b) Define transpose of a linear transformation. Let  $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$  be a linear transformation defined by  $T(x, y) = (0, x, y)$ . Find  $T^t$  (transpose of  $T$ ).

(c) Let  $A$  be an  $m \times n$  matrix with real entries. Prove that each entry of  $A$  is zero if and only if  $\text{trace}(A^t A) = 0$ .

(d) Let  $n$  be a positive integer and let  $V$  be the vector space of all polynomial functions over the field of real numbers which have degree at most  $n$ , i.e., the functions of the form

$$f(x) = c_0 + c_1x + c_2x^2 + \dots + c_nx^n.$$

Let  $D$  be the differentiation operator on  $V$ . Find a basis for the null space of the transpose operator  $D^t$ .

6. (a) Consider the vector space  $\mathbb{R}^3$  over  $\mathbb{R}$  equipped with the standard inner product. Applying Gram-Schmidt orthogonalization process, orthonormalize the following set of vectors:

$$\{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}.$$

(b) Let  $V$  be a finite dimensional inner product space and  $f$  be a linear functional on  $V$ . Then prove that there exists a unique vector  $\beta$  in  $V$  such that  $f(\alpha) = \langle \alpha, \beta \rangle$  for all  $\alpha \in V$ .

(c) Let  $T$  be a linear operator on a finite dimensional inner product space  $V$ . Show that there exists a unique linear operator  $T^*$  on  $V$  such that

$$\langle Tx, y \rangle = \langle x, T^*y \rangle \text{ for all } x, y \in V.$$

(d) Define self-adjoint operator and normal operator on a finite dimensional inner product space. Let  $V$  be a finite dimensional inner product space and  $T$  be a normal operator on  $V$ . Then prove that  $\alpha$  is a characteristic vector for  $T$  with characteristic value  $c$  if and only if  $\alpha$  is a characteristic vector for  $T^*$  with characteristic value  $\bar{c}$ .



7. (a) Let  $T$  be the linear operator on  $\mathbb{R}^2$  over  $\mathbb{R}$  which is represented in the standard ordered basis by the following matrix:

$$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

Find all the invariant subspaces of  $\mathbb{R}^2$  which are invariant under  $T$ .

- (b) Let  $T$  be the linear operator on a finite dimensional vector space  $V$  over the field  $F$ . Define minimal polynomial of  $T$ . Prove that  $T$  is diagonalizable if and only if the minimal polynomial  $p$  of  $T$  has the form  $p(x) = \prod_{i=1}^k (x - c_i)$  where  $c_1, c_2, \dots, c_k$  are distinct elements of  $F$ .

- (c) Let  $T$  be the linear operator on  $\mathbb{R}^3$  which is represented in the standard ordered basis by the following matrix:

$$\begin{pmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{pmatrix}$$

Exhibit a basis for  $\mathbb{R}^3$  with respect to which the matrix representation of  $T$  is diagonal.

8. (a) If  $f(x)$  is a polynomial in  $F[x]$  of degree 2 or 3, then show that  $f(x)$  is reducible over the field  $F$  if and only if it has a zero in  $F$ .

Let  $f(x) = x^4 - 2x^3 + x + 1$ . Show that  $f(x)$  is irreducible over  $\mathbb{Q}[x]$ .

- (b) Define an irreducible element and a prime element in an integral domain  $D$ . Show that every irreducible element is a prime element in a unique factorization domain.

- (c) Show that 2 is an irreducible element in the domain  $D = \mathbb{Z}[\sqrt{-6}]$ . Using the equality  $2 \cdot 5 = (2 + \sqrt{-6})(2 - \sqrt{-6})$ , establish that 2 is not a prime element in  $D$ .

9. (a) Define a unique factorization domain. Give an example of it with explanation.

- (b) Let  $D$  be a PID (principal ideal domain) and  $\langle p \rangle$  be a nonzero ideal in  $D$ . Show that  $\langle p \rangle$  is a maximal ideal if and only if  $p$  is irreducible.



(c) (i) Define a Euclidean domain. Prove that every Euclidean domain is a PID.

(ii) Find a  $gcd(d)$  of the elements  $a = 7+4i$  and  $b = 4+3i$  in  $\mathbb{Z}[i]$  with a Euclidean valuation  $v$  defined by  $v(m+in) = m^2 + n^2$  for  $m+in \in \mathbb{Z}[i]$ . Also express  $d$  as  $d = au + bv$  for some  $u, v \in \mathbb{Z}[i]$ .

10. (a) State and prove Cayley-Hamilton theorem. Use the theorem to find  $A^{100}$ ,

$$\text{where } = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}.$$

(b) Find an orthogonal matrix  $P$  such that  $P^{-1}AP$  is a diagonal matrix, where

$$A = \begin{pmatrix} 3 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 1 & 3 \end{pmatrix}.$$

11. (a) Define the dual space of a vector space  $V$ .

If  $V$  is a vector space of dimension  $n$  over a field  $F$ , then the dimension of its dual space is also  $n$ .

(b) Let a linear transformation  $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be defined by

$T(x, y, z) = (2x + y - 2z, 2x + 3y - 4z, x + y - z)$ . Find all eigen values of  $T$  and find a basis of each eigen space.

(c) Reduce the following quadratic form into Canonical form and examine whether it is positive definite or not:  $6x^2 + y^2 + 18z^2 - 4yz - 12zx$ .

