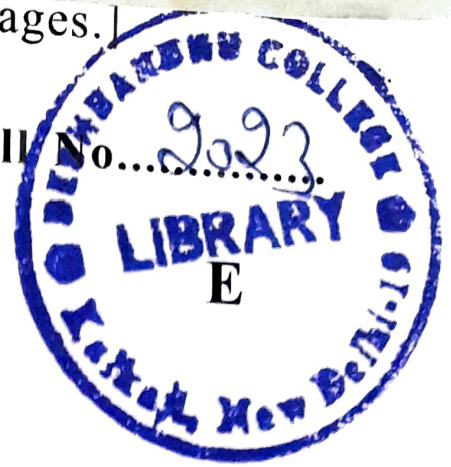


12

Your Roll No. 2023



Sr. No. of Question Paper : 4559

Unique Paper Code : 32493402

Name of the Paper : (SEC) Microbial Techniques

Name of the Course : **B.Sc. (H) Biochemistry
(CBCS)**

Semester : IV (CBCS)

Duration : 2 Hours

Maximum Marks : 50

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt 4 questions in all.
3. Question No. 1 is compulsory.
4. All questions carry equal marks.

1. (a) Justify the following :

- (i) The bacterial cell wall has D amino acids.
- (ii) Turbidometric methods are not suitable for viable cell counting.

- (iii) Gelatin is not preferred as a solidifying agent in media.
- (iv) Refrigeration prevents food from spoiling for a limited period of time.
- (v) A typical growth curve represents a closed-system culture.

(b) Define :

- (i) Virusoids
- (ii) Negative staining
- (iii) Disinfectant
- (iv) Psychrophiles
- (v) Aerotolerant anaerobes (7.5,5)

2. (a) Write about the contribution of the following scientists :

- (i) Joseph Lister
- (ii) Alexander Fleming
- (iii) Anton von Leuwenhoek

(b) Explain the experimental evidences instrumental in establishing the Germ Theory.

(c) You are given a mixed sample of *E. coli* and *Lactobacillus*. How will you identify the two species under the microscope? Explain the procedure as well as the principle of the technique. (3,4,5.5)

3 (a) Give the appropriate method of sterilization (chemical/physical) of the following and explain its principle.

(i) LB Agar

(ii) Hospital bedding

(iii) Chloramphenicol solution

(iv) Poultry produce

(b) During a laboratory procedure, a pathogenic culture spills on the floor of the laboratory. What measures will be taken to handle the above-mentioned situation? Explain the sequence of action in a flowchart.

(c) Draw an Algal cell. (6,3.5,3)

4. (a) Which type of media can be used in the following situation? (Justify with example)

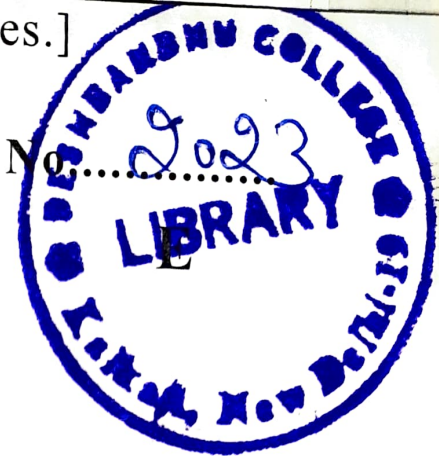
(i) To revive a bacterial strain kept at -20°C for a long period of time.

- (ii) To select an antibiotic resistant strain of *E. coli*.
 - (iii) To differentiate between pathogenic and non-pathogenic staphylococcus species.
 - (iv) To grow microbial flora present in tap water.
- (b) Draw and explain the phases of a typical bacterial growth curve. (8,4.5)
5. (a) What are viable cells? Explain two methods of viable cell counting.
- (b) What is the advantage of spore formation by a fungus? Depict the different types of fungal spores using a diagram.
- (c) Explain the principle of Hemagglutination assay and Plaque assay. A student plated 10 μ l of 10^{-3} diluted phage lysate and observed 39 colonies. Calculate the PFU/ml (4,4,4.5)
6. Write short notes on :
- (a) Prions and diseases caused by them.
 - (b) Nutritional requirements of a microorganism.
 - (c) Conditions influencing the effectiveness of antimicrobial agents. (3.5,4,5)

[This question paper contains 2 printed pages.]

13

Your Roll No.



Sr. No. of Question Paper : 4565

Unique Paper Code : 32163403

Name of the Paper : Biofertilizers

Name of the Course : SEC : Botany for Honours

Semester : IV

Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **three** Questions in all.
3. Question No. 1 is compulsory.
4. Draw well labelled diagrams wherever necessary.

