04/12/18

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This question paper contains 8 printed pages.]



**Your Roll No.....**

**r. No. of Question Paper : 153**

nique Paper Code : 42347901

ame of the Paper : Programming in Java

ame of the Course : **B.Sc. Mathematical Sciences/ B.Sc. (Prog.) – DSE-1A**

emester : V

uration : 3 Hours Maximum Marks : 75

**nstructions for Candidates**

. Write your Roll No. on the top immediately on receipt of this question paper.

. **Section A** is compulsory.

. Attempt any **five** questions from **Section B.**

. Parts of a question must be answered together.

## SECTION A

.. (a) Illustrate the different uses of keyword static with suitable example. (5)

(b) Give the output that will be generated on execution of each of the following code segments : (2×4)

P.T.O.

(i)
```
class A
{

   publicstaticvoid main(String[] st)
   {
  int m1 = 6;
     int m2 = 4;
        String s = "7";
        System.out.println(s+m1+m2);
        System.out.println(m1+m2);
   }
}
```

(ii)
```
class A

public static void main(String[] args)
{
       String a = "TEST STRING";
       a = a.substring(4,7);
       char b = a.charAt(1);
       a = a + b;
       System.out.println(a);
}
}
```

(iii)
```
class Inherit_Single
  {
       protected int s;
       Inherit_Single()
       {s = 10;}
  }

  class SubClass extends Inherit_Single
  {
       SubClass()
       {s = 11;}
       void display()
       {System.out.println(s);}
```



```
}
class MainClass
{
      public static void main (String args[])
      {
      SubClass obj = new SubClass();
      obj.display();
      }
}
```

(iv)
```
int sum=0;

int b[]={1,2,3,4};

for(int i:b)

     sum=sum+i;

System.out.println("Sum is"+sum);
```

(c) What is the purpose of the keyword `final`? Illustrate its use with the help of an example, in the context of a variable, a method and a class. (6)

(d) Write a program that accepts as input an integer n, followed by n integers and prints the smallest of these numbers. (4)

(e) Considering the following declaration of variables, evaluate the value of the given expression and determine its data type. (2)

```
int m=1, double s=45.6, char s1='a',
byte t=23;
```

Expression : `(m*s+s1)+t`

## SECTION B

2. (a) Write a method `searchFirst(s1, s2)` to search the first instance of a given substring `s2` within another string `s1` and return the starting index of `s2` (assume that search is successful). (5)

(b) Illustrate the notion of method overloading and method overriding in java with suitable examples. (5)

3. (a) Write a code segment in java to do the following : (6)

- Declare an interface `Rectangle` in package `Pack1`
- Declare another package `Pack2` and implement the interface `Rectangle` to calculate the area of rectangle.



(b) Give the output of the following : (4)

```
int rec_sum(int n)
{
    if (n<=1)
        return n;
    elsereturn n+rec_sum(n-1);
}
```

Show the runtime stack when the method `rec_sum` is called with the argument 5.

4. (a) What is Dynamic method Dispatch? Illustrate with the help of an example. (4)

(b) Consider the following files `file1.java` and `file2.java` : (6)

```
//file1.java
package mypack1;
public class A
{
  int a1;
  private int a2;
  protected int a3;
  public int a4;
  :
}
```

```
class  B
{
      :
}
class  C  extends  A
{
      :
}
//file2.java
package  mypack2;
import  mypack1.*;
class  D
{
      :
}
class  E  extends  A
{
      :
}
```

Which variables of class A are accessible in classes B, C, D and E? Why?

5. (a) State the purpose of the methods used in the lifecycle of an applet. (5)

(b) Write a code to create an applet with background color red that displays a message "HELLO WORLD". (5)



6. (a) Write a java program to copy the contents of file file1.txt to file file2.txt. (4)

(b) Consider classes A, B, and C where B is subclass of A and C is a subclass of B. Define constructors in each class to display the name of the class and determine the order of their execution. (6)

7. (a) Write a java program to accept an integer at the runtime. The program should throw and handle a user defined exception MyException if the number entered is a negative number. (6)

(b) What is multilevel inheritance? Given the definition of the class Person with data members name and age, define the subclass Employee with data members Emp_id, Company_name, Designation and Salary. Write methods to (i) input (ii) display the data members. (4)

8. (a) Differentiate : (2×3)

(i) Byte Stream and Character Stream

(ii) == and equals

(iii) String and StringBuffer class

(b) What will be the output on execution of the following code : (4)

```
classTest
{
     publicstaticvoidmain(String args[])
    {
          intx = -3;
          System.out.println(x>>1);
           System.out.println(x<<1);
          inty = 4;
          System.out.println(y>>1);
           System.out.println(y<<1);
      }
    }
```

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This question paper contains **4** printed pages]

**Roll No.** | | | | | | | | | | |

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S. No. of Question Paper : **168**

Unique Paper Code : **42357501** **IC**

Name of the Paper : **Differential Equations**

Name of the Course : **B.Sc. (Math Sci.)/B.Sc. (Prog.) : DSE-2**

Semester : **V**

Duration : **3 Hours** Maximum Marks : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*All* the questions are compulsory.

Attempt any *two* parts from each question.

1. (*a*) Solve : 6½

$$(2x + \tan y)\,dx + (x - x^2 \tan y)dy = 0.$$

(*b*) Solve : 6½

$$\frac{dy}{dx} + \frac{y}{2x} = \frac{x}{y^3},\ y(1) = 2.$$

(*c*) Solve : 6½

$$p^2 - 9p + 18 = 0.$$

2. (*a*) Solve the initial value problem : 6½

$$\frac{d^2y}{dx^2} + 4y = 8 \sin 2x,\quad y(0) = 6,\ y'(0) = 8.$$

P.T.O.

(*b*) Find the general solution of the differential equation : 6½

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 4y = 2x \ln x.$$

(*c*) For the differential equation : 6½

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 4y = 0,$$

show that $e^x$ and $e^{4x}$ are solutions on the interval $-\infty < x < \infty$. Are these linearly independent ? Justify.

Also find the solution that satisfies the conditions $y(0) = 1$, $y'(0) = 4$.

3. (*a*) Using the method of variation of parameters, solve the differential equation : 6

$$\frac{d^2y}{dx^2} + 4y = \sec^2 2x.$$

(*b*) Given that $y = e^{2x}$ is a solution of : 6

$$(2x + 1)\frac{d^2y}{dx^2} - 4(x + 1)\frac{dy}{dx} + 4y = 0,$$

find a linearly independent solution by reducing the order. Write the general solution.



(*c*) Find the general solution of : 6

$$x^2\frac{d^2y}{dx^2} - 6x\frac{dy}{dx} + 10y = 3x^4 + 6x^3,$$

given that $y = x^2$ and $y = x^5$ are linearly independent solutions of the corresponding homogeneous equation.

4. (*a*) Solve : 6

$$\frac{a\,dx}{(b-c)yz} = \frac{b\,dy}{(c-a)zx} = \frac{c\,dz}{(a-b)xy}.$$

(*b*) Solve : 6

$$3\frac{dx}{dt} + 2\frac{dy}{dt} - x + y = t - 1,$$

$$\frac{dx}{dt} + \frac{dy}{dt} - x = t + 2.$$

(*c*) Check condition of integrability and solve : 6

$$zydx = xzdy + y^2dz.$$

5. (*a*) Eliminate the arbitrary function $f$ from the equation : 6

$$f(x^2 + y^2 + z^2,\ z^2 - 2xy) = 0$$

to form the corresponding partial differential equation.

(*b*) Find the general integral of the partial differential equation : 6

$$x(x^2 + 3y^2)\,p - y\,(3x^2 + y^2)\,q = 2z(y^2 - x^2).$$

P.T.O.

(*c*) Show that the equation : 6

$$xp = yq,\ z(xp + yq) = 2xy$$

are compatible and find their solution.

6. (*a*) Find the complete integral of the equation : 6½

$$p^2x + q^2y = z.$$

(*b*) Find the complete integral of the equation : 6½

$$pqz = p^2(xq + p^2) + q^2(yp + q^2).$$

(*c*) Reduce the following differential equation to canonical form : 6½

$$\frac{d^2z}{dx^2} - x^2\frac{\partial^2 z}{\partial y^2} = 0.$$

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[This question paper contains 5 printed pages.]



**Your Roll No.:.....**

**Sr. No. of Question Paper : 331**

**IC**

Unique Paper Code : 32177908

Name of the Paper : Green Chemistry

Name of the Course : **B.Sc. (H) Chemistry : DSE – 1**

Semester : V

Duration : 3 Hours Maximum Marks : 75

**Instruction for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **any five** questions.
3. Each question carries 15 marks.
4. Attempt all parts of a question together.
5. Molecular weights of H = 1, C = 12, N = 14, O = 16.

6. Answer any five of the following questions:

(a) Can toluene be used as a solvent in microwave reactions? Explain.

(b) Why use of catalytic reagents should be preferred over the stoichiometric reagents for chemical reactions.

P.T.O.

(c) Explain any three principles of green chemistry with the help of example.

(d) Give the uses of perchloroethylene (PERC, $CI_2C=CCI_2$). Suggest a green solvent that can replace it and highlight its advantages over PERC.

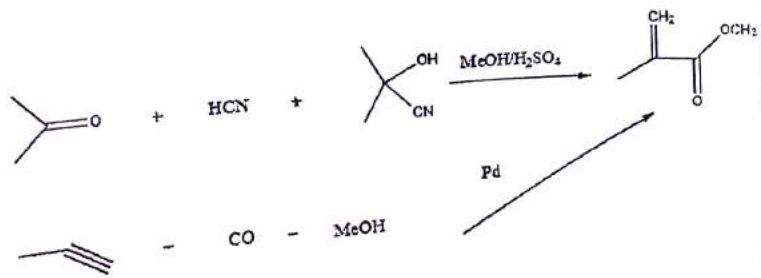
(e) Outline the importance of co-crystal controlled solid-state synthesis in green chemistry.

(f) How does cradle to cradle principle help in reducing hazards? (3x5)

2. (a) What are ionic liquids? Explain their advantages by taking example of a reaction involving use of ionic liquids.

(b) Discuss the principle of energy transfers in ultrasound waves and give its benefits over conventional heating.

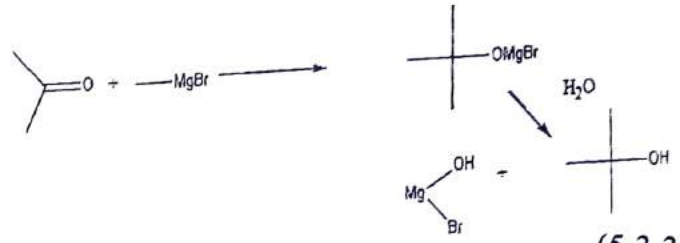
(c) Methyl methacrylate may be synthesized by the following two routes.






Which route is greener? Justify your answer.

(d) Differentiate between percentage yield and atom economy. The precent yield of following reaction is very high but this reaction is not considered a green synthesis. Explain.




