

NO - 13

[SXA - S 110 A]

M.Sc. DEGREE EXAMINATION.

First Semester

Applied Mathematics

Paper III — CLASSICAL MECHANICS

(Effective from the admitted batch of 2014–2015)

Time : Three hours Maximum : 80 marks

Answer any FIVE questions.

All questions carry equal marks.

Question ONE is compulsory.

- (a) Explain all types of constraints.
- (b) If  $u, v$  are constants of motion, then show that  $[u, v]$  is also a constant of motion.
- (c) State
  - (i) Jacobi identity
  - (ii) Poisson theorem.
- (d) Write about Time dilation.

2. (a) Derive the Lagrange's equations from D'Alembert's principle. (a)
- (b) Obtain the equations of motion of a particle in space using Cartesian coordinates.
3. (a) Derive Lagrange's equations from Hamilton's principle. (b)
- (b) Write the equations of motion of a uniform hoop rolling down on an inclined plane without slipping.
4. (a) Derive Hamilton's equations from variational principle.
- (b) State and prove principle of least action.
5. Prove the following properties of the Poisson brackets :
- (a)  $[u, u] = 0$
- (b)  $[u, v] = -[v, u]$
- (c)  $[au + bv, w] = a[u, w] + b[v, w]$ , where  $a$  and  $b$  are constants.
- (d)  $[uv, w] = [u, w]v + u[v, w]$ .

- (a) Show that the transformation  
 $Q = \log\left(\frac{1}{q} \sin p\right)$ ,  $P = q \cot p$  is a canonical transformation and hence find the function  $F$ .
- (b) Discuss the problem of Harmonic oscillator using the Hamilton-Jacobi method.

Define Lorentz transformation. Prove that Lorentz transformations form a group.

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$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} \rightarrow \mathbb{P}$$

$$P(t)$$

$$x = g \sin \theta \cos \phi$$

$$y = g \sin \theta \sin \phi$$

$$z = g \cos \theta$$

$$x = g \sin \theta \cos \phi + g \cos \theta \sin \phi$$

$$y = g \sin \theta \sin \phi + g \cos \theta \cos \phi$$

**[SXA – S 112 A]**

M.Sc. DEGREE EXAMINATION.

First Semester

Applied Mathematics

Paper V — NUMERICAL METHODS AND  
PROGRAMMING

(With effect from admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) Write down the FORTRAN expression for the following :

(i) 
$$\frac{ae^{-x} + be^x}{(a+b)\cos(\alpha+wt)}$$

(ii) 
$$\frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

(iii) 
$$5 + 3x + 6x^2 + x^3$$
.

- (b) Draw a flow chart for printing prime numbers between two given numbers.

- (c) ~~Describe the convergence of Newton-Raphson method.~~
- (d) ~~Find the inverse of the matrix~~
- $$\begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 2 & -1 \end{bmatrix}$$
- ~~using Gauss-Jordan method.~~
2. (a) Explain the FORMAT statement for READ and WRITE statements. Also explain FORMAT statement for reading and writing the elements of a  $3 \times 3$  matrix. (a)
- (b) Explain various IF statements in FORTRAN. Give suitable examples. (b)
3. (a) Explain DO and CONTINUE statements in FORTRAN. (a)
- (b) Write a FORTRAN program to find the roots of a quadratic equation. (a)
4. (a) Explain function subprogram in FORTRAN. Write a function subprogram to find factorial of a given number. (a)
- (b) What are arrays in FORTRAN? How they processed? Write a program to find transpose of a matrix. (b)

(a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation  $x^3 - 5x + 1 = 0$ .

(b) Using Chebyshev method, find the root of the equation  $f(x) = \cos x - xe^x = 0$ .

(a) Solve the system of equations.

$$x_1 + x_2 + x_3 = 6$$

$$3x_1 + 3x_2 + 4x_3 = 20$$

$$2x_1 + x_2 + 3x_3 = 13.$$

using the Gauss-Elimination method.

(b) Solve the system of equations

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ -10 \end{bmatrix} \text{ using the Cholesky}$$

method.