1. (a) Expand the following (**any four**) : (1×4=4)

(i) FYM

(ii) CRYEMA

(iii) PSB

(iv) IARI

(v) PGPR

(b) Define (any two) :



(2×2=4)

(i) Hartig net

(ii) Curing in fertilizer technology

(iii) Carriers for biofertilizers

2. Write short notes on the following (any three) :

(5×3=15)

(i) Types of Biofertilizers

(ii) Green revolution

(iii) Composting techniques

(iv) Actinomycetes and its symbiotic association

3. (a) Discuss the role of earthworms in improving the physical, chemical and biological properties of soil. (8)

(b) Discuss briefly the significance of *Azotobacter* in sustainable agriculture. (7)

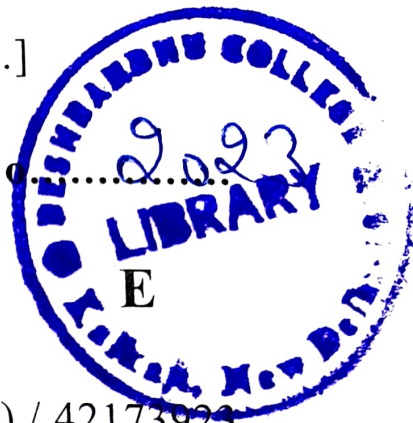
4. (a) Discuss briefly isolation and culturing process of *Rhizobium*. (8)

(b) Explain with the help of diagram *Azolla-Anabaena* symbiosis and its significance in paddy fields. (7)

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[This question paper contains 8 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 4570

Unique Paper Code : 32173902 (Hons.) / 42173923
(Prog.)

Name of the Paper : SEC – Basic Analytical
Chemistry

Name of the Course : **B.Sc. (Hons.) / B.Sc. (Prog.)**

Semester : IV / VI

Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions out of **six**.
3. **All** questions carry equal marks.
4. Attempt all parts of a question together.
5. Use of non-programmable scientific calculator is allowed.

1. (a) Give one word or phrase for the following : (3)

(i) Square of standard deviation

(ii) A solution prepared from all the reagents
but no analyte

(iii) Substance added to exhibit a visual cue for
completion of a reaction

(b) Define the following terms : (3)

(i) Eutrophication

(ii) Glass Electrode

(iii) Chelate

(c) Write the chemical equation involved in the interaction of nickel ions with spraying agent in the chromatographic separation. Why is it necessary to expose the chromatogram paper to the fumes of ammonia after spraying it with 1% alcoholic solution of DMG? (3.5)

2. (a) In a set of measurements, the following concentrations of iron in ppm were reported as :

20.2, 20.4, 20.3, 20.1, 19.9, 20.0, and 19.8.

Calculate :

(i) Standard deviation

(ii) Relative standard deviation. (3)

(b) Define R_f and give its full form. Enlist the advantages of thin layer chromatography over paper chromatography. (3)

(c) Discuss in brief the method involved in estimation of concentration of Fe^{+2} ions in a multivitamin tablet. Name the analytical technique used. (3.5)

3. (a) Define complexometric titrations. Give the full form of a polydentate ligand commonly used in complexometric titrations. Why is the disodium salt of EDTA used instead of tetrasodium salt of EDTA in complexometric titrations?

(3)

(b) Differentiate between any **two** the following :

- (i) Determinate and indeterminate errors
- (ii) Biochemical oxygen demand and chemical oxygen demand
- (iii) Homogenous and heterogeneous samples

(3)

(c) Give the full form of DO and explain its significance. Name the method and explain the principle involved in estimation of DO in a water sample.

(3.5)

4. (a) When can zero be used as a significant figure?

Indicate the number of significant figures in the following expressions :

(i) 1.0030

(ii) 0.03010

(iii) 0.0075020

(iv) 500

(3)

(b) Briefly explain the composition of soil. What are the factors which determine its fertility?

(3)

(c) Define hardness of a water sample. Name any two indicators used in its estimation and draw their structure. Why hardness of a water sample is expressed in terms of calcium carbonate and parts per million?

(3.5)

5. (a) What is a buffer solution? What is its application in complexometric titrations involving EDTA solution? (3)
- (b) What is the principle involved in ion exchange chromatography? Give one example each of cation and anion exchange resin. (3)
- (c) A high degree of precision does not always imply high accuracy. Justify the statement. (3.5)
6. (a) Explain two instrumental techniques used in analytical process of determination of a sample. (3)
- (b) What do you understand the term 'alkalinity of a water sample'? Name the ions which contribute to the alkalinity of a water sample. Which combination of ions cannot be estimated for alkalinity? (3)

(c) Define the term sampling. Explain its significance in chemical analysis? (3.5)

[This question paper contains 4 printed pages.]

15



Sr. No. of Question Paper : 4628
Unique Paper Code : 32353401
Name of the Paper : SEC 2-Computer Algebra Systems and Related Softwares
Name of the Course : CBCS-LOCF-B.Sc. (II) Mathematics
Semester : IV

Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper has four questions in all.
3. All questions are compulsory.
4. Use anyone of the CAS := Mathematica/Maple/Maxima/any other to answer the questions

Q1. Attempt both parts (i) and (ii).

- (i) Fill in the blanks 1 × 5 = 5
- a. The line numbers assigns to the input as
 - b. You can obtain information about a specific command by typing.....
 - c. The command to calculate π to 100 decimal places is
 - d. Lines are terminated by to suppress the output
 - e. The command to calculate the binomial coefficient $\binom{7}{2}$ is

- (ii) Explain any FIVE of the following 'R' commands in short : 1 × 5 = 5
- a. qqnorm()
 - b. read.csv()

- c. ls()
- d. rm()
- e. as.character()
- f. tail()

Q2. Write a short note on any four from the following:

$2 \times 4 = 8$

- (i) How to include exclusions and gridlines in a plot in any CAS. Also explain the difference between them.
- (ii) How to put a logarithmic scale on horizontal axis in a plot of 2^x in any CAS.
- (iii) How to sketch a contour plot in any of the CAS.
- (iv) How to plot 3-dimensional surface in any CAS. Explain it by an example.
- (v) How to form a new matrix from two existing matrices of same order by stacking them on top of each other in any CAS.
- (vi) Explain the rules for defining a function in any CAS.