12. (a) Find the value of  $k$  so that the following expression forms an inner product:

$$(\vec{a}, \vec{b}) = a_1b_1 - 3a_1b_2 - 3a_2b_1 + ka_2b_2, \text{ where } \vec{a} = (a_1, a_2), \vec{b} = (b_1, b_2).$$

Use the Gram-Schmidt orthogonalisation process to find the orthonormal basis of  $\mathbb{R}^3$  generated by the set of vectors  $\{(1, -1, 1), (2, 0, 1), (0, 1, 1)\}$ .



- (b) If  $\{\beta_1, \beta_2, \dots, \beta_r\}$  is an orthonormal set of vectors in a Euclidean space  $V$ , then for any vector  $\alpha$  in  $V$ , show that  $\|\alpha\|^2 \geq c_1^2 + c_2^2 + \dots + c_r^2$ , where  $c_i$  is the scalar component of  $\alpha$  along  $\beta_i$ ,  $i = 1, 2, \dots, r$ . When does the equality occur?
- (c) Find the orthogonal complement of the subspace  $P$ , generated by the vectors  $(1, 1, 0)$  and  $(0, 1, 1)$  in  $\mathbb{R}^3$ .

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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: MATHEMATICS**

**Paper: VII**

**Full Marks: 80 (Theory)**

**Time: 4 Hours (Theory)**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer any **one question** from the following:

1. (a) Define half adder and draw a logic circuit for it.  
(b) State the Huntington's postulates of Boolean algebra.  
(c) Write a program either in C or FORTRAN77 to read an  $n \times n$  matrix and test whether it is orthogonal or not.  
(d) Write a program either in C or FORTRAN77 to swap the values of two variables.
2. (a) Describe Do-Loop in FORTRAN77 with suitable examples. What is the difference between Do-Loop and implied Do-Loop?

Or

Explain the 'while' loop and 'do-while' loop in C with example.



- (b) Draw a flowchart to find a root of  $f(x) = 0$  by bisection method.
- (c) Write an algorithm to test whether an integer is prime or not.
- (d) Express OR and AND gates using only NOR gate .
3. (a) State and prove Baye's theorem for conditional probability.
- (b) An even number of cards are drawn from a full pack of cards. What is the probability that half of them will be black and half of them will be red ?
- (c) Two persons A and B have agreed to meet at a specific spot between 1 p.m. and 2 p.m. It has been mutually agreed that the first one to come will wait for 20 minutes and then leave the place. What is the probability of a meeting between A and B if the arrival of each during the indicated hours can occur at random and also the times of arrival are independent ?
4. (a) Show that the most probable number of successes in a Bernoullian sequence of trials in  $f(x) = \lambda e^{-\lambda x}, (\lambda > 0), x > 0$  the integer(s) is determined by the inequality.
- $$(n+1)p - 1 \leq i_m \leq (n+1)p$$
- (b) Calculate mean and variance of normal distribution using moment generating function.
- (c) A random variable X is uniformly distributed over the interval (0,2) . Find the distribution of the quadratic equation  $t^2 + 2t - X = 0$  .
5. (a) If X and Y are independent variates both uniformly distributed over (0,1), find the distribution of  $X + Y$  and  $X - Y$  .
- (b) Calculate median and mode of the distribution having p.d.f.  $f(x) = \lambda e^{-\lambda x}, (x > 0), x > 0$  .
- (c) A population is defined by the probability density function  $f(x, a) = \frac{x^{l-1} e^{-ax}}{\Gamma(l) a^l} (0 < x < a)$  being a known constant. Estimate the parameter by the method of maximum likelihood estimation. Show that the estimate is consistent and unbiased.
6. (a) Define an unbiased and consistent estimate. Prove that the sample mean is always unbiased and consistent estimate of the population mean.



- (b) Show that the distribution of the sample is the statistical image of the distribution of the population.
- (c) Find the sampling distribution of the sample mean for Poisson distribution.
7. (a) Give an example of a Boolean algebra. Explain the difference between Boolean algebra and algebra of real numbers.

- (b) For all  $x, y, z \in B$  (a Boolean algebra) prove, not using truth table, that

$$x + xyz + xy^c z^c + yz + y^c z = x + z$$

- (c) Define disjunctive normal form of a Boolean function and express the following function in SOP form in smallest number of variables

$$x^c yz + xy^c z^c + x^c yz + x^c y^c z + xy^c z + x^c y^c z^c$$

- (d) Explain NOR gate with block diagram and truth tables.
8. (a) Draw a flow chart to integrate a function  $f(x)$  in  $[a, b]$  by trapezoidal rule.
- (b) Write a FORTRAN or C program to evaluate the infinite series

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

- (c) Write an algorithm to find the real roots of a quadratic equation with proper messages indicating the character of the roots.
- (d) Write a FORTRAN or C program to sort a set of  $n$  real numbers using bubble sort.
9. (a) State and prove Tchebycheff's Theorem.
- (b) Show that central limit theorem (for equal components) implies Law of Large number (for equal components)
- (c) If  $X, Y$  are independent  $\chi^2$  -variates having  $m$  and  $n$  degree of freedom respectively, find the distribution of  $X/Y$ .
- (d) If  $X$  is  $\gamma(n)$  variate, then show that  $P(0 < X < 2n) = (n-1)/n$