(a) Find the largest eigen value and the corresponding eigen vector using power

method for the matrix  $A = \begin{bmatrix} 1 & 1 & 21 \\ 1 & -1 & -20 \\ 1 & 0 & -10 \end{bmatrix}$

(b) Find the eigen value of the matrix  $A = \begin{bmatrix} 3 & 1 \\ 1 & 1 \end{bmatrix}$

using the Rutishauser method.

-C/B

**[SXA – S 108 A]**

M.Sc. DEGREE EXAMINATION.

First Semester

Applied Mathematics

**REAL ANALYSIS**

(Effective from the admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) Define a countable set. Show that a countable union of countable sets is countable.
- (b) If  $f$  and  $g$  be complex continuous functions on a metric space  $X$ . Then  $f + g$  and  $fg$  are continuous on  $X$ .

(c) If  $f \in R$  on  $[a, b]$ . Let  $\alpha$  be a function which is continuous on  $[a, b]$  and whose derivative  $\alpha'$  is Riemann integrable on  $[a, b]$ .  

$$\int_a^b f(x) d\alpha(x) = \int_a^b f(x) \alpha'(x) dx.$$

(d) Verify that the mixed derivatives  $D_{1,2}f$  and  $D_{2,1}f$  are equal.  

$$f(x, y) = \begin{cases} x + y & \text{if } x \neq 0 \text{ (or) } y \neq 0 \\ 0 & \text{otherwise} \end{cases}$$

2. (a) Prove that every neighborhood is an open set.

(b) Prove that, if  $K \subset Y \subset X$ . Then  $K$  is closed relative to  $X$  if and only if  $K$  is closed relative to  $Y$ .

3. (a) A mapping  $f$  of a metric space  $X$  into a metric space  $Y$  is continuous on  $X$  if and only if  $f^{-1}(V)$  is open in  $X$  for every open set  $V$  in  $Y$ .

(b) Prove that if  $f$  be monotonic on  $(a, b)$ . Then the set of points of  $(a, b)$  at which  $f$  is discontinuous is at most countable.

- (a) Prove that, if  $f$  is continuous on  $[a, b]$  and if  $\alpha$  is of bounded variation on  $[a, b]$ , then  $f \in R(\alpha)$  on  $[a, b]$ .
- (b) State and prove fundamental theorem of integral calculus.  $\alpha$  & more  $\int_C^B f(x) dx$   $\rightarrow$   $f$  is differentiable on  $[a, b] \Rightarrow \int_a^b f(x) dx = \int_a^b f(x) dx$
- (a) Let  $u$  and  $v$  be two real-valued functions defined on a subset  $S$  of the complex plane. Assume also that  $u$  and  $v$  are differentiable at an interior point  $C$  of  $S$  and that the partial derivatives satisfy the Cauchy-Riemann equations at  $C$ . Then the function  $f = u + iv$  has a derivative at  $C$ . Moreover.

$$f'(C) = D_1 u(C) + i D_1 v(C).$$

- (b) State and prove that chain rule.

- (a) If  $K$  is compact, if  $f_n \in C(k)$  for  $n = 1, 2, 3, \dots$  and if  $\{f_n\}$  is pointwise bounded and equicontinuous on  $k$ , then (i)  $\{f_n\}$  is uniformly bounded on  $k$ , (ii)  $\{f_n\}$  contains a uniformly convergent subsequence.

- (b) Prove that the series  $\sum_{n=1}^{\infty} (-1)^n \frac{x^n + n}{n^2}$  converges uniformly in every bounded interval.

State and prove the Stone - Weierstrass theorem.

**[SXA - S 316 A]**

**M.Sc. DEGREE EXAMINATION.**

**Third Semester**

**Applied Mathematics**

**PROGRAMMING LANGUAGE - C**

**(Effective from the admitted batch of 2014 - 2015)**

**Time : Three hours**

**Maximum : 80 marks**

**Answer any FIVE questions.**

**First question is compulsory.**

**All questions carry equal marks.**

- (a) Define a constant. Discuss about classification of constants.
- (b) Write a program to generate multiplication table of a given number by using a function.
- (c) Give declaration about one dimensional arrays and two dimensional arrays.
- (d) Define structure. Explain about declaring and initializing of structure variables.