(5,3,3,4)

3. (a) Give one example of any five of the following

(i) Right fit pigment

(ii) Microwave assisted reaction

(iii) Renewable feedstock

(iv) Bio catalyst

(v) 100% atom economical reaction

(vi) Solvent free reaction (5x1)

(b) Outline the green method for any five of the following:

(i) Simmons-Smith Reaction

(iii) Synthesis of adipic acid

(iv) Hofmann elimination

(v) Synthesis of disodium iminodiaceate

(vi) Poly lactic acid (5x2)

4. (a) Discuss the benefits of microwave assisted chemical reactions.

(b) What is the relation between risk and exposure? Explain.

(c) What is photocatalysis? Discuss the applications of photocatalytic conversions?

(d) Outline the limitations responsible for the Flixiborough accident. Suggest the green method to cynthesize cyclohexanol and compare it with the conventional method. (3,3,4,5)

5. (a) What are the benefits of combinatorial chemistry over traditional approach in the light of green chemistry?

(b) Discuss a green method for synthesizing healthier fats and oil.



(c) What are anti-foulants? Give structure of one environmentally safe marine antifoulant and discuss its advantages.

(d) Discuss the role of green chemistry for sustainable davelopment. (4,4,4,3)

6. Write short notes on any five of the following:

(a) Renewable feedstock

(b) Inherently safer design

(c) Polyetnylene glycol as green solvent

(d) Uses of blocking/protecting groups

(e) Importance of developing analytical techniques

(f) Asymmetrical catalysis

(g) Goals of green chemistry (5x3)

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[This question paper contains 8 printed pages.]



**Your Roll No.....**

**Sr. No. of Question Paper : 339** **IC**

Unique Paper Code : 42177925

Name of the Paper : Chemistry of d Block Elements, Quantum Chemistry and Spectroscopy

Name of the Course : **B.Sc. (Prog) Chemistry : DSE - IA**

Semester : V

Duration : 3 Hours Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **three** questions from **Section A** and any **three** from **Section B.**
3. **Section A** and **B** are to be attempted separately in the same sheet.
4. Calculators and log tables may be used.

## Section A

*Attempt any* **three** *questions.*

1. (a) Give brief reasons for **any five** of the following :

(i) Transition metals usually show variable oxidation states.

(ii) $CuSO_4.5\ H_2O$ is coloured but anhydrous $CuSO_4$ is colourless.

(iii) Densities of third transition series elements are almost double the respective elements of second transition series.

(iv) Transition metals form interstitial compounds.

(v) Many transition metals and their compounds act as catalyst.

(vi) The radii of first transition series elements decrease from left to right but the decrease is not as prominent as in s & p block elements. (10)

(b) Complexes with empirical formula $CoBr(NH_3)_5SO_4$ exist in two isomeric forms A & B. Form A yields one mole of $BaSO_4$ when treated with a solution of $BaCl_2$ whereas form B yields one mole of AgBr when treated with a solution of $AgNO_3$. Write down the structural formulae of both the forms. What are these isomers called? (2½)



2. (a) Give the IUPAC names of **any three** of the following complexes :

(i) $[Cr(NH_3)_6]\ [Cu(CN)_5]$

(ii) $Na\ [Mn(CO)_5]$

(iii) $[Cr\ CO_3(NH_3)_5]\ NO_3$

(iv) $[(en)_2Co(NH)(OH)Co(en)_2]\ Cl_3$ (4½)

(b) Calculate CFSE in terms of $\Delta_t$ of a $d^6$ metal ion placed in a tetrahedral field. Draw the splitting diagram. (4)

(c) State Jahn Teller theorem. Giving suitable reason, explain which of the following complexes will be distorted :

$[Fe(H_2O)_6]^{3+}$ or $[Cr(H_2O)_6]^{2+}$ (4)

3. (a) The complex $[Co(en)_2Cl_2]$ exists in two isomeric forms A & B. A is optically active but B is not. Explain the reason briefly and draw the structures of A & B. (4½)

(b) Write the formulae of **any two** of the following :

(i) Potassium carbonylpentacyanidoferrate (II)

(ii) μ-amido-μ- superoxidotetrakis(ethylene diamine)dicobalt(III) nitrate

(iii) Caesium tetrafluoridooxidochromate (III) (4)

(c) Which will show greater value of $\Delta_o$ and why?

(i) $[Co(NH_3)_6]^{3+}$ or $[Co(H_2O)_6]^{3+}$

(ii) $[Fe(H_2O)_6]^{2+}$ or $[Fe(H_2O)_6]^{3+}$ (4)

4. (a) For $Mn^{3+}$ ion, the electron pairing energy is 336 KJ $mole^{-1}$. The crystal field splitting energy for $[Mn(H_2O)_6]^{3+}$ ion is 250 KJ $mole^{-1}$. Will the complex ion have a high spin or a low spin configuration? Calculate CFSE for both the configurations to justify your answer. (4½)

(b) $[Ni(CO)_4]$ has tetrahedral geometry but $[Ni(CN)_4]^{2-}$ is square planer. Explain with the help of VBT. (4)



(c) Given below is the latimer diagram for Fe in acidic medium :

$Fe\ O_4^{2-}$ 2.20 $Fe^{3+}$ 0.77 $Fe^{2+}$ −0.47 Fe

Answer the following questions :

(i) Is there any state which undergoes disproportionation? Explain.

(ii) Calculate skip step emf for $Fe^{3+}$ ------ Fe change

(iii) Is there any tendency of $Fe^{2+}$ to reduce to Fe? Give reason for your answer.

**OR**

Write short notes on **any two** of the following :

(i) Separation of lanthanides by ion exchange method

(ii) Inner and outer orbital complexes

(iii) Geometrical isomerism in square planer complexes (4)

## Section B

Physical constants

Planck's constant, $h = 6.626 \times 10^{-34} Js$

Boltzmann Constant, $k = 1.38 \times 10^{-23} JK^{-1}$

Mass of electron, $m_e = 9.31 \times 10^{\times -31} kg$

Velocity of light, $c = 3 \times 10^8 \text{ m s}^{-1}$

*Attempt* **three** *questions.*

1. (a) Is the function $e^{-\frac{x^2}{2}}$ an eigen function of the operator $\frac{d^2}{dx^2}$? Give reason.

   (b) Define Lambert – Beer's Law. What are its limitations? Give one application of this law.

   (c) The wave number of J=2 rotational state of $1_H35_{Cl}$ is 120 $cm^{-1}$. Calculate moment of inertia and the bond length of the molecule.

   (d) Phosphorescence is a slow phenomenon. Explain. (3,3,4,2.5)

2. (a) Normalize the function $\psi = x(a-x)$ over the interval $0 \leq x \leq a$.

   (b) What is Stark – Einstein law of photochemical equivalence? What are the reasons for breakdown of this law?



   (c) The absorption band in IR spectrum of $12_C16_O$ is at 2150 $cm^{-1}$. Calculate the force constant of CO bond and the zero-point energy of the molecule.

   (d) At room temperature several rotational levels are populated but only the lowest vibrational level is populated. Explain. (3,3,4,2.5)

3. (a) Calculate the transmittance, absorbance and molar extinction coefficient of a solution which absorbs 80% of light of wavelength 250 nm passed through a cell of path length 1cm containing a solution of concentration 0.25 M.

   (b) Explain the terms inter system crossover, internal conversion and primary process.

   (c) Calculate the energy required for excitation of $\pi$ electron in Butadiene using free electron model. Average C – C bond length is 140 pm.

   (d) IR signal for stretching of C – C bond is at a lower frequency than for C = C bond. Explain. (3,3,4,2.5)

4. (a) What is Bohr's Principle of Correspondence? Explain it taking example of particle in a box.

(b) What is the essential condition for a molecule to show IR spectrum? Will $CO_2$ show a spectrum in IR? Give reason.

(c) In photochemical synthesis of HBr, the quantum efficiency was found to be 0.2 with light of wavelength 280nm. How many moles of HBr will be produced per Joule of energy absorbed?

(d) Rotational spectra are observed in microwave region but vibrational spectra are observed in IR region of electromagnetic radiation. Explain.

(3,3,4,2.5)

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*This question paper contains 3 printed pages.*

*Your Roll No.* .....

IC

| | |
|---|---|
| *Sl. No. of Ques. Paper* | : 350 |
| *Unique Paper Code* | : 42237903/32237903 |
| *Name of Paper* | : Animal Biotechnology |
| *Name of Course* | : B.Sc. (Prog) / B.Sc. (Hons) : DSE – 1 |
| *Semester* | : V |
| *Duration* | : 3 hours |
| *Maximum Marks* | : 75 |

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt **five** questions in all including Question No. 1, which is compulsory.*

1. (a) Define the following :
   (i) Restriction site
   (ii) Cosmid
   (iii) Shuttle vector
   (iv) Transduction
   (v) Horizontal gene transfer. 5

   (b) Differentiate between the following :
   (i) Linkers and adapters
   (ii) Neo and Isoschizomers
   (iii) Natural and synthetic culture medium
   (iv) Probe and primer
   (v) Genomic and *c*DNA libraries. 10

P.T.O.

(c) Expand the abbreviations :

(i) RFLP

(ii) YAC

(iii) SCID

(iv) PEG 4

(d) Write important contributions of the following scientists :

(i) Kary Mullis

(ii) EM Southern

(iii) Karl Ereky

(iv) Frederick Sanger. 2

(e) Write the importance of following in biotechnology :

(i) Taq polymerase

(ii) $T_4$ DNA ligase

(iii) *Hind* III

(iv) Alkaline phosphatase. 4

(f) Temperature for ligating the cohesive termini is a compromise between the rate of enzyme action and association of the termini. Explain the statement. 2

2. (a) Define cloning vector. Describe pUC18/19 as an ideal cloning vector. 6

(b) Describe the colony hybridization method of screening of genomic library. 6

3. (a) What are restriction endonucleases? Give an account of type II restriction endonucleases. 6

(b) Explain method of production of hGH by recombinant DNA technology. 6



4. (a) Explain the construction of transgenic animals by retroviral method. Add a note on their applications with suitable examples. 8

(b) Explain the technique of electroporation. 4

5. (a) What is gene therapy? Describe various methods of gene therapy and its types giving example. 7

(b) Describe technique of western blotting. 5

6. (a) Describe *Agrobacterium* based method of production of transgenic plants with a suitable example. 8

(b) What are the advantages of λ-bacteriophage based vectors? 4

7. Write short notes on any *three* of the following :

(a) DNA fingerprinting

(b) Dideoxy method of sequencing

(c) DNA microarray

(d) Molecular diagnosis of sickle cell anemia. 3×4

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This question paper contains 4+2 printed pages]

**Roll No.** | | | | | | | | | | |



S. No. of Question Paper : **387**

Unique Paper Code : **32177902**

**IC**

Name of the Paper : **Inorganic Materials of Industrial Importance**

Name of the Course : **B.Sc. (Honours) Chemistry/ B.Sc. (Prog.) : DSE-2**

Semester : **V**

Duration : **3 Hours** Maximum Marks : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Attempt *five* questions in all.