10. (a) The first, second and third moments of probability distribution about the point 2 are 1, 16, -40 respectively. Find the mean, variance and third central moment of probability distribution.
- (b) Prove that Schwartz's inequality for expectations, i.e.  $[E(XY)]^2 \leq E(X^2)E(Y^2)$  and Hence deduce that  $-1 \leq \rho(X, Y) \leq 1$ .
- (c) The joint density function of the random variables X,Y is  $f(x, y) = 2(0 < x < 1, 0 < y < x)$ .  
Find the marginal and conditional density functions. Compute  $P(0.25 < X < 0.75 | Y = 0.5)$
- (d) If X is standard normal variate, then prove that  $Y = \frac{1}{2}X^2$  is  $\gamma(\frac{1}{2})$  variate.
11. (a) Consider a random sample of size n without replacement from a finite population of size N and variance  $\sigma^2$ . Show that variance of sample mean is  $\sigma^2 \frac{(N-n)}{(n(N-1))}$ .
- (b) The variable X is normally distributed with mean 68 cm and s.d. 2.5 cm. What should be the size of the sample whose mean shall not differ from the population mean by more than 1 cm. with probability 0.95. [ Given that the area under standard normal curve to the right of the ordinate at 1.96 is 0.25 ]
- (c) Find the condition that the sample mean and the sample variance are uncorrelated.
12. (a) The weights in gram of sample of 12 items are 7, 13, 22, 15, 12, 14, 18, 8, 21, 23, 10, 17 taken at random from its population which is normal having standard deviation 5. Find 95% confidence interval for the mean of the population. [Given that the area under standard normal curve to the right of the ordinate at 1.96 is 0.25 ]
- (b) A die was thrown 120 times and the frequencies of different faces were observed to be the following:
- |                    |    |    |    |    |    |    |
|--------------------|----|----|----|----|----|----|
| Face               | 1  | 2  | 3  | 4  | 5  | 6  |
| Observed Frequency | 25 | 17 | 15 | 23 | 24 | 16 |
- Test the hypothesis that the die is fair using a significance level of 0.05.
- [ Given that  $P(X^2 > 11.1) = 0.05$  for 5 degree of freedom ]



(c) A computer while calculating correlation coefficient between two variables  $X$  and  $Y$  from 25 pairs of observations obtained the following results.

$$\begin{aligned} n &= 25 & \Sigma X &= 125 & \Sigma X^2 &= 650 \\ \Sigma Y &= 100 & \Sigma Y^2 &= 460 & \Sigma XY &= 508 \end{aligned}$$

It was however later observed that at the time of checking it had copied down two pairs as.

$X$	$Y$
6	14
8	6

while the correct values are

$X$	$Y$
8	15
6	5

Obtain the correct value of the correlation coefficient.

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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: MUSIC**

**Paper: VII**

**Full Marks: 100 (Practical)**

**Time: 4 Hours (Practical)**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

1. Write down Two full-length 'Dhrupad' mentioning their Ragas and Talas from the following Ragas :

Bhupali, Asavari, Bhimpalasi, Chhayanat.

রাগ ও তাল উল্লেখ করে নিম্নলিখিত রাগগুলি থেকে যেকোনো দুইটি পূর্ণদৈর্ঘ্যের 'ধ্রুপদ' লেখ:

ভূপালী, আসাবরী, ভীমপলাসী, ছায়ানট।

2. Write down Two full-length 'Dhamar' mentioning their Ragas and Talas from the following Ragas :

Khamaj, Kafi, Kedar, Bahar



রাগ ও তাল উল্লেখ করে নিম্নলিখিত রাগগুলি থেকে যেকোনো দুইটি পূর্ণদৈর্ঘ্যের 'ধামার' লেখ:

খামাজ, কাফি, কেদার, বাহার।

3. Write down the scanning of the Vanees (only sthayee) of Two Dhrupads and Two Dhamars in Barabar Layas, Dwigun, Trigun and Chougun Layas in one avartana.

এক-আবর্তনে দুইটি প্রপদ ও দুইটি খামার-এর বাণীগুলি (শুধুমাত্র স্থায়ী) বরাবর-লয়, দ্বিগুণ, ত্রিগুণ ও চৌগুণ-লয়ে বিভাজিত করে লেখ।

4. Write down the full-length vandishes of the the Drut-Khayals along with the Talas in all the following Ragas:

Yaman, Gour-Malhar, Purvi, Ramkeli, Hameer and Vrindabani – Sarang.

নিম্নলিখিত রাগগুলির দ্রুত-খয়ালের পূর্ণদৈর্ঘ্যের বন্দিশগুলি তালসহ লিপিবদ্ধ কর:

ইমন (য়মন), গৌড়-মল্লার, পূর্বা, রামকেলি, হামীর এবং বৃন্দাবনী-সারং।

5. Describe the following Hindustani Talas with their all aspects:

Chautal, Dhamar, Ektal, Jhanptal, Trital and Rupak.

নিম্নলিখিত হিন্দুস্তানী তালগুলির সকল বিষয়সহ পূর্ণাঙ্গ বিবরণ দাও:

চৌতাল, ধামার, একতাল, ঝাঁপতাল, ত্রিতাল এবং রূপক।

6. State the full-length description of the Talas created by Rabindranath Tagore.

রবীন্দ্রসৃষ্ট তালগুলির পূর্ণদৈর্ঘ্য বিবরণ দাও।

7. Given the vivid description of Two Talas of Kirtan including their Lagu-lawā and Guru-lawā of each.

কীর্তন-এর দুইটি তালের প্রত্যেকটির লঘু-লওয়া এবং গুরু-লওয়া সহ বিস্তারিত বিবরণ দাও।

8. According to your syllabus, state a full-length notation of a Drut-Khayal-Vandish both in Hindustani and Rabindrik notation-system ( in any one Raga).