2. (a) Explain (i) ~~Form~~<sup>(a)</sup> output with examples. (ii) Form  
(b) Write a 'C' program to find the roots of a quadratic equation. (a)
3. (a) Explain (i) Switch (ii) Do (iii) For statements with examples. (b)  
(b) Write a program to reverse a given integer. (b)
4. (a) Explain the control instructions available in C.  
(b) What are logical operators? Explain precedence and associativity of logical operators.
5. (a) Explain recursion. Write a recursive program to find factorial  $n$ .  
(b) Write a program to illustrate the method of sending an entire structure as a parameter to a function.
6. (a) Differentiate between array and pointers.  
(b) Write a program to find the multiplication of two matrices.

- (a) Explain the difference between call by value and call by reference.
- (b) Write a program to accept different goods with the number, price and date of purchase and display them by using structures.
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**[SXA – S 323 A]**

**M.Sc. DEGREE EXAMINATION**

**Third Semester**

**Applied Mathematics**

**OPTIMIZATION TECHNIQUES — I**

(Effective from the Admitted Batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) What is meant by degeneracy in Linear Programming Problem? How do you solve it?
- (b) What is the difference between Regular simplex method and Dual simplex method?
- (c) Explain North-West Corner method to find an initial basic feasible solution to the given transportation problem.
- (d) What are the characteristics of Dynamic programming?

2. (a) Use Simplex method to solve the following LPP :

$$\text{Maximize } Z = 4x_1 + 10x_2$$

Subject to the constraints :

$$2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90$$

$$x_1 \geq 0, x_2 \geq 0.$$

(b) Use Big M method to solve the following LPP :

$$\text{Minimize } Z = 12x_1 + 20x_2$$

Subject to the constraints :

$$6x_1 + 8x_2 \geq 100$$

$$7x_1 + 12x_2 \geq 120$$

$$\text{and } x_1, x_2 \geq 0.$$

3. (a) Write computational procedure for LPP by Revised Simplex method.

(b) Use Revised Simplex method to solve the following LPP :

$$\text{Maximize } Z = 30x_1 + 23x_2 + 29x_3$$

Subject to the constraints :

$$6x_1 + 5x_2 + 3x_3 \leq 26$$

$$4x_1 + 2x_2 + 5x_3 \leq 7$$

$$x_1, x_2, x_3 \geq 0.$$

Ques.

(a) Use duality to solve the LPP :

$$\text{Minimize } Z = 15x_1 + 10x_2$$

Subject to the constraints :

$$3x_1 + 5x_2 \geq 5$$

$$5x_1 + 2x_2 \geq 3$$

$$x_1, x_2 \geq 0.$$

(b) Use Dual Simplex method to solve the LPP :

$$\text{Minimize } Z = 2x_1 + 3x_2$$

Subject to the constraints :

$$2x_1 - x_2 - x_3 \geq 3$$

$$x_1 - x_2 + x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0.$$

5. Use Branch-and-Bound technique to solve the following LPP :

$$\text{Maximize } Z = 7x_1 + 9x_2$$

Subject to the constraints :

$$-x_1 + 3x_2 \leq 6$$

$$7x_1 + x_2 \leq 35$$

$$0 \leq x_1, x_2 \leq 7$$

$x_1, x_2$  are integers.

6. (a) Explain Hungarian method to solve Assignment problem.
- (b) Consider the problem of assigning five jobs to five persons. The assignment given below. Determine the assignment schedule.

| Persons | Jobs |   |   |   |   |
|---------|------|---|---|---|---|
|         | 1    | 2 | 3 | 4 | 5 |
| A       | 8    | 4 | 2 | 6 | 1 |
| B       | 0    | 9 | 5 | 5 | 4 |
| C       | 3    | 8 | 9 | 2 | 6 |
| D       | 4    | 3 | 1 | 0 | 3 |
| E       | 9    | 5 | 8 | 9 | 5 |

7. (a) Solve the following Transportation problem to minimize the total cost, obtaining initial basic feasible solution by V approximation method.