Question **1** is compulsory.

*All* questions carry equal marks.

1. (*a*) Fill in the blanks or mark True/False as required :

(*i*) Plasticizers provide ..... to the paint film.

P.T.O.

(*ii*) The three main constituents of the most common commercial glass are ....., ..... and ..... .

(*iii*) Fullerene ($C_{60}$) structure has ..... hexagons.

(*iv*) Excessive use of chemical fertilizers causes ..... in water bodies.

(*v*) Full form of DAP is ..... .

(*vi*) Catalysts can make a thermodynamically unfavourable reaction proceed. (True/False)

(*vii*) Ceramics normally exhibit ductile fracture. (True/False)

(*viii*) Nutrients which are required in very small amounts by plants are known as ..... nutrients.



(*b*) Give one word/phrase for the following (any *five*) :

(*i*) The process of coating a metal deposit on base metal by passing direct current through a solution of an electrolyte.

(*ii*) Full form of LIP.

(*iii*) The unpigmented dispersion or solution of resin in oil and/or thinners.

(*iv*) Substances which increase the activity of catalyst.

(*v*) Fibrous glass composed of intermingled fine threads or filaments of glass.

(*vi*) Applying a coat of tin over iron or steel articles. 10.5

2. (*a*) Describe the general characteristics of ceramics. Why China clay pots are stronger than earthenware ?

(*b*) What are superconductors ? Explain Meissner effect. Why superconductor materials do not function at high temperatures ?

(*c*) Why is it important to prepare the surface before electroplating ? Describe the process for chromium plating. 5,5,5

3. (*a*) Explain the manufacture, properties and applications of any *one* of the following fertilizers :

(*i*) Calcium ammonium nitrate

(*ii*) Ammonium phosphate.

(*b*) What is critical pigment volume concentration (CPVC) ? How does it affect the properties of a paint formulation ?

(*c*) Differentiate between cement, mortar and concrete. 5,5,5

4. (*a*) Give the composition and applications of any *two* of the following kinds of glass :

(*i*) Soda lime glass

(*ii*) Photosensitive glass

(*iii*) Safety glass.



(*b*) What is 'catalytic efficiency' ? Explain it in terms of 'turnover number' and 'turnover frequency' ?

(*c*) Describe briefly the principle, working and applications of polymer cell. 2.5×2,5,5

5. (*a*) What is the drying mechanism of a paint film ? Describe the role of the following additives in a paint formulation :

(*i*) Anti-skinning agent

(*ii*) Stabilizer

(*iii*) Preservative.

(*b*) Describe the single-walled and multiple-walled carbon nanotubes ? Give the applications of carbon nanotubes.

(*c*) Explain the characteristic features of ZSM-5 catalyst. Give its uses with suitable examples. 5,5,5

6. (*a*) Distinguish between direct and indirect fertilizers ? What are the harmful effects of chemical fertilizers on the environment ?

(*b*) What are the characteristics of a good catalyst ? How can a catalyst be deactivated ?

(*c*) Write a short note on any *one* of the following :

(*i*) Solar cell

(*ii*) Fire and Heat retardant paints. 5,5,5

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[This question paper contains 4 printed pages.]



**Your Roll No.**.....

**Sr. No. of Question Paper : 392**

**IC**

Unique Paper Code : 42167902

Name of the Paper : Cell and Molecular Biology

Name of the Course : **B.Sc. (Prog.) : DSE – 2A**

Semester : V

Duration : 3 Hours Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all including Question No. **1** which is compulsory.
3. All the parts of a question must be attempted together.
4. Illustrate your answers with well-labelled diagrams wherever necessary.

1. (a) Explain briefly the following (**any five**) : (5×1=5)

   (i) Fluorochromes

   (ii) Primary Cell Wall

   (iii) Palindromic sequences

   (iv) Telomere

   (v) Replisome

   (vi) hn RNA

P.T.O.

(b) Fill in the blanks **(any five)** : (5×1=5)

(i) Site where pyruvate is converted to Acetyl CoA _____ .

(ii) Nucleosomes are linked together by _____ .

(iii) The experimental support of Semiconservative mode of replication was given by _____ .

(iv) The longest phase during meiotic division is _____ .

(v) Location of RUBISCO in chloroplast is _____ .

(c) Fill in the blanks **(any five)** : (5×1=5)

(i) Formation of ATP from ADP and inorganic phosphate is called _____ .

(ii) The intervening sequences of DNA bases within eukaryotic genes that are not represented in mature RNA are called _____ .

(iii) _____ is a marker enzyme for mitochondria.

(iv) A covalent linkage joining successive sugar molecules in a polynucleotide chain is called _____ .



(v) The cell theory was proposed by _____ .

(vi) A cluster of associated genes and recognition sites participating in regulating transcription is called _____ .

2. Comments on following **(any three)** : (3×5=15)

(i) Permeability of membrane

(ii) Lac operon

(iii) Phase contrast microscopy

(iv) Theta mode of replication

3. Differentiate between the following **(any five)** : (5×3=15)

(i) Euchromatin and Heterochromatin

(ii) Scanning electron microscope (SEM) and Transmission electron microscope (TEM)

(iii) Inducible and repressible gene regulation

(iv) Prokaryotic and eukaryotic RNA polymerases

(v) Nuclear DNA and mitochondrial DNA

(vi) Rho and sigma factor

4. (a) Give an account of structure and function of Golgi apparatus. (5)

(b) Describe nucleosome concept of chromatin structure. (5)

(c) Explain the process of mitosis with the help of suitable diagrams and describe its significance. (5)

5. (a) Give experimental evidences to prove that RNA is genetic material. (5)

(b) Explain Fluid Mosaic Model of membrane structure. (5)

(c) Discuss Endosymbiotic theory. (5)

6. (a) Discuss in brief special features of genetic code. (5)

(b) Describe the structure and types of RNA. (5)

(c) Differentiate between Rough and Smooth Endoplasmic reticulum. (5)

7. (a) Discuss role of CDKs in cell cycle regulation. (5)

(b) Describe structure and function of Peroxisomes. (5)

(c) Give a brief account of mechanism of initiation of transcription in prokaryotes. (5)

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This question paper contains 4 printed pages]

Roll No. | | | | | | | | | | |



S. No. of Question Paper : **413**

Unique Paper Code : **42227928** **IC**

Name of the Paper : **Electricity and Magnetism**

Name of the Course : **B.Sc. (Prog.) DSE-2A**

Semester : **V**

Duration : **3 Hours** Maximum Marks : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Attempt *four* questions in all, including

Question No. **1**, which is compulsory.

1. Answer any *six* of the following : 6×5=30

   (*a*) Derive the equation of continuity.

   (*b*) Stating Gauss's law, derive $\text{div}(\mathbf{E}) = \rho/\epsilon_0$.

   (*c*) Derive an expression for the torque acting on a rectangular loop (length *a*, width *b* and carrying a constant current I in anticlockwise direction) placed in *x-y* plane in the presence of a uniform magnetic field $\mathbf{B} = B\hat{k}$.

P.T.O.

(*d*) What do you understand by polarization of electromagnetic waves ? Describe how circularly and elliptically polarized waves can be obtained from two linearly polarized waves.

(*e*) Write down *three* properties of diamagnetic materials. Give *two* examples.

(*f*) A current of 5 A flowing through a coil is cut off completely in 0.5 sec. Calculate the e.m.f. induced in the coil if it has a self-induction of 0.05 H.

(*g*) Show that $W = \frac{1}{2}LI^2$ is the work done to establish a current I in a coil of self-induction L.

(*h*) Evaluate grad($r^n$), $\boldsymbol{r} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ and $n > 0$.

(*i*) State and prove reciprocity theorem for mutual inductance (i.e. $M_{12} = M_{21}$).

2. (*a*) Prove that vector $\mathbf{A} = \frac{\boldsymbol{r}}{r}$ is irrotational, where $\boldsymbol{r}$ is position vector. 5

(*b*) Find the unit vector normal to the surface $\phi = x^2 - 2xy + z^2$ at the point (–2, 3, 1) in the direction of the vector $\mathbf{A} = 2\boldsymbol{i} - 4\boldsymbol{j} + 4\boldsymbol{k}$. 5

(*c*) Find $\nabla\phi$, if $\phi = \frac{1}{r}$, $\boldsymbol{r} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$. 5



3. (*a*) What do you mean by energy density of an electrostatics field ? Show that in free space it is given by $\frac{1}{2}\epsilon_0 E^2$ where, **E** is the electric field. 7

(*b*) Define the concept of potential. Find out the electric field a spherical charge distribution at a point (*i*) inside the sphere (*ii*) Outside the sphere (*iii*) On the sphere. 8

4. (*a*) Using Biot-Savart's law, derive an expression for the magnetic field due to a circular coil of radius '*a*' carrying current 'I' at a point on its axis. 7

(*b*) Starting from Biot-Savart's law, prove that $\nabla.\mathbf{B} = 0$. Explain its physical significance. 8

5. (*a*) Derive Faraday's law of electromagnetic induction in differential form. 5

(*b*) A coil of wire of certain radius has 600 turns and a self-inductance of 50 mH. What will be the self-inductance of a second similar coil with 500 turns ? 5

(*c*) What do you understand by dielectric polarization. Establish the relation $\mathbf{D} = \varepsilon_0 \mathbf{E} + \mathbf{P}$. 5

6. (*a*) Under what conditions does Ampere's circuital law fail ? How Maxwell modified it to make it consistent with continuity equation ? 10

(*b*) Derive the relation $\mu = \mu_0(1 + \chi)$, where $\chi$ is magnetic susceptibility of material and other symbols have their usual meaning. 5

7. (*a*) Write down Maxwell's four equations in integral form. 6

(*b*) Obtain the wave equations for the electric and magnetic field vectors and find the expression for the velocity of EM wave in vacuum. 9

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**Sr of the question paper:** 427

**Unique Paper Code:** 32177908

**Name of the paper:** Green Chemistry

**Name of the Course:** B.Sc. (Prog) APS Industrial Chem. : DSE-3

**Semester:** V

**Duration: 3 hrs**

**Maximum Marks: 75**

**Instruction for the candidates**

1. Write your Roll no on the top immediately on the receipt of the question paper
2. Attempt ***six*** questions. ***Question no 1 is compulsory***

Ques 1 A) State *True* or *False*.

i) Green chemistry is a new branch of chemistry.
ii) Chlorofluorocarbon is an excellent green solvent.
iii) Ozone layer is depleted by aromatic hydracarbons.
iv) VOC should be used in paints to make them environment-friendly.
v) Trans fats are good for health.

B) Fill in the blanks:

i) Risk = Hazard x .....
ii) ..... is extracted from the orange peel using liquid $CO_2$.
iii) ..... gas was leaked to cause Bhopal gas tragedy.
iv) .....is a green solvent.

C) Discuss any three of the following microwave assisted reactions:

(i) Hofmann elimination
(ii) Hydrolysis of amide.
(iii) Microwave assisted reaction in solid state (any one example)
(iv) Oxidation of toluene.
(v) Decarboxylation.