Q3. Do any four from the following:

$2 \times 4 = 8$

- (i) Write the command for sketching the curve $y = (x - 1)^2$, $-2 \leq x \leq 2$, with colour of the curve blue
- (ii) Write the command for plotting the graph of the following:
 $y = e^x \cos x$, $z = e^x \sin x$, $0 \leq x \leq 5$.

(iii) $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 3 & 5 & 1 \end{bmatrix}$

Write commands for generating:

- a. Eigen values and Eigen vectors of Matrix A
- b. Diagonalise the matrix

(iv) Write the output of the following commands in the statistical software 'R'

```
>Garden=c(47,19,50,46,9,4)
>Hedgerow=c(10,3,0,16,3,0)
>Parkland=c(40,5,10,8,0,6)
>Pasture=c(2,0,7,4,0,0)
>data=c(Garden, Hedgerow, Parkland, Pasture, Woodland)
>bird=matrix(data,ncol=5,dimnames=list(c('Blackbird','Chaffinch','Great
Tit','House Sparrow','Robin','Song Thrush'), c('Garden', 'Hedgerow', 'Parkland',
'Pasture'))))
>bird
```


(v) Write command for solving the system of equations:

$$x + 2y + 3z = 2, \quad x - y + 3z = 6, \quad 2x + 3y - 4z = 2$$

Q4. Attempt any three parts from the following:

(4X3=12)

(i) Write code of the following in software- R:

a. Make a list "L1" in software R, containing following vectors:

$$V1 = \{p, q, r, s\}, \quad V2 = \{2, 3, 4, 5\} \text{ and } V3 = \{1.5, 3.5, 8.5\}.$$

b. Write code to extract V2 from L1

c. Find square root of the mean of V2.

d. Add V4 = {3, 7, 5, 11} at third position in the list L1.

(ii) Consider the following dataframe object 'x':

	C1	C2	C3	C4	C5
R1	8	15	53	28	1
R2	23	7	35	55	9
R3	7	9	1	6	17
R4	11	14	56	3	32
R5	9	2	12	45	5
R6	12	18	9	3	13

Write code of the following in software- R:

a. Find the column means and column sums of 'x'.

b. Find the minimum and maximum values of the dataframe 'x'.

c. Create a scatter chart of 'x'.

(iii) Explain difference between the following in software-R

a. `as.data.frame()` and `data.frame()` commands.

b. matrix and data fame.

c. `order()` and `rank()` commands.

d. vector and list.

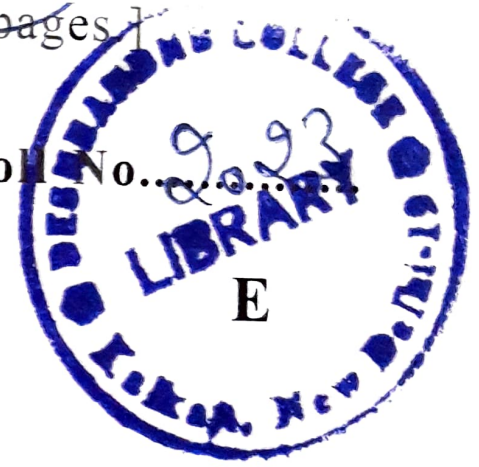
(iv) Write possible R commands for the following questions:

	C1	C2	C3	C4	C5
R1	12	5	35	8	12
R2	13	27	32	5	5
R3	21	10	11	16	19
R4	5	11	16	10	23
R5	13	2	12	42	5
R6	10	14	8	20	30

- a. Create the above matrix 'z'.
- b. Extract second column of 'z'.
- c. Make Histogram of row "R2".
- d. Convert this matrix into dataframe.
- e. Find standard deviation of vector "R3" of the converted dataframe

16

Your Roll No. 2023



Sr. No. of Question Paper : 4639

Unique Paper Code : 32223903

Name of the Paper : Electrical Circuits and Network Skill

Name of the Course : B.Sc. Hons.-(Physics)_SEC Paper

Semester : IV

Duration : 3 Hours

Maximum Marks : 50

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all. **All** questions carry equal marks.
3. Use of non-programmable scientific calculators is permitted.
4. Use simple diagrams to elaborate your answers.

1. (a) State Thevenin's Theorem and Norton's Theorem?
(b) Define linear and non linear devices with examples. (5,5)
2. (a) State Kirchhoff's laws for DC circuits with suitable diagram.
(b) Discuss the real and imaginary components of AC power with mathematical derivations. (5,5)
3. (a) Describe the Construction and working of a Bridge rectifier. How is better than a center tapped full wave rectifier?
(b) Describe R.M.S. and mean values of electrical signals with mathematical expressions and suitable diagrams. (5,5)

4. (a) Discuss the construction and working of a DC Generator with the help of suitable diagram.
- (b) Differentiate between AC motor and AC generator on the basis of their construction and working Principle. (5,5)
5. (a) Explain what is the effect of phase reversal on three phase induction motor.
- (b) What is power factor correction and what are its advantages? (5,5)
6. (a) Describe working principle of Relay. What are different types of Relays.
- (b) An extension board has 4 switch and sockets of 5 Amp rating. What should be the minimum rating of fuse and why? (5,5)

7. Write Short note on any **two** of the following : (5,5)

(a) Ladder Diagrams

(b) Relay as a protective device

(c) Circuit breakers

(d) Superposition theorem

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[This question paper contains 4 printed pages.]