| Requirement | Available |   |    |   | (a) |
|-------------|-----------|---|----|---|-----|
|             | 7         | 9 | 3  | 2 |     |
|             | 4         | 4 | 3  | 5 | 14  |
|             | 6         | 4 | 5  | 8 | 20  |
| Requirement | 11        | 9 | 22 | 8 |     |

- (b) Use Dynamic programming to solve following problem.

$$\text{Minimize } Z = y_1^2 + y_2^2 + y_3^2$$

Subject to the constraints :

$$y_1 + y_2 + y_3 \geq 15$$

$$\text{and } y_1, y_2, y_3 \geq 0.$$

**[SXA – S 317 A]**

M.Sc. DEGREE EXAMINATION

Third Semester

Applied Mathematics

BOUNDARY VALUE PROBLEMS – I

(Effective from admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) Obtain a sequence of vectors which converges, to the initial value problem

$$y' = \begin{pmatrix} 0 & 1 \\ -2 & 3 \end{pmatrix} y, \quad y(0) = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

- (b) Show that  $u'' + fu' + gu = 0$  may be made self-adjoint by multiplying it by the integrating factor  $\exp \left[ \int_0^t f(x) dx \right]$ .

(c) Find the index of compatibility boundary value problem

$$u'' = 0$$

$$u(0) = 0, u(1) = 0$$

(d) Test the system is completely controllable or not

$$\dot{x} = \begin{pmatrix} -2 & 2 \\ 1 & -1 \end{pmatrix}x + \begin{pmatrix} 1 \\ 0 \end{pmatrix}u.$$

2. (a) Prove that the solutions of IVP depend continuously on initial conditions.

(b) Find the solutions of  $y' = \begin{pmatrix} 0 \\ -\lambda^2 \end{pmatrix}y + \begin{pmatrix} 6 \\ 0 \end{pmatrix}$

3. (a) Find the particular solution of the equation  $y' = \begin{pmatrix} 1 & 1 \\ 0 & -1 \end{pmatrix}y + \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ .

(b) State and prove the relation between solutions of scalar and vector adjoints.

4. (a) Find a fundamental matrix of

$$y'_1 = 3y_1 - y_2,$$

$$y'_2 = y_1 - y_3$$

$$y'_3 = -y_1 + 2y_2 + 3y_3.$$

(b) Find the index of compatibility, and the solution space of the boundary value problem.

$$y' = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix} y$$

$$\begin{pmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} y(0) + \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & -1 & 0 \end{pmatrix} y(1) = 0$$

(a) Find the values of the parameter  $\lambda$  for which the boundary value problem  $u'' + \lambda^2 u = 0, u(0) = 0, u(1) = 0$  are compatible.

(b) Find the Green's function to the boundary value problem

$$u'' = 0, u(0) - u'(0) = 0, \\ u(1) + u'(1) = 0$$

Prove that the constant system  $\dot{x} = Ax + Bu$  is completely controllable if and only if the  $n \times nm$  controllability matrix  $U = [B, AB, A^2B, \dots, A^{n-1}B]$  has rank  $n$ .

7. (a) Prove that the system

$$\begin{aligned}\dot{x} &= A(t)x(t) + B(t)u(t) \\ y &= C(t)x(t)\end{aligned}$$

is completely observable if and only if the symmetric observability matrix

$$V(t_0, t_1) = \int_{t_0}^{t_1} \phi^T(\tau, t_0) C^T(\tau) C(\tau) \phi(\tau, t_0) d\tau$$

is nonsingular.

(b) Show that the system

$$\dot{x}_1 = a_1 x_1 + b_1 u$$

$$\dot{x}_2 = a_2 x_2 + b_2 u$$

$$y = x_1$$

is completely observable.

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**[SXA – S 321 A]**

M.Sc. DEGREE EXAMINATION.

Third Semester

Applied Mathematics

**MEASURE THEORY**

(Effective from the admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer FIVE questions from the following  
Seven questions.

Question No. 1 is compulsory.

All questions carry equal marks.