5.4.6

Ques 2 A) What are green solvents? Give two examples. Also discuss the advantages of using these solvents over conventional solvents.

(B) What are photo catalysts? Discuss the application by taking a suitable example

(C) Describe green synthesis of adipic acid and catechol 4x3=12

Ques 3 (A) What are fluorous biphasic solvents? Give two examples.

(B) Describe ultrasound assisted sonochemical Simmons-Smith reaction.

(C) What are antifoulants? Mention two marine antifoulants with their chemical structure. What are adadvantages of Sea Nine 211 over TBTO? 4x3=12

Ques 4 (A) What is combinatorial chemistry? Describe its advantages with example.

(B) Explain the importance of selection of starting materials in green synthesis along with an example.

(C) What are biodegradable polymers? Describe a synthetic process of compostable plastic from corn. 4x3=12

Ques 5 (A) What are ionic liquids. Give two examples. Mention advantages of ionic liquids over traditional solvents.

(B) Describe ultrasound assisted sonochemical Simmons-Smith reaction.

(C) Differentiate between heterogeneous and homogeneous catalysis with suitable example.

4x3=12

Ques 6 (A) (i)Define the terms viz. % yield and atom economy? In what way % atom economy is superior to % yield? Suggest a chemical reaction to differentiate between the two.

(ii) What do you understand by asymmetric catalysis? Give one example.

(B) Which is a greener route to synthesise the following compound (compare by calculating atom economy).

(i)


(ii)


(Mol mass: C=12, H=1, O=16, N=14)

3,3,6

Ques 7 (A) What are rightfit organic pigments? Give two examples. Mention the benefits of using rightfit pigments over heavy metal pigments or organic pigments.

(B) Why biocatalysts are green catalysts? Discuss the advantages of biocatalysis over the conventional chemical catalysts.

(C) Discuss the enzymatic inter-esterification for production of no Trans-fat or oils.

4x3=12

Ques 8 Write short note on any three of the following:

(A) Oxidation reagents and catalysts
(B) Derivatisation and protecting group
(C) Principles of inherent safer design (ISD)
(D) Renewable feedstock

4x3=12

[This question paper contains 4 printed pages]

**Your Roll No.** : .....

**Sl. No. of Q. Paper** : **461** **IC**

Unique Paper Code : 42227929

Name of the Course : **B.Sc.(Prog.) : DSE - 3A**

Name of the Paper : Elements of Modern Physics

Semester : V 2018

***Time : 3 Hours*** ***Maximum Marks : 75***

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in **all**.

(c) Question **NO.1** is compulsory.

**1.** Answer any **five** of the following : 3×5

(a) For a relativistic massless particle establish

$$E = pc$$

where E is the total energy, p is the momentum and *c* is the velocity of light.

(b) Enlist three problems of Rutherford's atomic model.

P.T.O.

(c) How does the double-slit experiment establish the wave nature of an electron ?

(d) Give the significance of the probability density of a particle.

(e) The wave function for a particle confined in a 1-dimensional box is

$$\psi(x) = A\sin\left(\frac{n\pi x}{L}\right)$$

show that $A = \sqrt{\left(\frac{2}{L}\right)}$

(f) The radius of $C^{12}$ is $3.0 \times 10^{-15}$ m. Deduce the radius of $He^4$.

(g) Define work function and threshold frequency in the photoelectric effect.

(h) 1 gram of an unknown radioactive substance, $X^{226}$, disintegrates at the rate of $6.02 \times 10^{10}$ disintegrations per second. Calculate its mean life.

**2.** (a) Describe Davisson-Germer experiment and discuss its results. 10

(b) One of the diffraction peaks observed by Davisson and Germer for a 65 keV electron beam was such that the angle between the incident beam and the scattered beam is $60^0$. For what value of crystal spacing is this peak seen in the first order ? 5





**3.** (a) Stating Bohr's postulates, obtain the expression for various energy levels of a hydrogen atom. 10

(b) If an electron makes a transition from n = 4 to n = 2, determine the wavelength of emitted radiation. 5

**4.** (a) What is a wave packet? Prove that the deBroglie wave packet associated with a moving body travels with the same velocity as the body. 10

(b) Estimate the ground state energy of a particle in a one dimensional box of length L using uncertainty principle. 5

**5.** (a) Obtain the time independent Schrodinger wave equation for a non-relativistic particle. What is the significance of a wave function? Also give the conditions for an acceptable wave function. 10

(b) Correlate operator $\hat{H}$ and $\hat{p}$ to its corresponding physical quantity. 5

**6.** A particle of mass m and energy $E < V_0$ travelling along x-axis has a potential barrier defined by

$$V(x) = \begin{cases} 0..... & x < 0 \\ V_0..... & 0 < x < a \\ 0..... & x > 0 \end{cases}$$

Derive the expressions for reflection and transmission coefficient of the particle. 15

**7.** (a) Fi.nd the size and density of the $^{12}_{6}C$ nucleus. Given $R_0$ = 1.2fm. 5

(b) What is binding energy? Obtain semi empirical binding-energy formula which gives the binding energy of a nucleus in terms of its atomic number Z and mass number A. Give the graph of variation of binding energy/nucleon versus atomic mass number. 10

**8.** (a) Discuss β-particle spectra in β-decay and hence the concept of neutrino. 10

(b) Complete the following nuclear reactions : 5

$$^{27}_{12}Mg \rightarrow ^{27}_{13}Al + ?? + ??$$

$$^{236}_{94}Pu \rightarrow ^{232}_{92}U + ??$$

$$^{22}_{11}Mg \rightarrow ^{22}_{10}Ne + ?? + ??$$

Constants :

$h = 6.62 \times 10^{-34}$ Js

$c = 3 \times 10^{8}$ m/s

$e = 1.6 \times 10^{-19}$ C

$m_e = 9.1 \times 10^{-31}$ kg

$m_n = 1.6749 \times 10^{-27}$ kg = 1.00866u

$m_p = 1.6726 \times 10^{-27}$ kg = 1.00728u

$R = 1.097 \times 10^{7}$ $m^{-1}$

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*This question paper contains 4 printed pages.*

*Your Roll No.* .....

I

*No. of Ques. Paper* : **534**

*ique Paper Code* : **32497908**

*me of Paper* : **Basic Microbiology**

*me of Course* : **B.Sc. (Hons.) Biochemistry : DSE-1**

*mester* : **V** 2018

*uration* : **3 hours**

*aximum Marks* : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt five questions in all, including Q. No. 1 which is compulsory.*

(a) Explain the following briefly:

(i) Replicative form

(ii) Spontaneous generation

(iii) CFU

(iv) Spheroplast

(v) Segmented genome

(vi) Pathogens

(vii) Holozoic nutrition. 1×7

(b) Justfy the following statements:

(i) Fungi are economically important.

P. T. O.

(ii) Viruses are obligatory intracellular parasites.

(iii) Mycoplasma are unaffected by penicillin.

(iv) The period between 1800–1900 AD is significant for the emergence of microbiology as a science.

(v) Charophyta are called stoneworts.

(vi) *E.coli* is gram negative. 6×2

2. (a) Discuss Koch's postulates and their importance in microbiology.

(b) Give the diagrammatic representation of life cycle of ascomycetes.

(c) What are the different body forms exhibited by green algae? How do green algae reproduce? 4,5,5

3. (a) What is lysogenic conversion? Discuss its importance?

(b) Give the difference in pigment contents of *Rhodophyta* and *Pyrrhophyta*.

(c) Name the scientist who described three kingdom classification of microorganisms. What was the basis of this classification? Briefly mention the important features of the three kingdoms. 4,4,6

4. Differentiate between the following :

(a) Prokaryotes and Eukaryotes



(b) Sexual and Asexual mode of reproduction in Yeast

(c) Enveloped and Naked Virus

(d) Isogamy and Anisogamy. 3.5×4

5. (a) Give the industrial applications of following:

(i) Archaebacteria

(ii) Fungi.

(b) Why is the alga "Prototheca" medically important?

(c) Mention the differences between Rickettsia and Chlamydia. 6,3,5

6. (a) Describe various feeding structures in Protozoa. What do you understand by the term hyperparasitism?

(b) Give *one* word for the following:

(i) The macroscopic degenerative changes that occur in host cells after infection with animal viruses

(ii) A disease caused by Rhizoctonia

(iii) A culture containing only one type of microorganism

(iv) A cell wall component of Phaeophyta

(v) The causative organism of the disease protothecosis.

(c) Explain the distribution and nutritional requirements of Fungi. 4,5,5

7. Write short notes on:

(a) Viroids

(b) Fungal cell wall structure and synthesis

(c) Bacterial morphology

(d) Algae thallus organization. 3.5×4

8. Explain the following with the help of a diagram:

(a) Ultrastructure of Eubacteria

(b) Structure of T4 Bacteriophage

(c) Life cycle of Basidiomycetes. 4,5,5

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*This question paper contains 4 printed pages.*

*Your Roll No.* .....

*Sl. No. of Ques. Paper*: **540** **I**

*Unique Paper Code* : **32167501**

*Name of Paper* : **Analytical Techniques in Plant Sciences**

*Name of Course* : **B.Sc. (H) Botany : DSE-1**

*Semester* : **V** 2018

*Duration* : **3 hours**

*Maximum Marks* : **75**



*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt five questions in all including Q. No. 1 which is compulsory. All the parts of a question must be attempted together.*

1. (a) Explain the following:

   (i) FISH

   (ii) PAGE

   (iii) ddNTPs

   (iv) TLC

   (v) IF 5

   (b) Match the following:

| *Column A* | *Column B* |
|---|---|
| Uranyl acetate | G-banding |
| Staining condensed chromosomes | $P^{32}$ |

P. T. O.

Lambert Beer's Law

$\beta$ particles

DEAE cellulose

Positive staining

Ion exchanger

Spectrophotometry

5

(c) Define:

(i) Resolving power

(ii) Chromosome painting

(iii) Standard deviation

(iv) Marker enzymes

(v) Immunofluorescence. 5

2. Write short notes on any *three*:

(a) Negative staining

(b) Phase contrast microscopy

(c) Southern blotting

(d) Analytical centrifugation

(e) Chi-square test. 5×3=15

3. Differentiate between any *three*:

(a) Differential and density gradient centrifugation

(b) GLC and HPLC

(c) X-ray crystallography and X-ray diffraction

(d) SEM and TEM



(e) Freeze fracture and freeze etching. 5×3=15

4. (a) Diagrammatically depict the process of polymerase chain reaction. 5

(b) Comment on the role of GFP in biological research. 5

(c) What is the measure of central tendency? Discuss three most common measures used. 5

5. Answer any *three* of the following:

(a) Comment on the technique of affinity chromatography.

(b) Explain the technique of FISH and write its applications.

(c) Briefly explain the sample preparation for light microscopy.

(d) Discuss the role of antibodies in biological research. 5×3=15

6. Answer any *three* of the following:

(a) Discuss the role of autoradiography in biological research.

(b) Compare and contrast the technique of PAGE and SDS-Page.