Your Roll No.

Sr. No. of Question Paper : 4640

Unique Paper Code : 32223904

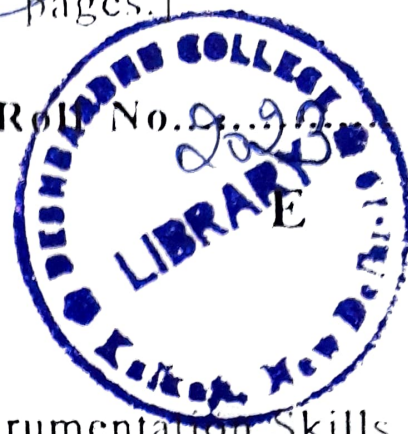
Name of the Paper : Basic Instrumentation Skills

Name of the Course : B.Sc. (Hons.)-CBCS—SEC

Semester : IV

Duration : 3 Hours

Maximum Marks : 50



Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FIVE** questions in all.
3. **All** questions carry equal marks.
4. Question No. **1** is compulsory.
5. Scientific (non-programmable) calculators are allowed.

1. Answer any **five** of the following questions :

(5×2=10)

(a) Calculate the maximum percentage error in the difference of two measured voltages when

$$V_1 = 90 \pm 2\% \text{ and } V_2 = 70 \pm 3\%.$$

- (b) What are the conditions for the AC bridge to be balanced?
- (c) What are the general characteristics of a digital voltmeter?
- (d) A PMMC instrument has FSD of $150\mu\text{A}$ and a coil resistance of $2\text{k}\Omega$. Calculate the shunt resistance value to convert the instrument into an ammeter with FSD 200mA .
- (e) Give two specifications of a millivoltmeter and explain their importance.
- (f) Explain electrostatic focusing in CRO.
- (g) What is a distortion factor meter?
2. (a) What are the advantages of electronic voltmeter over conventional multimeter? With a neat block diagram of an electronic voltmeter, explain how voltages are measured. (2+5)
- (b) Explain some important specifications of an electronic voltmeter. (3)

3. (a) What are the major components of a CRO? Draw the basic block diagram of a CRO and explain the working principle of each component. (2+6)
- (b) What are the applications of CRO? (2)
4. (a) Explain the difference between a signal generator and a pulse generator. (3)
- (b) Draw a block diagram and explain how a low frequency signal generator works. Provide some of its specifications. (5+2)
5. (a) What is a Q-meter? Give a detail explanation of the principle of operation of a Q-meter with the help of a block diagram. (2+5)
- (b) Find the value of Q-factor and the resonance frequency of a series LCR circuit With $C=1\mu\text{F}$, $L=100\text{mH}$ and $R=200\Omega$. (3)
6. (a) What are the characteristics of a digital meter? Explain the working principle of a digital voltmeter. (2+5)

- (b) Determine the resolution of a 3-1/2 digit DVM. How would a voltage of 11.1212 V be displayed on 10 V range and 100 V range? (3)
7. (a) Explain with the help of a functional block diagram, the principle of operation of a digital frequency counter. (7)
- (b) What do you understand about the accuracy and the resolution of a frequency counter? (3)

[This question paper contains 4 printed pages.]

18

Your Roll No.



Sr. No. of Question Paper : 5618

Unique Paper Code : 42173924

Name of the Paper : SEC- Instrumental Methods
of Analysis

Name of the Course : **B.Sc. (Prog.)**

Semester : IV/VI

Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any 4 questions. All questions carry equal marks.
3. Answers should be numbered in accordance with the number in the question paper.

1. (a) Explain with neat diagram the instrumentation of Infra - red spectrophotometer.

(b) Write the structure of TMS. How many signals are shown by it in NMR spectrum?

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(c) How UV spectroscopy is useful in distinguishing between conjugated and a nonconjugated diene? Explain with suitable example. (3.5,3,3)

2. (a) Differentiate between the following giving suitable examples (Any 2) :

(i) Hypsochromic and bathochromic shift

(ii) Beer's Law and Lambert's Law

(iii) Hot bands and Overtones

(iv) Finger print and Functional group region

(b) Predict the appearance of low-resolution NMR spectrum of ethanol. (3,3,3.5)

3. (a) What is chemical shift? The observed chemical shift of a proton is 300 Hz from TMS at 100 MHz instrument, calculate the chemical shift in δ .

(b) Discuss the effect of polar solvents on shift of absorption bands in UV-VIS spectroscopy. Give suitable example.

(c) Why trans stilbene absorbs at longer wavelength as compared to its cis isomer? (3.5,3,3)

4. (a) Define the following terms (**Any 3**) briefly. Illustrate your answer with suitable examples.

(i) Chromophore

(ii) Auxochrome

(iii) Monochromatic light

(iv) Frequency

(v) Upfield and downfield

(b) Giving any 4 reasons, explain why TMS is selected as standard reference compound in NMR spectroscopy. (2,2,2,3.5)

5. (a) Write short notes on the following (**Any 3**) :

(i) UV spectroscopy

(ii) IR spectroscopy

(iii) Atomic Absorption spectroscopy

(iv) Nuclear Magnetic Resonance spectroscopy

(b) Write any 2 uses of IR spectroscopy.