- (a) If  $\{A_n\}$  is a countable collection of set of real numbers, prove that  $m^*(UA_n) \leq \sum m^* A_n$ .
- (b) State and prove monotone convergence theorem.
- (c) If  $f$  is absolutely continuous on  $[a, b]$ , then show that it is of bounded variation on  $[a, b]$ .
- (d) Prove that every convergent sequence is Cauchy sequence.

2. (a) Prove that the outer measure of an interval is its length.

(b) Let  $\langle E_i \rangle$  be a sequence of measurable sets. Then prove that  $m(UE_i) \leq \sum mE_i$ . Also prove that if the sets  $E_n$  are pairwise disjoint,  $m(UE_i) = \sum mE_i$ .

3. Let  $f$  be defined and bounded on a measurable set  $E$  with  $mE$  finite. In order to prove that  $\inf_{f \leq \psi} \int_E \psi(x) dx = \sup_{f \geq \phi} \int_E \phi(x) dx$  for all functions  $\phi$  and  $\psi$ , prove that it is necessary and sufficient that  $f$  is measurable.

4. (a) State and prove bounded convergence theorem.  
(b) State and prove Fatou's lemmas.

5. Let  $f$  be an increasing real valued function on the interval  $[a, b]$ . Then prove that  $f$  is differentiable almost everywhere. In addition prove that the derivative  $f'$  is measurable and  $\int_a^b f'(x) dx = f(b) - f(a)$ .

6. (a) State and prove Holder inequality.  
(b) Prove that the  $L^p$  spaces are complete.

- (a) Given  $f \in L^p$ ,  $1 < p \leq \infty$  and  $\varepsilon > 0$ . Prove that there is a step function  $\phi$  and a continuous function  $\psi$  such that  $\|f - \phi\|_p < \varepsilon$  and  $\|f - \psi\|_p < \varepsilon$ .
- (b) Let  $g$  be an integrable function on  $[0, 1]$  and suppose that there is a constant  $M$  such that  $|\int f g| \leq M \|f\|_p$  for all bounded measurable functions  $f$ . Then prove that  $g$  is in  $L^q$  and  $\|g\|_q \leq M$ .

[SXA - S 427 A]

M.Sc. DEGREE EXAMINATION.

Fourth Semester

Applied Mathematics

Paper IV (Elective) — OPTIMISATION  
TECHNIQUES - II

(Effective from the admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer FIVE questions.

Question No. 1 is compulsory.

All questions carry equal marks.

- (a) Distinguish between pure and mixed strategies. Explain the maximin and minimax principle used in game theory.
- (b) What are the situations that make replacement of items necessary? Describe various types of replacement situations.
- (c) Explain briefly the important characteristics of a queueing system. Distinguish between the steady and transient states.
- (d) Discuss the importance of critical path in scheduling and controlling projects. Mention four conventions that are used in drawing a network for a project.

2.

(a) Explain the principle of dominant strategy method in solving a game without a saddle point. From this, solve the following game.

(b)

|          |     | Player B |    |     |    |   |
|----------|-----|----------|----|-----|----|---|
|          |     | I        | II | III | IV | V |
| Player A | I   | 3        | 5  | 4   | 9  | 6 |
|          | II  | 5        | 6  | 3   | 7  | 8 |
|          | III | 8        | 7  | 9   | 8  | 7 |
|          | IV  | 4        | 2  | 8   | 5  | 3 |

(a)

(b) Use the matrix method to solve the game.

$$\begin{bmatrix} 8 & -3 & 7 \\ 6 & -4 & 5 \\ -2 & 2 & -3 \end{bmatrix}$$

3.

(a) A health centre requires 2000 units of a drug per month. Each unit of the drug costs Rs. 100 and the average procurement cost per order is Rs. 150. If the inventory carrying cost is 30% of average inventory value per annum what quantity of drug should be ordered? If the procurement lead time is 6 days, what should be the reorder level?

(b) In a manufacturing company, annual requirement is 24,000 units. Supply is instantaneous and shortages are permitted. The cost of order each time is Rs. 350/. The cost of carrying inventory is Rs. 0.10 per unit per month. The cost of shortage is Rs. 0.20 per unit per month. Find the economic quantities to be procured and the total cost of inventory in such cases.