পাঠক্রম অনুসারে একটি যেকোনো রাগের দ্রুত-খয়াল-বন্দিশের পূর্ণদৈর্ঘ্য স্বরলিপি লেখ — হিন্দুস্তানী ও রবীন্দ্রিক উভয়প্রকার স্বরলিপি পদ্ধতি অনুযায়ী।



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**Question Paper**

**B.Sc. Honours Examinations 2020**

(Under CBCS Pattern)

**Semester - VI**

**Subject: NUTRITION**

**Paper: CC - 14 (T + P)**

**(Entrepreneurship development, Enterprise Management and  
Entrepreneurship for small catering units – Theory + Practical)**

**Full Marks: 40 (Theory) + 20 (Practical) = 60**

**Time: 4 Hours**

*Candidates are required to give their answer in their own  
words as far as practicable.*

*Questions are of equal value.*

Answer any **one question** [within 250 words] from each Part.

**Part A: Entrepreneurship development, Enterprise Management  
and Entrepreneurship for small catering units (Theory)**

1. Define entrepreneur and mention its types. Write the significance of entrepreneurship development. Write the major challenges faced by women entrepreneur.
2. Briefly describe the fundamental steps of establishing a small scale industry.
3. Classify enterprise based on different domains. Write the functions of marketing. What are the 4PS of marketing?



4. Define 'food service unit'. Discuss about origin and kind of food service unit.
5. What do you mean by manager in an organization? Write the distinguished functions of a manager.
6. Write a short note on input-output cycle in a production. Briefly state the functions of marketing. What do you mean by marketing mix?
7. Give a brief idea about the cost estimation in formulating a project.
8. What is *a la carte* menu? Describe the various types of meal services noted in different sectors.
9. What do you mean by job specification? Briefly state about the different factors affecting the planning of a menu.
10. What are the types of kitchen area? What are the factors that affect the selection of kitchen equipment in a food service unit?
11. Describe the food storage capacity in a food service unit. How can be kitchen hygiene and sanitation maintained?
12. What is clientele? Describe the sequential steps for planning a small food service unit.

**Part B: Entrepreneurship development, Enterprise Management  
and Entrepreneurship for small catering units (Practical)**

1. Give a plan for set up a business related to the any field of food, nutrition and dietetics.
2. How do you standardize a recipe in a food service unit?
3. Give an idea about planning school tiffin for a school going children.
4. Planning and prepare a menu for packed meals for office employees.
5. Write the procedure for preparation of Quick food.
6. Write the procedure to prepare any specialized cuisine.
7. Write a checklist for good hygiene practice.
8. Write the procedure of market survey of food service units.
9. Write down the methodology for survey of institution facilitating entrepreneurship.



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**3rd Year (Honours)**

**Subject: NUTRITION**

**Paper: VII**

**Full Marks: 100 (Practical)**

**Time: 4 Hours (Practical)**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

1. Write the principles of formulation of diet chart. What is food service management? Write the principles & functions of food service management.
2. Prepare a diet chart with proper planning for a Pre- school children/ Adolescents boy (Subject selected by you).
3. Prepare a diet chart with proper planning for a Pregnant mother / Lactating mother (Subject selected by you).
4. Prepare a diet chart with proper planning for an Elderly person (Subject selected by you).
5. Submit your project report on public health / nutritional biochemistry / nutritional survey.



6. Submit a report on the basis of internship in a hospital dietary department or diet clinic.
7. Submit a report on Educational excursion in research hospital/ nutrition research.

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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: PHILOSOPHY**

**Paper: VII**

**Full Marks: 80 (Theory)**

**Time: 4 Hours (Theory)**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

1. Explain with illustration four different criteria of sentence meaning.
2. Critically explain the conditions necessary for a knowledge-claim.
3. Write the different meanings of the word "meaning" (according to Hospers).
4. Explain with example different types of possibilities and impossibilities.
5. How do you know our physical world? Explain after Hospers.
6. Discuss the principle of verifiability. What are the limitations of it? Critically explain with example.
7. What do you know about cause? In this context formulate the idea that cause as constant conjunction.



8. Is there any statement which is synthetic and a priori? Discuss.
9. Explain Interactionism as a theory of mind-body relationship.
10. Discuss after John Locke the theory of Representative Realism.
11. What are the characteristics of law of nature?
12. Explain briefly the account of phenomenalism.

### বঙ্গনুবাদ

- ১। বাক্যার্থের যেকোনো চারটি মানদণ্ড উল্লেখ করো।
- ২। কোনো কিছু জানি বলে দাবী করার ক্ষেত্রে আবশ্যিক শর্তাবলী সম্পর্কে সুবিচার আলোচনা করো।
- ৩। ‘অর্থ’ শব্দের বিভিন্ন অর্থ লেখ (জন হস্পার্সকে অনুসরণ করে)।
- ৪। দৃষ্টান্তসহ বিভিন্ন প্রকার সম্ভাব্যতা এবং অসম্ভাব্যতার মধ্যে পার্থক্য করো।
- ৫। আমরা কিভাবে আমাদের বাহ্য জগৎ সম্পর্কে অবগত হই জন হস্পার্সকে অনুসরণ করে লেখ।
- ৬। যাচাইযোগ্যতার সূত্রটি আলোচনা করো। এই সূত্রটির কী ধরনের সীমাবদ্ধতা আছে? উদাহরণ সহ সবিচার ব্যাখ্যা করো।
- ৭। কারণ বলতে তুমি কি বোঝ? এই প্রসঙ্গে সতত সংযোগবাদের ধারণাটি ব্যক্ত করো।
- ৮। পূর্বতঃসিদ্ধ এবং সংশ্লেষক বচন আছে কি? আলোচনা করো।
- ৯। দেহ ও মনের সম্পর্ক বিষয়ে ক্রিয়া-প্রতিক্রিয়াবাদ ব্যাখ্যা করো।
- ১০। জন লক-কে অনুসরণ করে প্রতিনিধিত্বমূলক বঙ্গনুবাদ আলোচনা করো।
- ১১। প্রাকৃতিক নিয়মের বৈশিষ্ট্যগুলি লেখ।
- ১২। সংক্ষেপে অবভাষ তত্ত্বটি আলোচনা করো।