(2.5,2.5,2.5,2)

6. (a) Explain the NMR spectrum of the n-propanol with respect to :

(i) Types of hydrogens present

(ii) Number of signals this compound show

(b) What are the different criteria for choosing a suitable solvent in UV- Visible spectroscopy?

(c) What is the relation between wavelength and energy of electromagnetic radiation? Convert the wavenumber of 2500cm^{-1} to wavelength in \AA .

(3,3,3.5)

[This question paper contains 8 printed pages.]

Your Roll No.

Sr. No. of Question Paper : 5623

Unique Paper Code : 32173908

Name of the Paper : Skill Enhancement Course:
Green Methods in Chemistry

Name of the Course : **B.Sc. (Hons.) Chemistry /**
B.Sc. (Prog)

Semester : IV / VI

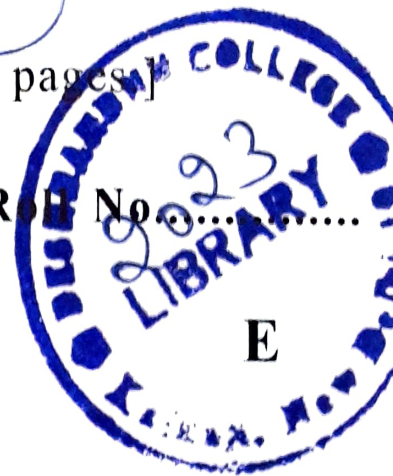
Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **three** questions in all.
3. Question **1** is compulsory and carries **14** marks.
4. **All** other questions carry **12** marks each.
5. Attempt all parts of a question together.

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1. (a) Select the most appropriate option :-

(i) Which amongst the four industries is most waste generating? The E-factors have been specified.

- | | |
|---------------------|--------|
| (a) Oil refining | 0.1 |
| (b) Bulk Chemicals | <1-5 |
| (c) Fine Chemicals | 5-50 |
| (d) Pharmaceuticals | 25-100 |

(ii) Which of the following legislations gave birth to green chemistry initiatives?

- (a) The Clean Water Act of 1972
- (b) The Montreal Protocol of 1989
- (c) The Pollution Prevention Act of 1990
- (d) The Superfund Act of 1980

(iii) What is the U.S. Presidential Green Chemistry Challenge Award?

- (a) An award related to recycling
 - (b) An award for industry only
 - (c) The only chemistry award given by the President
 - (d) Challenges companies to become fuel efficient
- (iv) Which of the following are among the 12 Principles of Green Chemistry?
- (a) Design commercially viable products
 - (b) Use only new solvents
 - (c) Use catalysts, not stoichiometric reagents
 - (d) Re-use waste
- (v) The second listed of the 12 Principles of Green Chemistry is :
- (a) Prevent waste
 - (b) Catalysis

(c) Atom economy

(d) Benign solvents

(vi) _____ is an example of green energy source.

(a) Microwave

(b) Ultrasound

(c) Sunlight

(d) All of the above

(b) Fill in the blanks with the appropriate word(s) (**any five**) :

(i) _____ is one of the toxic organic solvents used for the dry cleaning purposes.

(ii) _____ is extracted from orange peel using liquid CO_2 prepared from dry ice.

(iii) Roger Sheldon introduced the parameter _____ which is used frequently for measuring waste generated in various industrial processes.

(iv) Green Chemistry Principle No. 8 says

_____ .

(v) _____ is the full form of Three R's.

(vi) Rearrangement is an example of atom _____ reactions.

(c) Expand the following (**any three**) :-

(i) VOCs

(ii) ISD

(iii) EPA

(iv) TBTO

(6,5,3)

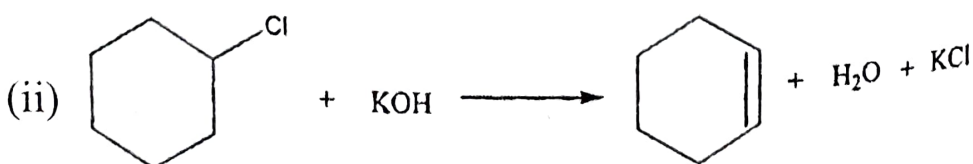
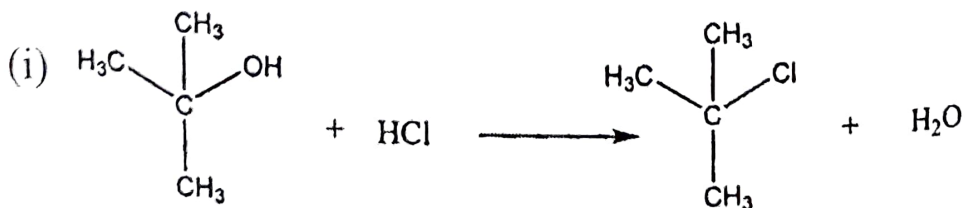
2. (a) Define Rightfit™ pigments. What are the associated advantages of using these pigments? Describe the synthetic pathway taking any example.

(b) What are the problems associated with the conventional solvents? Which solvents classify as green? Comment on the use of any of the green solvents highlighting its applicability.

(c) What properties of a biocatalyst make it relevant in green chemistry? Give one industrial application of a biocatalyst. (4,4,4)

3. (a) What are antifouling agents? Discuss why SeaNine™ is considered as a safe marine antifoulant in comparison to the conventional one.