(a) Suppose the value of money is 10% per year and that machine A is replaced after every 3 years and machine B after every 6 years. Their yearly costs are given as :

| Year :      | 1     | 2   | 3   | 4     | 5   | 6   |
|-------------|-------|-----|-----|-------|-----|-----|
| Machine A : | 1,000 | 200 | 400 | 1,000 | 200 | 400 |
| Machine B : | 1,700 | 100 | 200 | 300   | 400 | 500 |

Determine which machine should be purchased.

(b) A computer contains 10,000 resistors. When any one of them fails, it is replaced. The cost of replacing a single resistor is Rs. 10. If all the resistors are replaced at the same time, the cost of the resistor would be reduced to Rs. 3 - 50. The percent surviving by the end of months  $t$  is as follows :

|                              |     |    |    |    |    |    |
|------------------------------|-----|----|----|----|----|----|
| Month (t) :                  | 0   | 1  | 2  | 3  | 4  | 5  |
| % serving by the month end : | 100 | 97 | 90 | 70 | 30 | 15 |

(a)

Find out the optimum plane of replacement.

5. (a) Explain  $(M/M/1):(N/FCFS)$  queueing and solve it in the steady state. Find mean queue length of this system.
- (b) Consider a box office ticket window manned by a single server. Customers arrive to purchase tickets according to Poisson process with a mean rate of 30 per hour. Service time has an exponential distribution with a mean of 90 seconds. Determine the following :
- (i) Fraction of the time the server is busy
  - (ii) The average number of customers queueing for service
  - (iii) The probability of having more than 10 customers in the system.

(a) State the principal assumptions made while dealing with sequencing problems. Write the Johnson's algorithm for processing  $n$  jobs on two machines.

(b) Find the sequence that minimizes the total elapsed time (in hours) required to process the following jobs on machine  $M_1, M_2, M_3$  in the order  $M_1M_2M_3$ .

|         |       | Job |   |   |   |   |
|---------|-------|-----|---|---|---|---|
|         |       | A   | B | C | D | E |
| Machine | $M_1$ | 5   | 7 | 6 | 9 | 5 |
|         | $M_2$ | 2   | 1 | 4 | 5 | 3 |
|         | $M_3$ | 3   | 7 | 5 | 6 | 7 |

Distinguish between PERT and CPM. Define the following terms with reference to a PERT chart

- (a) optimistic time (b) most likely time
  - (c) pessimistic time (d) total float (e) free float
  - (f) independent float.
- The following table lists the jobs of a project with their time estimates. Draw the project network. Calculate the length and variance of critical path. Find the probability that the project is completed in 41 days.

| Job<br>$i - j$ | Duration (days)     |                      |                      |
|----------------|---------------------|----------------------|----------------------|
|                | Optimistic<br>$t_o$ | Most likely<br>$t_m$ | Pessimistic<br>$t_p$ |
| 1 - 2          | 3                   | 6                    | 15                   |
| 1 - 6          | 2                   | 5                    | 14                   |
| 2 - 3          | 6                   | 12                   | 30                   |
| 2 - 4          | 2                   | 5                    | 8                    |
| 3 - 5          | 5                   | 11                   | 17                   |
| 4 - 5          | 3                   | 6                    | 15                   |
| 6 - 7          | 3                   | 9                    | 27                   |
| 5 - 8          | 1                   | 4                    | 7                    |
| 7 - 8          | 4                   | 19                   | 28                   |

**[SXA – S 428 A]**

M.Sc. DEGREE EXAMINATION.

Fourth Semester

Applied Mathematics

BOUNDARY VALUE PROBLEM – II

(Effective from the admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) Define stable, asymptotically stable and give examples.
- (b) Use Hurwitz criteria to derive a condition for asymptotically stability of the zero solution of  $u'' + pu' + qu = 0$ ; where  $p, q$  are real constants..
- (c) Obtain the solution of single species population model,  $\frac{dp}{dt} = p(a - b/np)$ , where  $a, b$  are positive constants and  $p > 1$ .
- (d) Show that the equation  $x'' + e^t x = 0$  is oscillatory.