(c) Briefly discuss the types of column chromatography.

(d) Name the following:

(i) Chemical used in cryofixation

(ii) Any *one* vital stain

(iii) DNA polymerase used in PCR

(iv) Scientists associated with DNA sequencing by chain termination method

(v) Marker enzyme for peroxisomes. 5×3=15

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**our Roll No.** : .....

**. No. of Q. Paper** : **611** I

nique Paper Code : 32357505

ame of the Course : **B.Sc.(Hons.) Mathematics : DSE-I**

ame of the Paper : Discrete Mathematics

mester : V 2018

***me : 3 Hours*** ***Maximum Marks : 75***



**structions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Do any **two** parts from each question.

## Section - I

(a) Define covering relation in an ordered set. Prove that if $X$ is any set, then in the ordered set $\wp(X)$ equipped with the set inclusion relation given by $A \leq B$ if and only if $A \subseteq B$ for all $A, B \in \wp(X)$, a subset B of X covers a subset A of X if and only if $B = A \cup \{b\}$, for some $b \in X \sim A$. 6

P.T.O.

(b) Let $\mathbb{N}_0$ be the set of whole numbers equipped with the partial order $\leq$ defined by $m \leq n$ if and only if m divides n and let $\wp(\mathbb{N})$ be the power set of $\mathbb{N}$ equipped with the partial order given by $A \leq B$ if and only if $A \subseteq B$ for all $A, B \in \wp(\mathbb{N})$. In which of the following cases is the map $\varphi : P \to Q$ order-preserving ?

(i) $P = Q = \mathbb{N}_0$ and $\varphi(x) = nx \ \forall x \in P$, where $n \in \mathbb{N}_0$ is fixed. 3

(ii) $P = Q = \wp(\mathbb{N})$ and $\varphi$ defined by 3

$$\varphi(A) = \begin{cases} \{1\} \text{ if } 1 \in A \\ \{2\} \text{ if } 2 \in A \text{ but } 1 \notin A \\ \varnothing \text{ otherwise} \end{cases}$$

(c) Let P = {a, b, c, d, e, f, u, v}. Draw a diagram of the ordered set $(P, \leq)$ where

$v < a < c < d < e < u$, $a < f < u$,

$v < b < c$, $b < f$

Also, find out $a \vee b$, $a \wedge b$, $e \vee f$ and $e \wedge f$. 6





**2.** (a) Let V be a vector space and let M = Sub V, the set of all subspaces of V. Prove that $(M, \subseteq)$ is a lattice as an ordered set but is not a sublattice of the lattice $(L, \subseteq)$, where $L = \wp(V)$, the power set of V. 6.5

(b) Prove that in a lattice L, the following inequalities are satisfied :

(i) $a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c) \ \forall a, b, c \in L$ 3

(ii) $(a \wedge b) \vee (b \wedge c) \vee (c \wedge a) \leq (a \vee b) \wedge (b \vee c) \wedge (c \vee a) \quad \forall a, b, c \in L$ 3.5

(c) Let $(L, \leq)$ be a lattice as an ordered set. Define two binary operations + and . on L by $x+y = x \vee y = \sup\{x, y\}$ and $x \,.\, y = x \wedge y = \inf\{x, y\}$. Prove that (L, +, .) is an algebraic lattice. 6.5

## Section - II

**3.** (a) Define a distributive lattice. Prove that a homomorphic image of a distributive lattice is distributive . 6

(b) Use the Quine-McCluskey method to find a minimal form of :

$xyz' + xy'z + xy'z' + x'yz + x'y'z$ 6

(c) (i) Find the conjunctive normal form of : 3

$(x_1 + x_2 + x_3)(x_1x_2 + x_1'x_3)'$.

(ii) Find the disjunctive normal form of : 3

$x_1'x_2 + x_3(x_1' + x_2)$.

**4.** (a) (i) Prove that $(x \wedge y)' = x' \vee y'$ and $(x \vee y)' = x' \wedge y'$ for all $x$, $y$ in a Boolean algebra B. 3.5

(ii) Show that the lattice ({1, 2, 4, 5, 10, 20}, gcd, lcm) does not form a Boolean algebra for the set of positive divisors of 20. 3

(b) Using the Karnaugh Diagrams, find a minimum form for p and q where :

$p = (x_1 + x_2)(x_1 + x_3) + x_1x_2x_3$ 3.5

$q = x_1x_2'x_3 + x_1x_2'x_3' + x_1'x_2x_3 + x_1'x_2x_3 + x_1'x_2'x_3'$ 3





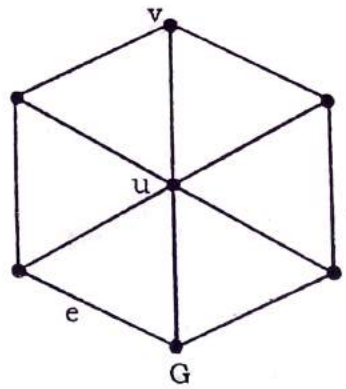
(c) Draw the contact diagram and give the symbolic representation (using seven gates) of the circuit given by

$p = (x_1 + x_2 + x_3)(x_1' + x_2)(x_1x_3 + x_1'x_2)(x_2' + x_3)$

6.5

## Section - III

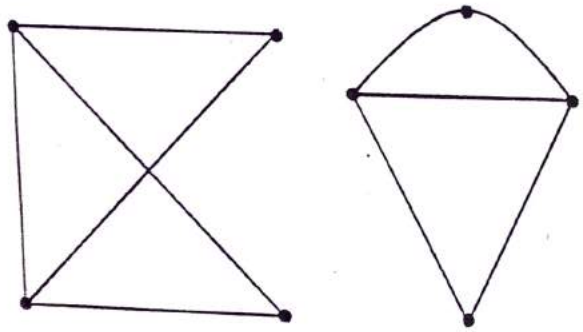
**5.** (a) (i) Draw pictures of the subgraphs G \{e}, G \{v} and G \{u} of the following graph G. 3



(ii) Answer the Königsberg bridge problem and explain your answer with graph. 3

(b) (i) Draw $K_4$ and $K_{3,4}$. 3

(ii) For the below pair of graphs , either label the graphs so as to exihibit an isomorphism or explain why graphs are not isomorphic. 3



(c) (i) Does there exist a graph G with 28 edges and 12 vertices, each of degree 3 or 4. Justify your answer. 2

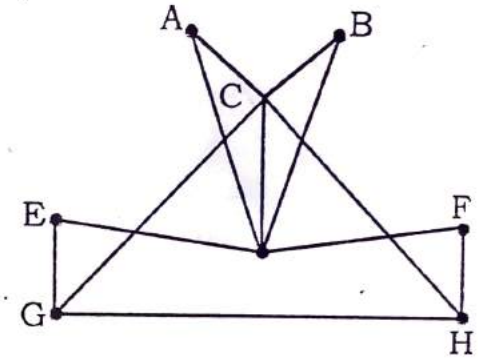
(ii) A complete graph with more than two vertices is not bipartite. Justify this statement. 2



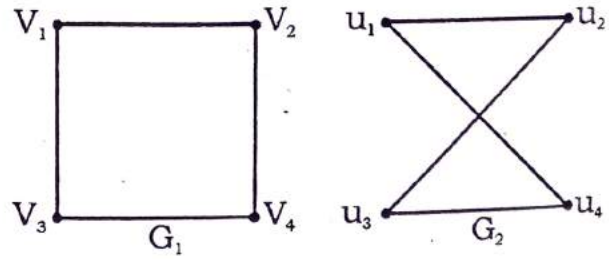


(iii) Draw a graph whose degree sequence is 1,1,1,1,1,1. 2

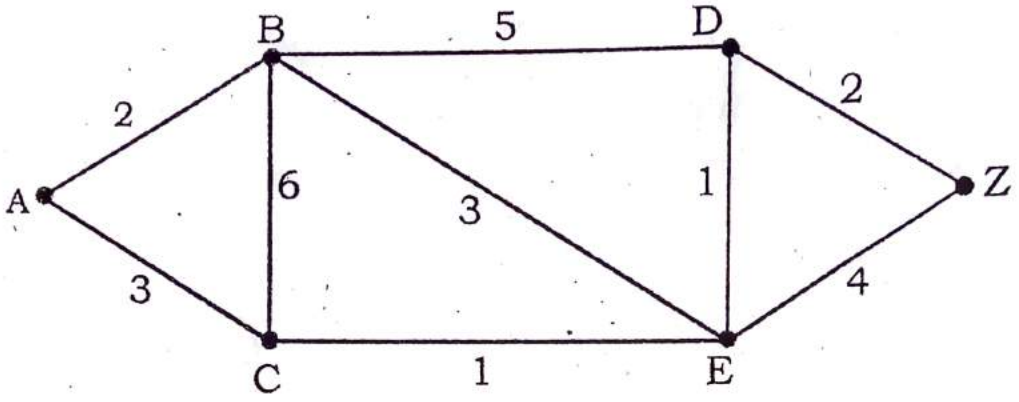
**6.** (a) Consider the Graph G given below. Is it Hamiltonian ? Is it Eulerian ? Explain your answers. 6.5




(b) Find the adjacency matrices $A_1$ and $A_2$ of the graphs $G_1$ and $G_2$ shown below. Find a permutation matrix P such that $A_2 = PA_1P^T$. 6.5



(c) Apply the improved version of Dijkstra's Algorithm to find a shortest path from A to Z. Write steps. 6.5



04/12/2018

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[This question paper contains 4 printed pages]

**Your Roll No.** : .....

**Sl. No. of Q. Paper** : **612** **I**

Unique Paper Code : 32357506

Name of the Course : **B.Sc.(Hons.) Mathematics : DSE - I**

Name of the Paper : Cryptography and Network Security

Semester : V

***Time : 3 Hours*** ***Maximum Marks : 75***

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Question **NO.1** is compulsory.

(c) Attempt any **five** questions from **2-8**.

**1.** (a) What is a transposition cipher ? Encrypt the message.

I THOUGHT TO SEE THE FAIRIES IN THE FIELDS BUT I SAW ONLY THE EVIL ELEPHANTS using rail fence technique of depth 2. 3

P.T.O.