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**Question Paper**

**B.Sc. Honours Examinations 2020**

(Under CBCS Pattern)

**Semester - VI**

**Subject: PHYSICS**

**Paper: CC - 14 (T + P) (Statistical Mechanics – Theory + Practical)**

**Full Marks: 40 (Theory) + 20 (Practical) = 60**

**Time: 4 Hours**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer any **one question** [within 250 words] from each Part.

**Part A: Statistical Mechanics (Theory)**

1. Discuss the basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.
2. (a) Obtain the expression for average energy of a classical oscillator at temperature T applying MB distribution function.  
  
(b) Find the two dimensional density of states between the energy range  $E$  and  $E + dE$ .
3. Write a short note on the third law of thermodynamics.
4. For a monatomic ideal gas at temperature T, calculate the partition function. Employing the relation of free energy or Helmholtz function  $F = -NkT(\ln Z)$ , calculate pressure from thermodynamic relation and hence obtain the equation of state for an ideal gas.



5. Derive the Bose-Einstein distribution formula and deduce Planck's radiation formula from Bose-Einstein statistics.
6. What are the characteristic features of liquid Helium at low temperature? What is  $\lambda$  - transition? Why is it named so?
7. Write a short note on Bose-Einstein condensation.
8. Obtain the statistical definition of temperature, pressure and chemical potential in terms of number of accessible microstates.
9. Derive the Fermi-Dirac (FD) distribution formula. Also discuss the nature of the FD distribution function at  $T=0$  and  $T>0$ .
10. Find the relation between entropy and number of microstates or thermodynamic probability.
11. Write a short note on the phase transitions of liquid helium and discuss the properties of its two stable isotopes, namely, He-4 and He-3.
12. The number of molecules of an ideal gas having  $x$ -component of velocity in the range between  $v_x$  and  $v_x + dv_x$  is given by  $n(v_x)dv_x = N \left( \frac{m}{2\pi kT} \right)^{1/2} e^{-\frac{mv_x^2}{2kT}} dv_x$ . Show that the pressure of the gas is given by  $P = nkT$ , where  $n$  is the number of molecules per unit volume.

### **Part B: Statistical Mechanics (Practical)**

1. Consider a system consisting of two particles each of which can be in any one of *two* single particle levels of respective energies 0 and  $k_B$  ( $k_B$  is the Boltzmann constant). The system is in contact with a heat reservoir at temperature  $T$ . Assume that the particles obey classical *Maxwell Boltzmann statistics*. Write down the Python program to compute the partition function  $Z(T)$  and average energy  $\langle E \rangle(T)$  of the system and to plot the average energy as a function of temperature.
2. Write a Python program to plot Planck's law for Black Body radiation and compare it with Rayleigh-Jeans Law at high temperature and low temperature regions.
3. Consider a system consisting of two particles each of which can be in any one of *two* single particle levels of respective energies 0 and  $k_B$  ( $k_B$  is the Boltzmann constant). The system is in contact with a heat reservoir at temperature  $T$ . Assume that the particles obey *Bose-Einstein*



*statistics*. Write down the Python program to compute the partition function  $Z(T)$  and average energy  $\langle E \rangle(T)$  of the system and to plot the average energy as a function of temperature.

4. Write a Python program to plot Specific Heat of Solids ( $C_v$ ) following Debye's model for high temperature and low temperature regimes. Show the expected output graphically.
5. Consider a system consisting of two particles each of which can be in any one of *two* single particle levels of respective energies 0 and  $k_B$  ( $k_B$  is the Boltzmann constant). The system is in contact with a heat reservoir at temperature  $T$ . Assume that the particles obey *Fermi-Dirac statistics*. Write down the Python program to compute the partition function  $Z(T)$  and average energy  $\langle E \rangle(T)$  of the system and to plot the average energy as a function of temperature
6. Write a Python program to show that the FD distribution function reduces to MB distribution function at very high temperature. Explain the fact physically.
7. Consider a system consisting of two particles each of which can be in any one of *three* single particle levels of respective energies 0,  $k_B$  and  $3k_B$  ( $k_B$  is the Boltzmann constant). The system is in contact with a heat reservoir at temperature  $T$ . Assume that the particles obey *Fermi-Dirac statistics*. Write down the Python program to compute the partition function  $Z(T)$  and average energy  $\langle E \rangle(T)$  of the system and to plot the average energy as a function of temperature.
8. Write a Python program to plot the variation of specific heat with temperature following Einstein's model. Show the expected output graphically.
9. Write down the Python program to plot specific heat of solids as given in Debye distribution function with temperature.
10. Write a Python program to plot the variation three dimensional density of states with energy. Show the expected output graphically.
11. Write down the Python program to plot Bose-Einstein distribution function with energy at a given temperature  $T$ .
12. Write a Python program to get the velocity distribution of free gas molecules inside a closed cylinder. Compare the variation with the Maxwell velocity distribution. Show the expected output graphically..