2.

- (a) Prove that the system  $x' = A(t)x$  and only if its fundamental bounded for  $t \geq t_0$ .

- (b) Test the stability at the zero solution dimensional system  $x' = \begin{pmatrix} -1 & 3 \\ -2 & 1 \end{pmatrix}x$  the phase portrait.

3. (a)

- If the system  $x' = A(t)x$  is strong then prove that the zero solution  $x' = A(t) \cdot x + f(t, x)$  is strong provided  $f(t, x)$  satisfies  $\|f(t, x)\| \leq \gamma(t) \|x\|$ , where  $\gamma(t)$  is non

continuous function such that  $\int_{t_0}^{\infty} \gamma(s) ds < \infty$

(b)

- Discuss the solution of  $u'' + 2ku' + qu = 0$  where  $k$  and  $q$  are positive constants. In reference to the nature of the critical point  $(0, 0)$  of its two dimensional system.

4.

(a)

- Test the stability based on approximation the zero solution.

$$x_1' = 3x_1 - 22 \sin x_2 + x_1^2 - x_2^3$$

$$x_2' = \sin x_1 - 5x_2 + \exp(x_1^2) - 1$$

- (b) Explain Krasovskii's method and determine the stability of the zero solution of

$$x_1' = -x_1 - x_2 - x_1^3,$$

$$x_2' = x_1 - x_2 - x_2^3.$$

- (a) If the inequality  $\frac{a}{d} > \frac{b}{e}$  holds, then show that the positive equilibrium point of prey-predator model.

$$x_1' = x_1 (a - b, x_1 - x_2)$$

$x_2' = x_2 (-d + e x_1 - f x_2)$  is globally asymptotic stable

- (b) Show that positive equilibrium point of prey-predator model

$$x_1' = x_1 (10 - 5x_1 - 4x_2)$$

$x_2' = x_2 (-20 + 15x_1 + 3x_2)$  is globally asymptotic stable.

6.

- (a) State and prove sturing separation theorem
- (b) Obtain the normal form of Bessel's equation  
 $t^2 x'' + t x' + (t^2 - p^2) x = 0$
- (i) Show that solution  $J_p(t)$  of Bessel's equation and  $Y_p(t)$  of normal Bessel's equation have common zeros for  $t > 0$ .
- (ii) If  $0 \leq p \leq \frac{1}{2}$ , show that every interval of length  $\pi$  contains atleast one zero of  $J_p(t)$ .

7.

- (a) Define upper and lower solution of  $x' = f(t, x)$ ,  $x(t_0) = x_0$  and obtain upper and lower solution at  $x^1 = x^2$ ,  $x(0) = -1$ .
- (b) State and obtain a non-linear version of variation of parameters formula.

[SXA - S 425 A]

M.Sc. DEGREE EXAMINATION

Fourth Semester

Applied Mathematics

STATISTICAL METHODS

(Effective from the admitted batch of 2014-2015)

Maximum : 80 marks

Time : Three hours

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

(a) Distinguish between a discrete and continuous random variable. A random variable  $X$  has a p.d.f  $f(x) = 6x(1-x)$ ,  $0 \leq x \leq 1$ . Show that  $f(x)$  is a p.d.f. Determine a number of such that  $P(X < b) = P(X > b)$ .

(b) Show that in a Poisson distribution with unit mean, the mean deviation about the mean is  $2/e$  times the standard deviation.

(c) Define correlation. If  $E(X) = E(Y) = 0$ ,  $Var(X) = Var(Y) = 1$  and  $\text{cor}(X, Y) = 0$ , find the correlation coefficient between  $(X - Y)$  and  $(X + Y)$ .

(d) If  $X$  has a chi-square distribution with  $m$  degrees of freedom, find the m.g.f. Hence obtain the mean and variance of chi-square distribution with  $n$  d.f.

2. (a) State and prove the Chebyshev's inequality  
(b) Find the expectation of the number of failures preceding the first success in an infinite series of independent trials with constant probability  $p$  of success in each trial.