(b) Define the terms Cryptanalysis and Brute-force attack. What is a Product cipher ? 3

(c) What is Euler's Totient function ? Find $\varphi(62)$ and $\varphi(63)$. 3

(d) Briefly describe Mix Columns in Advance Encryption Algorithm (AEA) with an example. 3

(e) What is the difference between weak and strong collision resistance ? 3

**2.** (a) Explain the general Caesar encryption and decryption algorithm. Using this cipher, encrypt AND decrypt the message

WE ARE DISCOVERED SAVE YOURSELF with k =10. 6

(b) Using the Playfair Matrix :

| | | | | |
|---|---|---|---|---|
| T | M | P | O | S |
| Z | V | W | X | Y |
| E | O | C | U | R |
| F | N | A | B | D |
| L | G | H | I/J | K |





encrypt the following message THE ENEMY MUST BE STOPPED AT ALL COSTS DO WHATEVER IS NECESSARY . 6

**3.** (a) State and explain Chinese Remainder Theorem (CRT) with the help of an example. 6

(b) (i) Why does by PGP (Pretty Good Privacy) generate a signature before applying compression ? 3

(ii) Explain all the services provided PGP. 3

**4.** (a) Determine the multiplicative inverse of $x^5 + x^4 + x^2 + 1$ in GF $(2^8)$ with $m(x) = x^8 + x^4 + x^3 + x + 1$ . 6

(b) Define elliptic curves $E_p$ (a, b) over $Z_p$ . State the condition on a and b such that $E_p$ (a, b) forms a group under addition. What are the negatives of the following elliptic curve points over $Z_{17}$ : P = (5,8); Q = (3,0) and R = (0,6) ? Also find P + Q. 6

**5.** Explain Feistel Encryption and Decryption Algorithm. Further explain Data Encryption Scheme (DES) with diagrams. 12

6. (a) Explain the three key objectives Confidentiality, Integrity and Availability of computer security. What is CIA triad ? 6

(b) Explain RSA Algorithm in detail. Hence perform encryption AND decryption using the following data :

$p = 11; q = 7; e = 11; M = 7.$ 6

7. (a) State Euler's Theorem. Hence find a number $x$ between 0 and 9 with $x$ congruent to $3^{503}$ modulo 10. Further prove the identity.

$$[(a \bmod n) + (b \bmod n)] \bmod n = (a + b) \bmod n$$

6

(b) (i) Define Digital Signature. Explain two disputes that can arise in the context of message authentication. 3

(ii) List any **three** differences between Conventional and Public-Key Encryption. 3

8. Develop tables for both polynomial multiplication and polynomial addition for the field $GF(2^3)$ modulo $m(x) = x^3 + x + 1$. Hence identify the multiplicative inverse of $x^2 + x$. 12

(31)

[This question paper contains 4 printed pages]

**Your Roll No.** : .....

**Sl. No. of Q. Paper** : **618** **I**

Unique Paper Code : 32227502

Name of the Course : **B.Sc.(Hons.) Physics : DSE - I**

Name of the Paper : Advanced Mathematical Physics

Semester : V 2018



***Time : 3 Hours*** ***Maximum Marks : 75***

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **five** questions in all taking at least **two** questions from each section.

(c) **All** questions carry equal marks.

(d) Attend **all** parts of each question together.

## Section - A

**1.** (a) Determine whether the identity element exist or not for the binary operation * defined as: $a * b = a^b$ 4

(b) Let $T : R^3 \to R^3$ be defined by

$T(x, y, z) = (x+y-2z,\ x+2y+z,\ 2x+2y-3z)$.

Show that T is a non-singular transformation. 5

(c) Linear transformation T on $R^2$ is defined as :

$$T(x, y) = (3x - 4y,\ x + 5y)$$ 6

Find the matrix representation of T relative to the u-basis :

$$\{u_1 = (1, 3) \text{ and } u_2 = (2, 5)\}.$$

**2.** (a) Determine whether (1, 2, 5) ; (2, 5, 1) ; (1, 5, 2) are linearly dependent or not. 5

(b) Consider the following subspace of $R^4$ :

$W = \{(a, b, c, d) : a + b = 0,\ c = 2d\}$

Find the dimension and basis of W. 2,3

(c) Assume that A, $I - A$, $I - A^{-1}$ are all non-singular matrices, show that : 5

$$(I - A)^{-1} + (I - A^{-1})^{-1} = I.$$

**3.** (a) Given a matrix $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$, prove that its eigenvalue equation is given by

$$\lambda^2 - \lambda \mathrm{Tr}(A) + \det(A) = 0.$$ 5

(b) If $B = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, prove that :

$$e^{\theta B} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}.$$ 10





**4.** (a) Find the condition for the following matrix to be orthogonal : 7

$$\begin{bmatrix} a+b & b-a \\ a-b & a+b \end{bmatrix}.$$

(b) Evaluate $C^{20}$, where $C = \begin{bmatrix} -1 & 3 \\ 1 & 1 \end{bmatrix}$. 8

## Section - B

**5.** (a) Show that every second order tensor can be expressed as a sum of symmetric and skew-symmetric tensor. 3

(b) Prove that $(\vec{A} \times \vec{B}) \times \vec{C} = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{A}(\vec{B} \cdot \vec{C})$, using tensors. 7

(c) Given a vector $\vec{A} = (x,\ x + y,\ x + y + z)$.

Find the matrix elements of the second order skew-symmetric tensor associated with it. 5

**6.** (a) Prove that $\in_{ijk}$ is an isotropic tensor of order three. 3

(b) Prove that :

$$\vec{\nabla} \cdot (\vec{A} \times \vec{B}) = (\vec{\nabla} \times \vec{A}) \cdot \vec{B} - (\vec{\nabla} \times \vec{B}) \cdot \vec{A}$$ 7

(c) Using tensors, show that scalar product of two vectors is invariant. 5

**7.** (a) Stress tensor $(p_{ij})$ satisfies the equations $p_{ij}\in_{ijk}=0$ and $p_{ij}=f_i n_j$, where $f_k$ is the restoring force per unit area across the plane along $x_k$-axis and $\hat{n}$ is the unit vector normal to that surface. Prove that stress tensor is a symmetric tensor of order two. 7

(b) Stress tensor and strain tensor are related as

$$p_{ij}=\omega_{ijks}e_{ks},$$

where, elastic tensor $\omega_{ijks}$ is symmetric in i, j and k, s and its general form is

$$\omega_{ijks}=\lambda\delta_{ij}\delta_{ks}+\mu\delta_{ik}\delta_{js}+\gamma\,\delta_{is}\delta_{jk}.$$

Prove that :

(i) $\omega_{ijks}=\lambda\delta_{ij}\delta_{ks}+\mu\left(\delta_{ik}\delta_{js}+\gamma_{is}\delta_{jk}\right)$

(ii) $P_{ii}=(3\lambda+2\mu)e_{ii}$ 4,4

**8.** (a) A covariant tensor has components xy, $2y-z^2$, xz in cartesian co-ordinates. Find its covariant components in cylindrical co-ordinates. 10

(b) Prove that $g^{jk}$ is a symmetric contravariant tensor of order two. 5

*This question paper contains 3 printed pages.*

*Your Roll No.* .....

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| | | |
|---|---|---|
| *Sl. No. of Ques. Paper* | : 641 | **IC** |
| *Unique Paper Code* | : 32237901 | |
| *Name of Paper* | : **Animal Behaviour and Chronobiology** | |
| *Name of Course* | : **B.Sc. (H) Zoology : DSE – 1** | |
| *Semester* | : **V** 2018 | |
| *Duration* | : **3 hours** | |
| *Maximum Marks* | : **75** | |



*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt **five** questions in all including Question No. **1**, which is compulsory.*

1. (a) Define the following :
   (i) Actogram
   (ii) Reinforcement
   (iii) Jet lag
   (iv) Code breakers
   (v) Latent learning. 1×5=5

   (b) Differentiate between the following :
   (i) Innate and Learned behaviour
   (ii) Intersexual and Intrasexual selection
   (iii) Circatidal and Circalunar rhythms
   (iv) Eusocial species and Subsocial species

P.T.O.

(v) Master clock and Slave clock

(vi) Polymorphism and Polytheism. 2×6=12

(c) Give contributions of the following :

(i) Wallace Craig

(ii) Konrad Lorenz

(iii) Hamilton

(iv) Niko Tinbergen. 1×4=4

(d) Fill in the blanks :

(i) Pavlov's dog salivation experiment is an example of ..... conditioning.

(ii) Rheotaxis is movement of the animal with respect to ..... .

(iii) ..... is a semiochemical, which mediates interspecific interactions in a way that benefits the emitting organism but harms the receiver.

(iv) ..... is known as father of chronobiology.

(e) Illustrate direction component of waggle dance in honeybees with the help of diagrams. (No description required.) 2

2. (a) Give a detailed contribution of Karl von Frisch to animal ethology. 6

(b) Explain exogenous and endogenous rhythms with the help of suitable examples. 6

3. (a) Discuss various methods of studying and recording animal behaviour. 6



(b) Communication remains boon to form successful society. Explain. 6

4. (a) Explain with examples the role of parental care in mate choice. Add a note on the advantages and disadvantages of parental care. 6

(b) Explain how Fixed Action Patterns is different from Reflexes with the help of suitable example. 6

5. (a) Discuss reciprocal altruism with suitable examples. Add a note on its advantage in species survival. 6

(b) Explain positive and negative reinforcement with suitable examples. 6

6. (a) Explain proximate and ultimate causes of behavior with help of suitable examples. 6

(b) Explain intersexual selection. Why is it advantageous for species? 6

7. Write short notes on any *three* of the following :

(a) Chronotherapy

(b) Selfish gene

(c) Imprinting

(d) Infanticide

(e) Supernormal stimulus. 3×4=12

(33)

[This question paper contains 4 printed pages]



**Your Roll No.** : .....

**Sl. No. of Q. Paper** : **674** **I**

Unique Paper Code : 32497903

Name of the Course : **B.Sc.(Hons.) Biochemistry : DSE - 2**

Name of the Paper : Molecular basis of Non-infectious Diseases

Semester : V 2018

***Time : 3 Hours*** ***Maximum Marks : 75***

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in all.

(c) Question **NO.1** is compulsory.

(d) Use of scientific calculator / log tables may be allowed.

**1.** (a) Comment on the following : 10

(i) Inborn errors in metabolism like PKU is an example of monogenic disorders.

(ii) HDL is a good cholesterol.

P.T.O.

(iii) Huntington's chorea disease results due to accumulation of misfolded proteins.

(iv) Diabetic patients often show signs of polydipsia.

(v) Cancer is a multifactorial and polygenic disease.

(b) Explain the following : 9

(i) Balanced Diet

(ii) Metastasis

(iii) Scrapie

(iv) Metabolic syndrome

(v) Oncogenes

(vi) Proteasomes

**2.** (a) Differentiate between the following (any **4**) : 10

(i) Benign tumor and malignant tumor

(ii) Anorexia nervosa and Bullemia

(iii) Wet beriberi and Dry beriberi

(iv) Osteoporosis and Osteomalacia

(v) Sickle cell anemia and thalassemia

(b) PCOS is a multifactorial disease. Explain. 4





**3.** (a) Explain the mechanism of action of following drugs : 10

(i) Statins

(ii) Herceptin

(iii) Gleevac

(iv) Warfarin

(b) What dietary interventions should be done in the following diseases ? 4

(i) Beri - Beri

(ii) Alkaptonuria

**4.** (a) Expand and explain the following : 10

(i) IDDM

(ii) RDA

(iii) PEM

(iv) IBD

(v) CFTR

(b) Explain Achondroplasia. 4

**5.** (a) Discuss obesity. What are its medical consequences ? 6

(b) What are protein misfolding diseases ? Describe the molecular basis of Alzheimer's disease. 8



P.T.O.