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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: PHYSICS**

**Paper: VII**

**Full Marks: 100 (Practical)**

**Time: 4 Hours (Practical)**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer any **one question** [within 250 words] from each Group.

**Group - A**

**(Analog Electronics Experiments)**

1. Use an OP-AMP (IC 741) as i) an inverting amplifier for gain 10 and ii) an non-inverting amplifier for gain 11.
  - (a) Write the working formula.
  - (b) Draw the circuit diagram for inverting and non-inverting amplifier (Null adjustment required).
  - (c) Calculate the values of the components.



- (d) Draw a table considering the working formula for  $V_{in}$  vs.  $V_o$  using the following input voltages: 0.2V, 0.4V, 0.6V.
- (e) Draw the graphs (graph paper not required).
2. Use the 741 OP-AMP to construct i) an adder (3 input) ii) a subtractor (2 input) for gain 2 (for both cases).
- (a) Write the working formula.
- (b) Draw the circuit diagram for adder and subtractor (Null adjustment required).
- (c) Calculate the value of the components.
- (d) Draw a table considering the working formula for  $V_{in}$  vs.  $V_o$  using the following input voltages: 0.2V, 0.4V, 0.6V.
3. Measure the i) input off-set voltages, ii) off-set current and iii) input-bias currents of the given OP-AMP at gain 100.
- (a) Write the working formula for this and calculate the values of the circuit components.
- (b) Draw the circuit diagram for each case.
- (c) Draw the circuit diagram for observing Null adjustments.
4. Construct phase shift oscillator for two different frequencies between 500Hz - 10 KHz using OP-AMP 741.
- (a) Write the theory and related formula with conditions.
- (b) Draw the circuit diagram.
- (c) Calculate the circuit component for two specified frequencies.
5. Construct Wien-bridge oscillator for two different frequencies between 500Hz - 10 KHz using OP-AMP 741.
- (a) Write the theory and related formula with conditions.
- (b) Draw the circuit diagram.
- (c) Calculate the circuit component for two specified frequencies.



6. Construct an integrator (using sine wave) using the OP-AMP 741 IC and describe the method to determine the value of the capacitance from frequency response curve.
  - (a) Write the theory and related formula ( $f_0 \sim 160$  Hz).
  - (b) Draw the circuit diagram.
  - (c) Plot the nature of frequency response curve.

### **Group - B**

#### **(Digital Electronics Experiments)**

1. Construct AND and OR gates using diodes and resistors.
  - (a) Draw the circuit diagram and design the components for AND and OR gates. (Use LED and resistor for observing the outputs.)
  - (b) Draw the truth table for the gates, and also indicate the conditions of state of LEDs (at the output) in the corresponding tables.
2. Construct astable multivibrator (symmetrical) using transistors of frequencies 1KHZ, 10KHz and 15 KHz. Use NPN transistors and 5V power supply.
  - (a) Write the related formula.
  - (b) Draw the circuit diagram.
  - (c) Calculate the values of the circuit components.
  - (d) Draw the table for R & C values for different specified frequencies.
3. Use NAND gates (IC-7400) to construct two input OR, AND and NOT gate. Output is to be taken using LEDs and resistors with proper values (indicate it in circuit diagram).
  - (a) Draw the logic circuits indicating the pin numbers of the 7400 ICs. Draw the pin configuration of 7400.
  - (b) Draw the truth tables for the gates and also indicate the conditions of state of LEDs (at the output) in the corresponding tables.



4. Verify the following Boolean Expression using logic basic gates: (Output may be taken using LEDs and resistors, should be shown in diagram)

$$(A + B)(\bar{A} + C) = AC + \bar{A}B$$

- (a) Draw the logic circuit indicating IC number and pin number.
- (b) Draw the truth tables for the gates and also indicate the conditions of state of LEDs (at the output) in the corresponding tables.
5. Construct astablemultivibrator using IC-555 to generate symmetrical square-wave of frequencies 1KHZ, 5KHz, 10KHz. Use 5V power supply.
- (a) Write the related formula and conditions.
- (b) Draw the circuit diagram.
- (c) Draw the table for R & C values for different specified frequencies.
- (d) Draw the theoretical waveform at the collector and base of any one transistor.
6. Design a NOT gate circuit using transistor and resistor considering the below parameters:

$$h_{fe} \approx 80, I_c \approx 10mA, (V_{BE}) \approx 0.7V, (V_{CE}) \approx 0.02 \text{ and } V_{CC}, \text{ logic } 1 \approx 5V.$$

Draw the truth table for the gate and also indicate the conditions of voltage state (at the output) in the corresponding tables.



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Question Paper

**B.A./B.Sc./B.Com Part-III Examinations 2020**

**3rd Year Honours**

**Subject: POLITICAL SCIENCE**

**Paper : VII**

**Full Marks: 80 (Theory)**

**Time: 4 Hours**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer any **one question** [within 250 words] from the following.

1. Write, in your own words, how the concept of politics-administration dichotomy is valid, in the context of contemporary times of globalization.

জনপ্রশাসন ও রাজনীতির দ্বি-বিভাজনের ধারণা সমকালীন বিশ্বায়নের প্রেক্ষাপটে কতটা সমর্থনযোগ্য-নিজের ভাষায় লেখ।

**Or,**

Compare between public and private administration.