(b) Categorize each of these reactions (addition/elimination/substitution/rearrangement) and calculate the atom economy :-



(c) Explain the following briefly and correlate to the principle of green chemistry involved (**any two**) :

(i) Surfactants for carbon dioxide

(ii) PLA synthesis from corn

(iii) Solvents obtained from renewable resources

(iv) Asymmetric catalyst (4,4,4)

4. (a) Compare the two routes provided below for the synthesis of urethane. Which is greener and why? Explain the principle involved.



(b) Biodiesels have emerged as cleaner alternative to the conventional fossil fuel based sources. Justify the statement. Give the reaction involved, highlighting the green principles.

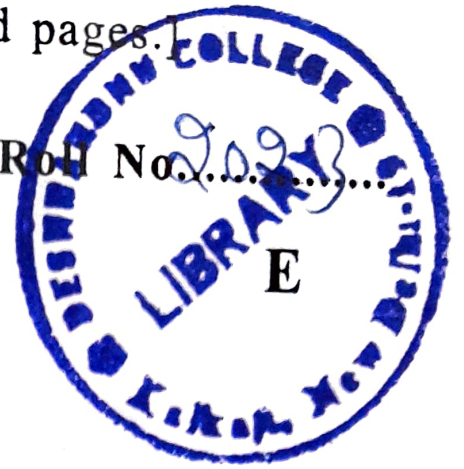
- (c) Draw a pyramid representing the pollution prevention hierarchy indicating the options to manage waste. Which is the least preferred option?

(4,4,4)

[This question paper contains 4 printed pages.]

(20)

Your Roll No.



Sr. No. of Question Paper : 5638

Unique Paper Code : 32223905

Name of the Paper : Renewable Energy and Energy Harvesting

Name of the Course : **B.Sc. (Hons) Physics / B.Sc. Prog.**

Semester : CBCS Part-II (Sem-IV) SEC

Duration : 3 Hours

Maximum Marks : 50

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question no. 1 is compulsory.
3. Attempt **five** questions in all.

1. Attempt any **five** questions :

0.5

- (a) A society in Gurugram has to run a diesel generator for 1.5 hour every day. The society's diesel electric generator of efficiency 40% consumes 5.4 kg of diesel every day. What is the electrical power output of the generator if the calorific value of diesel is 44.8kJ/g?
- (b) What is a dynamo? What kind of voltage is generated by a dynamo?
- (c) Prakash Kumar installed a solar panel of 1m^2 area and 15% efficiency on the roof of his house in Shahbad Dairy. It receives 14KJ/minute sunlight at 60 degree angle at 2:30pm, find the electrical power generated by the solar panel at that time.
- (d) A certain nuclear power plant converts 10% of the total energy available into electrical energy. It consumes U-235 to give Ba-141 and Kr-92. In the plant, the mixture of these three components becomes lighter by 50 milligram in one hour. What is the power output of the plant?
- (e) What do you understand by piezoelectric material? Name two piezoelectric materials.
- (f) How does the concept of Net Metering encourage people to adopt a renewable source of energy?

- (g) Why fossil fuels are not considered to be renewable? Explain same using the example of coal formation. (5×2=10)
2. Vijay Dinanath lives in a remote village in Odisha. Power shortage is a constant issue in his area. He wants to install a rooftop solar power harnessing unit. Design a rooftop solar power model for him by clearly mentioning each component's purpose. Also, list the factors that may act as deterrent to Vijay's decision. (6+4=10)
3. Hydropower projects are a great source of renewable energy. Enlist its benefits and negative impacts. Explain how a large hydropower station works? (4+6=10)
4. Keshundai lives in the sunniest part of Kerala. He wants to construct a solar cooker for daily uses. Propose a design of a solar cooker clearly describing the purpose of each component. Give one model to harness Geothermal Energy. (6+4=10)
5. What do you understand by piezoelectricity? Describe one way in which piezoelectric power can be harnessed for productive output. What are the pros and cons of piezoelectric power harnessing? (4+6=10)

6. What do you understand by environmental sustainability? How does the shifting towards renewable energy sources enhance sustainability? Enlist different alternative methods to achieve environmental sustainability. (3+3+4=10)
7. Describe the working of the different components of a wind energy harnessing system. What are the major challenges in effective harvesting of wind energy? (5+5=10)



Name of Course:

21

BSc (Prog)

Semester:

IV/VI

2023

Name of the Paper:

SEC- Basic Principles & Laboratory Operations

Unique Paper Code:

42173925

Duration:

2 hours

Maximum Marks:

38

S.No. - 5672 - A

Attempt any 4 questions. All questions carry equal marks.
Answers should be numbered in accordance with the number in the question paper.
Use of simple calculators is permitted.

Q1 (a) Differentiate between Determinate and Indeterminate Errors.

(b) Is a high degree of Precision same as high degree of Accuracy? Support your answer with a suitable example.

(c) Explain the term F-Test. Conduct an F-Test on the following samples:

- (i) Sample-1 having variance = 108.82, sample size = 41
 - (ii) Sample-2 having Variance = 55.99, sample size = 21
- Critical-F for (40,20) at alpha (0.025) is 2.287

3, 3, 3.5

Q2 (a) Define the following terms (Any four):

- (i) Standard Deviation
- (ii) Secondary Standard
- (iii) Mole
- (iv) Q- Test
- (v) Derived Units

(b) Calculate mean, standard deviation and variance for the following data:
4, 7, 12, 13, 9, 16, 8

(c) Discuss the importance of calibration of volumetric glassware in laboratory? How will you calibrate Pipette in a Chemistry Laboratory?