6. (a) Write short notes on : 4,5,5

(i) Cystic Fibrosis

(ii) Hemoglobinopathies

(iii) Diabetes Mellitus

7. (a) Define tumor suppressor genes. Explain the mechanism by which p53 acts to prevent a cell from becoming malignant. 8

(b) What is Atherosclerosis ? Describe the stages of atherosclerosis development. 6

8. (a) Explain : 8

(i) Causes and stages of cancer.

(ii) Molecular approaches to cancer treatment.

(b) What are prions ? Explain the differences between $PrP^{c}$ and $PrP^{sc}$ 6

(34)

[This question paper contains 7 printed pages]

**Your Roll No.** : .....

**Sl. No. of Q. Paper** : **684** **I**

Unique Paper Code : 32167502

Name of the Course : **B.Sc.(Hons.) Botany : DSE - II**

Name of the Paper : Biostatistics

Semester : V 2018



***Time : 3 Hours*** ***Maximum Marks : 75***

**Instructions for Candidates :**

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **five** questions in all.

(c) Question **NO.1** is compulsory.

(d) Nonscientific calculator allowed.

(e) Statistical table provided by the college may be use if required.

P.T.O.

**1.** (a) Define any **five** : 1×5=5

(i) Ogive curve

(ii) Null hypothesis

(iii) Quartile deviation

(iv) Degree of freedom

(v) Relative frequency

(vi) Independent variables

(b) Fill in the blanks : 1×5=5

(i) For 28, 23, 32, 24, 29, 25, 27, 29, 30 median value will be ..... .

(ii) The average of the upper and lower limit of a class is known as ..... .

(iii) The process of placing classified data into raw and column is known as ..... .





(iv) Number of observations falling within a particular class interval is called ..... .

(v) In a symmetric distribution the relation between mean, median and mode is as follows, Mode = 3 Median -..... .

(c) Match the following : 5

| A | B |
|---|---|
| (I) Mode | (i) Q2 |
| (II) Mean Deviation | (ii) $\sigma 2$ |
| (III) Median | (iii) p |
| (IV) Variance | (iv) $\delta$ |
| (V) Spearman Correlation coefficient | (v) Mo |

**2.** Discuss any **three** of the following : 5×3=15

(a) Explain the necessity of classification of data. Describe various criteria used in the classification of collected data.

(b) What do you mean by sampling ? Discuss

the different sampling methods used in biostatistics.

(c) What is geometric mean ? How to calculate it ? Discuss its merits and demerits.

(d) What is Spearman's correlation coefficient ? How to calculate it ? Explain its merits and demerits over Karl Pearson's correlation coefficient.

**3.** Differentiate between any **five** of the following : 3×5=15

(a) Grouped and Ungrouped data

(b) Frequency polygon and Histogram

(c) Positive and Negative correlation

(d) Quantitative and Qualitative variables

(e) Biological experiment and Survey

(f) Mean Deviation and Standard Deviation





**4.** (a) Make a bar diagram for following data of a town representing the population in different year. 3

| Year | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|---|---|---|---|
| Population in thousands | 43 | 55 | 65 | 79 | 90 | 102 | 132 | 154 |

(b) In a city total numbers of migratory birds during the month of February 2017 were recorded day wise. With the help of $\chi^2$ test explain if there is any significant difference. 5

| Day | Mon. | Tues. | Wed. | Thur. | Fri. | Sat. | Sun. |
|---|---|---|---|---|---|---|---|
| No. of birds | 64 | 80 | 73 | 88 | 62 | 92 | 66 |

(c) Calculate the student *t*-test of the following data of plant height of two species and check the significance. 7

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species A (in cm) | 22 | 20 | 26 | 25 | 30 | 21 | 25 | 29 | 28 | 24 |
| Species B (in cm) | 22 | 27 | 25 | 30 | 32 | 26 | 27 | 28 | 24 | 29 |

**5.** (a) Explain role of biostatistics in biological research. 4

(b) What do you mean by measures of dispersions ? Discuss significance of coefficient of variance over standard deviation. 4





(c) Carbohydrate content (g/100g) in seeds of three different varieties of "Wheat" was recorded. Calculate the coefficient of variance for carbohydrate content (g/100g) in all three different varieties. 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety A | 55 | 62 | 54 | 57 | 56 | 62 | 54 | 56 | 58 | 59 | 55 | 56 |
| Variety B | 58 | 54 | 21 | 51 | 59 | 46 | 65 | 31 | 68 | 41 | 70 | 36 |
| Variety C | 65 | 55 | 26 | 40 | 30 | 74 | 45 | 29 | 85 | 32 | 80 | 39 |

**6.** (a) What is regression coefficient. Explain the significance of two regression lines ? Discuss its similarities and dissimilarities with correlation coefficient. 7

(b) Calculate the regression coefficient for the following data. Calculate the expected protein content if carbohydrate content is 60. 5+3=8

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbohydrate content (% dw) | 53 | 56 | 52 | 54 | 55 | 51 | 57 | 57 | 59 | 56 |
| Protein Content (% dw) | 13 | 10 | 13 | 12 | 11 | 13 | 10 | 9 | 8 | 11 |

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*This question paper contains 6 printed pages.*

*Your Roll No.* .....

| | | |
|---|---|---|
| *S. No. of Paper* | : **752** | **I** |
| *Unique Paper Code* | : **32357501** | |
| *Name of the Paper* | : **Numerical Methods** | |
| *Name of the Course* | : **B.Sc. (H) Mathematics : DSE-2** | |
| *Semester* | : **V** 2018 | |
| *Duration* | : **3 hours** | |
| *Maximum Marks* | : **75** | |



*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt **all** questions, selecting **two** parts from each question. Use of non-programmable scientific calculator is allowed.*

1. (a) Given the following scheme for integration:

$$\int_a^b f(x)dx \approx \frac{h}{2} + [f(a) + 2\sum_{i=1}^{n-1} f(x_i) + f(b)],$$

write an algorithm to obtain the approximate value of the definite integral.

(b) Verify that the equation $x^5 - 2x - 1 = 0$ has a root in the interval (0, 1). Perform three iterations to approximate the zero of the equation by the Secant method using $p_0 = 0$ and $p_1 = 1$.

(c) Let $f$ be a continuous function on the closed interval $[a, b]$ and suppose that $f(a)f(b) < 0$.

Prove that the bisection method generates a sequence of approximations $\{p_n\}$ which converges to a root $p \in (a, b)$ with the property

$$|p_n - p| \leq \frac{b-a}{2^n}.$$

Hence, find the rate of the convergence of the method. 13

2. (a) Give the geometrical construction of the method of False Position to approximate the zero of a function. Further, write the algorithm for the computation of the root approximated by this method.

(b) Perform three iterations for finding the root of

$$f(x) = \frac{1}{x} - 37$$

by Newton's method starting with $p_0 = 0.01$. Further, compute the ratio

$$|p_3 - p|/|p_2 - p|^2$$

and show that this value approaches $|f''(p)/2f'(p)|$, with $p = 1/37$.



(c) Let $g$ be a continuous function on the closed interval $[a, b]$ with $g: [a, b] \to [a, b]$. And suppose that $g'$ is continuous on the open interval $(a, b)$ with $|g'(x)| \leq k < 1$ for all $x$ belongs to $(a, b)$. If $g'(p) \neq 0$, then prove that for any $p_0 \in [a, b]$, the sequence $p_n = g(p_{n-1})$ converges only linearly to the fixed point $p$. 13

3.(a) Using LU decomposition, solve the system of equations $Ax = b$, where:

$$A = \begin{bmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{bmatrix} \text{ and } b = \begin{bmatrix} -3 \\ -12 \\ 6 \end{bmatrix}.$$

(b) Use the SOR method with $\omega = 0.9$ to solve the following system of equations:

$$2x_1 - x_2 = -1$$

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

$$2x_2 + 6x_3 = 5$$

Use $x^{(0)} = \mathbf{0}$ and perform three iterations.

(c) (i) Compute the iteration matrix $T_{gs}$ of the Gauss-Seidel method for obtaining the approximate solution of the system of equations $Ax = b$ where $A$ is given as:

$$\begin{bmatrix} 3 & 2 & -2 \\ -2 & -2 & 1 \\ 5 & -5 & 4 \end{bmatrix}.$$

(ii) Determine the spectral radius of the matrix:

$$A = \begin{bmatrix} 2 & 1 \\ -1 & 5 \end{bmatrix}. \qquad 13$$

4. (a) Let $x_0, x_1, x_2, \ldots, x_n$ be $n+1$ distinct points in $[a, b]$. If $f$ is continuous on $[a, b]$ and has $n$ continuous derivatives on $(a, b)$, then prove that there exists $\xi \in (a, b)$ such that:

$$f[x_0, x_1, x_2, \ldots, x_n] = \frac{f^n(\xi)}{n!}.$$

(b) Experimentally determined values for the partial pressure of water vapor, $p_A$, as a function of distance $y$, from the surface of a pan of water are given below. Estimate the partial pressure at distance 2.1 mm from the surface of the water.

| $y$ (mm) | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $p_A$ (atm) | 0.10 | 0.065 | 0.042 | 0.029 | 0.022 | 0.020 |

(c) (i) Define an interpolating polynomial for a given set of data $(x_i, f(x_i))$, $i = 1, 2, \ldots, n$. Construct the Lagrange polynomials passing through the points $(1, e)$, $(2, e^2)$ and $(3, e^3)$.



(ii) Define the backward difference operator and the central operator . Prove that:

$$\delta = \nabla (1 - \nabla)^{-1/2}. \qquad 12$$

5. (a) Derive the formula:

$$f''(x_0) \approx \frac{f(x_0+h) - 2f(x_0) + f(x_0-h)}{h^2},$$

the second-order central difference approximation to the second order derivative of a function.

(b) Verify that:

$$f'(x) \approx \frac{f(x_0+h) - f(x_0-h)}{2h},$$

the difference approximation for the first order derivative provides the exact value of the derivative regardless of $h$, for the functions $f(x) = 1, f(x) = x$ and $f(x) = x^2$, but not for the function $f(x) = x^3$.

(c) Use the formula:

$$f'(x) \approx \frac{f(x_0) - f(x_0 - h)}{h}$$

to approximate the derivative of the function $f(x) = e^x$ at $x_0 = 0$, taking $h = 1, 0.1, 0.01$ and $0.001$. What is the order of approximation? 12

6. (a) Using Trapezoidal rule approximate the value of the integral:

$$\int_0^2 \tan^{-1} x \, dx \, .$$

Further verify the theoretical error bound.

(b) Derive the closed Newton-Cotes rule $(n = 3)$ for the computation of the definite integral:

$$\int_a^b f(x)dx.$$

(c) Apply Euler's method to approximate the solution of the given initial value problem:

$$x' = \frac{1 + x^2}{t}, (1 \leq t \leq 4), x(1) = 0, N = 5.$$

Further it is given that the exact solution is:

$$x(t) = \tan(\ln(t)).$$

Compute the absolute error at each step. 12

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[This question paper contains 4 printed pages.]