গণ ও ব্যক্তিগত মালিকানাধীন প্রশাসনের মধ্যে তুলনা কর।

2. Comment on the uniqueness on the concept of sustainable development.

টেকসই/সহনশীল উন্নয়নের ধারণার অভিনবত্বের সম্পর্কে মন্তব্য কর?

**Or,**



How the principles of authority and responsibility are mutually related in Public Administration?  
Explain

গণপ্রশাসনে কর্তৃত্ব এবং দায়িত্ববোধে কি পারস্পরিকভাবে সম্পর্কিত? আলোচনা কর।

3. Discuss, with relevant examples, the idea of administrative accountability towards people.  
জনগণের প্রতি প্রশাসনিক দায়বদ্ধতার ধারণার প্রাসঙ্গিক উদাহরণ সহ আলোচনা করো।

Or,

Evaluate the concepts of line and staff in the structure of administration.

প্রশাসনের কাঠামোর স্টাফ ও লাইনের ধারণাগুলির মূল্যায়ন কর।

4. Briefly evaluate the various approaches towards the evolution of Public Administration.  
জনপ্রশাসনের বিবর্তনে ধারায় যে দৃষ্টিভঙ্গিগুলি উঠে এসেছে - সেগুলির সংক্ষিপ্ত মূল্যায়ন কর?

Or,

Explain the importance of Budget in financial administration.

বিত্ত প্রশাসনের ক্ষেত্রে বাজেটের গুরুত্ব বিশ্লেষণ কর।

5. Briefly evaluate Max Weber's concept of bureaucracy.  
ম্যাক্স ওয়েবারের আমলাতন্ত্রের ধারণাটির সংক্ষিপ্ত মূল্যায়ন কর।

Or,

Reflect upon the constraints on people's participation in administration.

প্রশাসনে মানুষের অংশগ্রহণের ক্ষেত্রে প্রতিবন্ধকতাগুলির উপর আলোকপাত কর।

6. Write a critical note on the concept of 'incentive system' towards organizational mobility  
সংগঠনের গতিশীলতার ক্ষেত্রে 'উৎসাহদান ব্যবস্থার' ধারণাটির একটি সমালোচনামূলক টীকা লেখ।

Or,

Critically evaluate the performances of Panchayat Raj in West Bengal.

পঞ্চায়েতি রাজ ব্যবস্থায় পশ্চিমবঙ্গের কর্মসামর্থ্যের সমালোচনা সহকারে মূল্যায়ন কর।

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Question Paper

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: SANSKRIT**

**Paper: VII**

**Full Marks: 80 (Theory)**

**Time: 4 Hours (Theory)**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

यथेच्छमेकः प्रश्नः समाधेयः

1. सविभागं दुर्गविषयः मनुसंहितानुसारमालोच्यताम्।
2. किं नाम व्यसनम्? तत् मूलतः कतिविधम्? कस्याप्येकस्य विभागस्य सोदाहरणं व्याख्या कार्या।
3. दण्डस्याभावे कावस्था स्याद् देशस्य-मनुसंहितानुसारं विचार्यताम्।
4. राजोत्पत्तिविषये मनोः मतमुपस्थाप्यताम्।
5. स्त्रीधतम् इत्यस्मिन् विषये नातिदीर्घो निबन्धो विरचनीयः।
6. को नाम व्यवहारः? स कतिविधः? के च ते? तेषु द्वयोः व्याख्या कार्या।



7. याज्ञवल्क्यस्मृत्यनुसारं दायभागः आलोच्यताम्।
8. कौटिल्यसम्मतं विद्याविभागमुल्लिख्य वार्ताविद्यायाः स्वरूपं वर्णयताम्।
9. को नाम इन्द्रियजयः? कौटिल्यानुसारं प्रस्तूयताम्।
10. कः पञ्चाङ्गमन्त्रः? मन्त्रज्ञान-मन्त्ररक्षाविषये पूर्वाचार्याणां मतमुपस्थाप्य कौटिल्यमतं विशदीक्रियताम्।
11. वङ्गीयस्मृतिकारेषु रघुनन्दनस्यावदानम् आलोच्यताम्।
12. वङ्गीप्रदेशे स्मृतिचर्चा इति विषयः उपस्थाप्यताम्।

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Question Paper

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: SANTALI**

**Paper: VII**

**Full Marks: 80 (Theory)**

**Time: 4 Hours (Theory)**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

৯. 'মজায়েজ' তে পাকিস্তানি চিন্তাধারা নিয়ে আলোচনা করুন এবং এর মূল উদ্দেশ্য বিশ্লেষণ করুন (২৫০ শব্দ)।
১০. 'উজ্জ্বলিত হৃদয়' নামে উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন এবং উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন (২৫০ শব্দ)।
১১. উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন এবং উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন (২৫০ শব্দ)।
১২. উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন এবং উল্লেখিত গ্রন্থটির মূল উদ্দেশ্য বিশ্লেষণ করুন (২৫০ শব্দ)।





বিদ্যাসাগর বিশ্ববিদ্যালয়  
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**Question Paper**

**B.Sc. Honours Examinations 2020**

(Under CBCS Pattern)

**Semester - VI**

**Subject: ZOOLOGY**

**Paper: CC - 14 (T + P) (Evolutionary Biology – Theory + Practical)**

**Full Marks: 40 (Theory) + 20 (Practical) = 60**

**Time: 4 Hours**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer any **one question** [within 250 words] from each Part.