3, 3, 3.5

Q3 (a) Write the important components of a pH meter. How is it calibrated?

(b) What is a Significant Figure? Write the number of significant figures (any four) in the following:

- (i) 0.06900
- (ii) 36
- (iii) 4800
- (iv) 13.20
- (v) 20.00

(c) Define the term Unit. Write any two characteristics of a Unit. Name four basic measurements in our daily life.

3, 3, 3.5

Q4 (a) Write the general steps in chemical analysis. Describe briefly any one instrumental method of analysis.

(b) What are the uses of following laboratory apparatus:

- (i) Desiccator
- (ii) Chromatographic columns
- (iii) Drying Oven
- (iv) Meniscus Readers

(c) What are standard solutions? Write the difference between a primary standard and a secondary standard. Support your answer with two examples of each type.

3, 3, 3.5

Q 5 (a) Write a short note on the analytical methods that apply:

- (i) Electromagnetic radiation
- (ii) Electric charge

(b) A saline solution with a mass of 350 g has 40 g of NaCl in it. Calculate the percent concentration of the solute.

(c) Convert into moles:

- (i) 0.7 g of NaOH
- (ii) 8 g of NaHCO₃

3, 3, 3.5

[This question paper contains 8 printed pages.]

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Your Roll No.

Sr. No. of Question Paper : 5673

Unique Paper Code : 42343409

Name of the Paper : Programming in C++ (SEC)

Name of the Course : **B.Sc. (Prog.) Physical
Science / Mathematical
Science**

Year of Admission : 2019

Semester : IV

Duration : 2 Hours

Maximum Marks : 25

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question no. 1 is compulsory.
3. Attempt any **three** questions from Q. no. 2 to Q. no. 7.

1. (a) What is a constructor? Why does a constructor not have a return type? (2)

P.T.O.

(b) Differentiate between a structure and a class. (2)

(c) Rewrite the following program after removing the syntax error(s) if any. Underline each correction. (2)

```
#include<iostream>
using namespace std;
int main()
{
    var1 = 1, var2=2;
    myFunc(var1; var2);
    return 0;
}
void myFunc(int arg1, int arg2)
{
    arg1 = arg1 + arg2;
    count<<arg1>>arg2;
}
```

(d) Explain function overloading with suitable examples. (2)

(e) Consider the value of $x = 367$ and $y = 5$ for each of the following expression. What is the value of each of the expression? (2)

(i) $x \% 10$

(ii) $(x / 10) \% 10$

(iii) $x++ + y++$

(iv) $x+ = y$

2. (a) Change the following while loop code fragment to an equivalent for loop. (2)

```
cin >> x;

while (x != -1)
{
    cout << x << endl;
    cin >> x;
}
```

- (b) Write a recursive function to return the sum of the first n natural numbers. Show the stepwise execution for $n = 5$. (3)

3. Write a function that receives two numbers as arguments and displays all prime numbers between these two numbers. In case no arguments are passed,

3 and 10 should be treated as the default arguments. Call this function from main(), with one call taking the two arguments from the user and another call with no arguments. (5)

```
4. class A (5)
{
    int pri_A;
protected:
    int prot_A;
public:
    int publ_A;
};
class B:private A
{
public:
    void display()
    {
        pri_A=10; (1)
        prot_A=10; (2)
        publ_A=10; (3)
    }
};
```



```
class D:public B
{
public:
    void display()
    {
        pri_A=10;    (4)
        prot_A=10;   (5)
        publ_A=10;   (6)
        B::display(); (7)
    }
};
```

```
class C:public A
{
public:
    void display()
    {
        pri_A=10;    (8)
        prot_A=10;   (9)
        publ_A=10;   (10)
    }
};
```

For the statements labelled (1) to (10), mention if they are valid. Give reasons.

5. Write function in C++ which accepts a one-dimensional integer array and its size as arguments and replaces elements having odd values with twice its value and elements having even values with thrice its value.

Example:

If an array of five elements initially contains elements as

3, 4, 5, 16, 9

then the function should replace the content of the array as

6, 12, 10, 48, 18. (5)

6. Write a program that reads the text from the standard input unit (keyboard) and create a text file "File.txt". Write a function name *count(filename)* that accepts the filename as argument and counts the number of characters and blank spaces present in the text file. The output of the function should be as shown in the example below.

Example:

If the content of file are : Hello how are you Have
a nice day

The function **count(filename)** should display:

Number of blank spaces in file are 7

Number of character in file are 26 (5)

7. Create a class TwoDim which contains x and y coordinates as int. Define the following :

- I. Default constructor to initialize data members with zero
- II. Parameterized constructor to initialize data members with the values passed
- III. Function print1() to print coordinates of the class

Derive a class ThreeDim from the class TwoDim. assigning data member z in the derived class. Define the following :

- I. Default constructor to initialize data members with zero

II. Parameterized constructor to initialize data members with values passed

IV. Function print2() to print coordinates of the class

Write a main() function to create an object of class ThreeDim and print its coordinates. (5)

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[This question paper contains 6 printed pages.]