**Your Roll No.....2018**

**Sr. No. of Question Paper : 765** **IC**

Unique Paper Code : 32227505

Name of the Paper : Physics and Devices and Communication

Name of the Course : **B.Sc. (Hons.) Physics : DSE-2**

Semester : V



Duration : 3 Hours Maximum Marks : 75

**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. Question No. **1** is compulsory.
4. **All** question carry equal marks.

1. Attempt any **five** questions of the following : (5×3=15)

   (a) Draw the I-V characteristics of a UJT.

   (b) Define positive and negative photo masking with suitable diagrams.

P.T.O.

(c) Draw the small signal equivalent circuit of JFET.

(d) Define line and load regulation of a power supply.

(e) Distinguish between active and passive filters with examples.

(f) What is the phase locked state in phase locked loop (PLL)?

(g) Draw the block diagram for the implementation of RS232 on PC.

(h) Calculate the power developed by AM wave in a load of 100 ohms when the peak voltage of the carrier is 100 V and modulation index is 0.6.

2. (a) Discuss with appropriate diagrams the phenomenon of accumulation, depletion and inversion of a real metal oxide semiconductor (MOS) device. (12)

(b) Give the transfer characteristics of p-channel JFET. (3)

3. (a) Discuss the processes of diffusion and ion implantation of dopants in IC fabrication. (10)

(b) Explain the phenomenon of wet etching with suitable example. (5)



4. (a) Using appropriate circuit diagram obtain the expression for the gain of an active low pass filter. (6)

(b) Explain the working of voltage controlled oscillator. (6)

(c) If $R = 1k\Omega$ and $C = 0.1\ \mu F$ for a low pass filter and $R = 10\ k\Omega$ and $0.1\ \mu F$ for a high pass filter. Calculate the centre frequency for a corresponding band pass filter. (3)

5. (a) Draw the circuit diagram of a diode detector and explain its working. (5)

(b) What is analog modulation? Define modulation index and deduce the power relation between carrier and side bands in amplitude modulated wave? (10)

6. (a) Explain the working of a transistor based monostable multivibrator. (10)

(b) Sketch the wave forms of amplitude shift keying and frequency shift keying. (5)

7. (a) What is handshaking? Distinguish between parallel and serial data communication. (5)

P.T.O.

(b) Briefly explain the reactive ion etching (RIE) technique. (5)

(c) How the information is stored in a charge coupled device? (5)

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*This question paper contains 3 printed pages.*

*Your Roll No.* .....

| | | |
|---|---|---|
| *Sl. No. of Ques. Paper* | : 792 | **IC** |
| *Unique Paper Code* | : 32237909 | |
| *Name of Paper* | : **Immunology** | |
| *Name of Course* | : **B.Sc. (H) Zoology : DSE – 2** | |
| *Semester* | : **V** 2018 | |
| *Duration* | : **3 hours** | |
| *Maximum Marks* | : **75** | |



*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt five questions in all.*

*Question No. 1 is compulsory.*

1. (a) Define :
   (i) Epitope
   (ii) Diapedesis
   (iii) Opsonization
   (iv) Anaphylatoxin
   (v) Allergens. 5

   (b) Differentiate between the following :
   (i) Affinity and Avidity
   (ii) Innate and Adaptive immunity
   (iii) IPV and OPV
   (iv) Isotype and Idiotype
   (v) Polyclonal and Monoclonal sera. 10

P.T.O.

(c) Write the contribution/s of the following scientists :

(i) Emil Von Behring

(ii) Jules Bordet. 2

(d) Expand the following :

(i) HLA

(ii) TNF

(iii) GALT

(iv) MAC

(v) RIA

(vi) MASP 3

(e) Write the immunological significance of the following :

(i) Interferons

(ii) Bursa of Fabricius

(iii) Adjuvant

(iv) APC 4

(f) Give reasons :

(i) IgA survives the proteolytic degradation in GI tract.

(ii) Individuals whose immune systems are severely compromised should not receive live vaccines.

(iii) T cells are self-MHC restricted. 3

2. (a) Describe the basic structure of an antibody. How was the structure of antibody deduced? 8

(b) Differentiate between T cell and B cell epitopes. 4

3. (a) Explain the process of monoclonal antibody production by hybridoma technology. Add a note on clinical uses of monoclonal antibodies. 8



(b) Briefly describe delayed type of hypersensitivity. 4

4. (a) Differentiate between primary and secondary lymphoid organs. Write a note on structure and function of lymph node. 4,4

(b) Briefly discuss subunit vaccines with appropriate examples. 4

5. (a) Describe the classical pathway of complement activation.

(b) What is an immunogen? Give reasons why all antigens are not immunogens. 6,2,4

6. (a) Illustrate and discuss the cytosolic pathway for processing endogenous antigen.

(b) Differentiate between the Primary and Secondary humoral immune response. 6,6

7. Write short notes on : (any *three*)

(a) Erythroblastosis Fetalis

(b) Clonal Selection Theory

(c) AIDS

(d) Cytokines. 4,4,4

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[This question paper contains 4 printed pages.]



**Your Roll No.....**

**Sr. No. of Question Paper : 6829B**

Unique Paper Code : 42357501

Name of the Paper : Differential Equations

Name of the Course : **B.Sc. (Math Sci)-II / B.Sc. (Phy Sci)-II / B.Sc. (Life Sci)-II, Applied Sciences-II : DSE**

Semester : V 2018

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** the questions are compulsory.
3. Attempt any **two** parts from each question.
4. Marks of each part are indicated.
5. Use of non-programmable scientific calculator is allowed.

1. (a) Solve the initial value problem

$$(2x\cos y + 3x^2y)dx + (x^3 - x^2\sin y - y)dy = 0,\ y(0) = 2.$$

(6.5)

P.T.O.

(b) Solve $\frac{dy}{dx}+y=xy^3$. (6.5)

(c) Solve $y = 2px + x^2p^4$. (6.5)

2. (a) Solve the initial value problem

$$\frac{d^2y}{dx^2}-2\frac{dy}{dx}-3y=2e^x-10\sin x,\ y(0)=2,\ y'(0)=4. \quad (6)$$

(b) Solve $x^3\frac{d^3y}{dx^3}-4x^2\frac{d^2y}{dx^2}+8x\frac{dy}{dx}-8y=4\ln x$. (6)

(c) Consider the differential equation :

$$x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+2y=0$$

(i) Show that $x$ and $x^2$ are linearly independent solutions of the given differential equation over the interval $0 < x < \infty$.

(ii) Write the general solution of the given equation.

(iii) Find the solution that satisfies the conditions $y(1)=3$, $y(1)=2$. Explain why this solution is unique. (6)



3. (a) Using the method of variation of parameters, solve the differential equation

$$\frac{d^2y}{dx^2}+y=\sec x. \quad (6.5)$$

(b) Given that $y=x$ is a solution of

$$x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+4y=0,$$

find a linearly independent solution by reducing the order. Write the general solution. (6.5)

(c) To check the condition or integrability condition integrability and then solve the give differential equation :

$$y(y+z)dx + x(x-z)dy + x(x+y)dz = 0. \quad (6.5)$$

4. (a) Solve

$$\frac{dx}{dt}+4x+3y=t,$$

$$\frac{dy}{dt}+2x+5y=e^t. \quad (6)$$

(b) Solve

$$\frac{dx}{x\left(y^2-z^2\right)}=\frac{dy}{-y\left(z^2+x^2\right)}=\frac{dz}{z\left(x^2+y^2\right)} \quad (6)$$

(c) Solve $(2x^2 + 2xy + 2xz^2 + 1)dx + dy + 2zdz = 0$. (6)

5. (a) Define the order and degree of a partial differential equation. Form a partial differential equation corresponding to the complete integral given by $z = x + y + f(xy)$, where $f$ is an arbitrary function. (6.5)

(b) Form a partial differential equation corresponding to the complete integral given by $ax^2 + by^2 + z^2 = 1$, where $a$ and $b$ are arbitrary constants. (6.5)

(c) Reduce the following partial differential equation into canonical form.

$\frac{\partial^2 z}{dx^2} = k\frac{\partial^2 z}{\partial y^2}$, where $k$ is a fixed constant. (6.5)

6. (a) Find the complete integral of the partial differential equation $p^2y(1 + x^2) = qx^2$, by using Charpit' s method. (6)

(b) Use Lagrange's method to find the general solution of the partial differential equation
$(mz - ny)\,p + (nx - lz)q = ly - mx$. (6)

(c) Find the complete integral of the partial differential equation $p^2 + q^2 = 1$, by using Charpit's method. (6)

(39)

[This question paper contains 4 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 8521** **HC**

Unique Paper Code : 32227505

Name of the Paper : Physics of Devices and Communication

Name of the Course : **Physics : DSE**

Semester : V 2018



Duration : 3 hours Maximum Marks : 75

**Instructions for Candidates**

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

1. Attempt any **five** of the following : (5×3=15)

   (a) What is the need for modulation? Differentiate between amplitude and frequency modulation.

   (b) How is cascading of an active filter used for band pass and band rejection?

P.T.O.

(c) What is a CMOS and where do we find its application?

(d) Describe block diagram for an Ideal power supply.

(e) What is the difference between dry etching and wet etching?

(f) How is voltage regulation achieved using an IC regulator?

(g) A JFET has a pinch-off voltage of 4V and saturation current of 10 mA. (a) Determine the value of drain current if Vgs = 2V (b) Find the value of gate to source voltage if $i_D = 7$ mA.

2. (a) Explain working of a Monostable multivibrator using transistors. (8)

(b) Discuss the short circuit protection in a power supply. Explain using a circuit diagram. (7)

3. (a) Define amplitude modulation and modulation index. Derive an equation for amplitude modulated wave and draw its frequency spectrum. Obtain bandwidth, total voltage and total power in amplitude modulated wave. (10)



(b) Determine the power content of carrier and each sideband for an amplitude modulated signal having percentage modulation of 80% and total power of 2500 W. (3)

(c) Explain Overmodulation. (2)

4. (a) Give pin out diagram and working of the 565 PLL IC. (7)

(b) Determine the free running frequency ($f_{out}$), the lock range ($f_L$) and the capture range ($f_C$) when $R_1 = 12k'\Omega$, $C_1 = 0.01$ μF and $C_2 = 10$ μF applied to a 565 PLL. (3)

(c) Analyse circuit of a passive RC low pass and high pass filter giving its frequency response. (5)

5. (a) Discuss with a flow diagram the process of IC fabrication. (6)

(b) Explain the technique of oxidation for IC fabrication. (5)

(c) What is lithography? Which is better photolithography or electron-lithography and why? (4)

6. (a) Explain with help of a band diagram, depletion, inversion and accumulation for a MOS diode. (6)

(b) With the help of schematic diagram, explain the working principle of Charged coupled devices. (6)

(c) Give the drain and transfer characteristics of JFET. (3)

7. (a) Explain various lines and signals used in RS232 for serial communication. What do you understand by handshaking of RS232 in digital data communication? (10)

(b) What is the advantage of using parallel communication over serial communication? (5)