**Part A: Evolutionary Biology (Theory)**

1. Explain Darwinism in the light of modern synthetic theory.
2. Write down in brief about the origin and evolution of human.
3. Write a brief note on speciation in evolution.
4. (i) In the formula for determining a population's genotype frequencies, why is the 2 in the term  $2pq$  necessary?  
(ii) Brown hair (B) is dominant to blond hair (b). If there are 168 brown-haired people in a population of 200. What is the predicted frequency of heterozygote, homozygous dominant and homozygous recessive?



- (iii) In a given population, only the A and B allele is present in the ABO system. There are no individuals with type O blood or with O alleles in this particular population. If 200 people have type A blood, 75 have type AB blood, 25 have type B blood. What are the allelic frequency of this population?
- (iv) What allelic frequency will generate twice as many recessive homozygotes as heterozygote?
5. Briefly describe the major geological events of Paleozoic era. Draw and describe the evolution of horse using different fossils. What is neutral theory of evolution?
6. Describe the Chemical basis of origin of life with suitable reactions. Comment on the sources of variation in the population and their role in evolution. What is convergent and divergent evolution?

### Part B: Evolutionary Biology (Practical)

1. Write down the critical evolutionary significance on the following model specimen provided:



2. Write homology and analogy of the specimens provided:





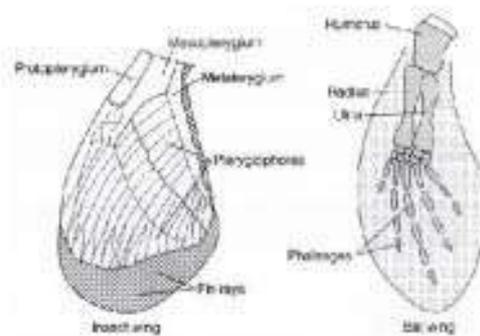
3. Graphically represent the frequency distributions of body weights [kg] of 80 people in the following dataset:

Body weight:	51-53	54-56	57-59	60-62	63-65	66-68	69-71
Number of people:	5	7	14	28	15	8	3

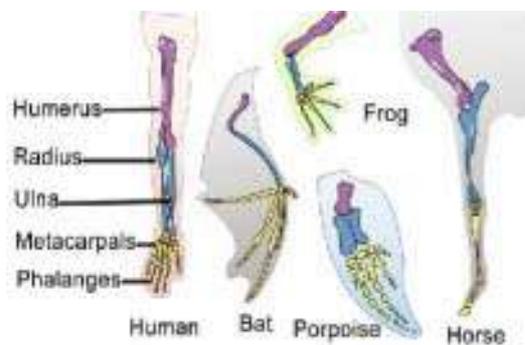
4. Write down the procedure and significance of chi-square test in evolutionary biology.

5. Study the homology and analogy from the provided organs below:

A.



B.





6. In rabbits, gray fur is dominant to white and black eyes are dominant to red. When a gray furred (heterozygous), red eyed rabbit is mated a number of times with a white furred, Black eyed (heterozygous) rabbit the offspring results are: 20 Gray/ Red. 25 Gray/Black , 32 White / Black, 23 White/ Red. Conduct a chi square test on these results and explain what those result means? Calculate using 0.05 level of significance.

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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (Honours)**

**Subject: ZOOLOGY**

**Paper: VII**

**Full Marks: 100 (Practical)**

**Time: 4 Hours (Practical)**

*Candidates are required to give their answer in their own words as far as practicable.  
Questions are of equal value.*

Answer **one question** [within 250 words] from the following:

1. Explain the principle, components and procedure of staining (Gram stain) of microbes.
2. Write down the principle and procedure of colorimetric analysis (Lowry's method) of protein.
3. Describe the qualitative test for carbohydrate.
4. State the identifying characters of spleen, lymph node and Bursa of Fabricius.
5. Describe the principle and procedure of estimation of haemoglobin.
6. Describe the principle and procedure of estimation of pH of a solutions.



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**Question Paper**

**B.A./B.Sc./B.Com. Part-III (1+1+1) Examination 2020**

**3rd Year (General)**

**Subject: ZOOLOGY**

**Paper: IV**

**Full Marks: 56 (Theory) + 30 (Practical) = 86**

**Time: 3 Hours**

*Candidates are required to give their answer in their own words as far as practicable.*

*Questions are of equal value.*

Answer **one question** [within 250 words] from each Group.

**Group A (Theory)**

1. Write a short note on Integrated Pest Management (IPM)?
2. What is sericulture? Briefly describe the life cycle of *Bombyx mori*?
3. What are the different methods of apiary management?
4. What are the different breeds of fowl? Describe about any one viral disease of fowl?
5. What is EIA? What are the importance and strategies of wild life conservation?
6. What is integrated farming ? Briefly describe marine pearl culture?



### Group B (Practical)

1. Write down the principle and procedure for the estimation of Oxygen (O<sub>2</sub>)?
2. Write the principle and procedure for the identification of human blood group?
3. Describe the principle and procedure of estimation of pH of solutions.
4. Write down the differences between LC<sub>50</sub> and LD<sub>50</sub>.
5. Write the principle, procedure and ecological significance of salinity of water?
6. Write down the identifying characters and applied importance of the following:
  - (i) *Plasmodium vivax*
  - (ii) *Ctenopharyngodonidella*
  - (iii) *Macrobrachium rosenbergi*