Your Roll No.....

Sr. No. of Question Paper : 5690

Unique Paper Code : 42353405

Name of the Paper : Sec-2 Mathematical Typesetting
System: LaTeX

Name of the Course : **B.Sc. Mathematical Science-
CBCS: Skill Enhancement**

Semester : IV

Duration : 2 Hours

Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **two** parts of each question.

1. (a) Create latex file use these environments title, section, subsection, subsubsection.

(b) Write input matrix environment command in latex :

P.T.O.

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}.$$

(c) Define preamble and Markup language. What is the extension file of the latex document? Write use package to include graphs in the latex file.

(d) Write latex code of the following :

$$\gamma^{(\Gamma(\eta+\lambda))} \quad (7)$$

2. (a) Write latex code of the following :

$$\left\{ \begin{array}{l} \alpha = f(z) \\ \beta = f(z^2) \\ \gamma = f(z^3) \end{array} \right\} \quad \text{and} \quad \left\{ \begin{array}{l} x = \alpha^2 - \beta \\ y = 2\gamma \end{array} \right.$$

(b) What is the difference between `\begin{equation}`, `\end{equation}` and `\begin{eqnarray}`, `\end{eqnarray}`.

(c) Write correct LaTeX code of the following :

$$f(\lambda x + (1 - \lambda)y) \leq \lambda f(x) + (1 - \lambda)f(y),$$

(d) What is the difference between the following commands in latex?

(i) `\`, and `\:`

(ii) `\vdots` and `\hdots`. (7)

3. Write the code in LaTeX to get the following output : (4)

(a) $(x + a)^n \neq \sum_{k=0}^n a^{n-k}.$

(b) $(1 + x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \dots.$

(c) $\sqrt[3]{\frac{x}{y}} + \sqrt[2]{z}.$

(d) Consider the sets $A_1, A_2, A_3,$

then $A_1 \cap (A_2 \cup A_3) = (A_1 \cap A_2) \cup (A_1 \cap A_3).$

4. Write the code in LaTeX to get the following output : (8)

(a) If A_t is a given function of t then the difference equation

$$x_t = ax_{t-1} + A_t$$

has the solution

$$x_t = a^t x_0 + (a^{t-1} A_1 + a^{t-2} A_2 + \dots + A_t).$$

(b) Consider the problem: $\max 20x_1 + 30x_2$

$$\text{subject to } \begin{cases} 3x_1 + 6x_2 \leq 150 \\ x_1 + 0.5x_2 \leq 22 \\ x_1 + x_2 \leq 27.5 \\ x_1, x_2 \geq 0 \end{cases}$$

(c) Consider

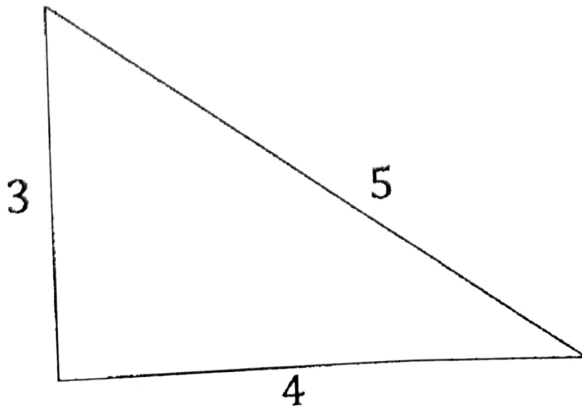
$$\int x^p \ln x \, dx = \frac{x^{p+1}}{p+1} \ln x - \frac{x^{p+1}}{(p+1)^2} \ln x + c \quad (p \neq -1)$$

(d) Write the LaTeX code to write the following :

$$A = \begin{bmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{bmatrix}.$$

5. (a) Write the command to draw an arc of a circle of radius 2.5 units centred at the point (2,2) making an angle of 45 degree.

(b) Write the command in PSTricks to draw the following picture.



(c) Write the command to draw a circle of radius 1.5 units centered at the point (3,2.5).

(d) Write the command in PSTricks to plot the function $y = \sin\left(\frac{1}{x}\right)$. (6)

6. (a) Write a presentation in beamer with the following content :

Slide-1: Title: Prime Number

Step-1. There is No Largest Prime Number.

Slide-2: Title: Proof

Step-2. Suppose the number of primes is finite.

Slide-3: Title: Prime Number

Step-3. Let p be the number of all primes.

Slide-4: Title: Prime Number

Step-4. Then $p + 1$ is not divisible by any prime.

Slide-5:

Step-5. Therefore, $p + 1$ is also a prime, a contradiction.

(b) Using beamer prepare a presentation with the following content :

Slide 1: Title of presentation with authors name and date

Slide 2: Some trigonometry identities:

$$\sin^2\alpha + \cos^2\alpha = 1$$

$$2 \sin \alpha \cos \alpha = \sin 2\alpha$$

Slide 3: Thank You

(c) Write a presentation in beamer with the following content:

Slide 1: Title: Real Number

Step-1. The set of real numbers is denoted by R.

Slide-2: Title: Greek Letters

Step-2. Let $\alpha = 3$, $\beta = 4$ and $\gamma = 5$.

Slide-3: Title: Triangle Inequality

Step-3. Triangle Inequality: $|\alpha + \beta| \leq |\alpha| + |\beta|$.

(d) What is beamer presentation? Write the four advantages of beamer. (6)