3. (a) State and establish the lack of memory property of the geometric distribution. For the geometric distribution with p.m.f.  $f(x) = p(1-p)^x$ ,  $x = 1, 2, 3, \dots$ , show that Chebychev's inequality

$P(|x - 2| \leq 2) > \frac{1}{2}$ , while the actual probability is  $15/16$ .

- (b) (i) If  $X$  has a Poisson distribution such that  $P(X = 2) = \frac{2}{3}P(X = 1)$ , evaluate  $P(X = 3)$ .  
(ii) If for a Poisson variant  $X$ ,  $E(X^2) = 6$ , find  $E(X)$ .  
(iii) If  $X$  and  $Y$  are independent Poisson variates with means 1 and 2 respectively, find the variance of  $3X + Y$ .

- (a) Explain Cauchy distribution and show that the characteristics function of standard cauchy variance is  $e^{-|t|}$ .
- (b) (i) In a normal population with mean 15 and standard deviation 3.5, it is known that 647 observations exceed 16.5. Find the total number of observations in population.
- (ii) In a test administrated to 1000 children, the mean score is 42 and standard deviation 24. Assume normal distribution and find the number of children with score lying between 20 and 40.
- (a) Obtain the correlation coefficient between the heights of fathers (X) and of the sons (Y) from the following data :

X: 65 66 67 68 69 70 71 67

Y: 67 68 64 72 70 68 70 67

- (b) Obtain the equations of the two lines of regression for the following data. Obtain the estimate of X for Y = 70.

X: 64 65 67 67 68 69 70 72

Y: 67 68 65 68 72 72 69 71

6. (a) In a large city A, 20% of a random sample of 900 children have defective eyes. In another city B, 15% of a random sample of 1600 children had the same defect. Is the difference between the two proportions significant?
- (b) Out of 8000 graduates in a two year course, females, out of 1600 graduates, 120 are females. Use  $\chi^2$  to determine if the destination is made in appointment basis of sex.
7. (a) The gain in weights (in Kgs) of pigs fed on two diets A and B are given below. Test whether the two diets differ significantly as regards their effect on increase in weight:

Diet A : 25 32 30 34 24 14

Diet B : 44 34 22 10 47 31

Diet A : 32 24 30 31 35 25

Diet B : 40 30 32 35 18 21 35 29

- (b) Two independent samples of 8 and 7 respectively had the following values of variables.

Sample I : 9 11 13 11 15 9 12 1

Sample II : 10 12 10 14 9 8 10

Test whether the estimates of population variance differ significantly.

**[SXA – S 210 A]**

M.Sc. DEGREE EXAMINATION.

Second Semester

Applied Mathematics

Paper V – ADVANCED NUMERICAL METHODS  
(Effective from admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carries equal marks.

- (a) Find the values of  $a_0$  and  $a_1$  so that  
 $Y = a_0 + a_1x$  fits the data given here under:

|       |     |     |     |     |     |
|-------|-----|-----|-----|-----|-----|
| $x :$ | 0   | 1   | 2   | 3   | 4   |
| $y :$ | 1.0 | 2.9 | 4.8 | 6.7 | 8.6 |

- (b) Determine the maximum error in evaluating  
 $\int_0^{\pi/2} \cos x dx$  by Simpson's rule using 4  
subintervals.

(c) Given  $\frac{dy}{dx} - 1 = xy$  and  $y(0) = 1$  obtain series for  $y(x)$  and compute  $y(0.1)$  four decimal places.

(d) Classify the type of the following differential equation  $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2) \frac{\partial u}{\partial x} = 0$ ,  $-\infty < x < \infty, -1 < y < 1$ .

2. (a) Certain corresponding values of  $\log_{10} x$  are given below:

|                 |        |        |        |        |
|-----------------|--------|--------|--------|--------|
| $x :$           | 300    | 304    | 305    | 306    |
| $\log_{10} x :$ | 2.4771 | 2.4829 | 2.4843 | 2.4856 |

Find  $\log_{10} 310$  by Lagranges interpolation.

(b) Suppose  $f_i = x_i^{-2}$  and  $f_i^1 = -2x_i^{-3}$ ,  $x_i = \frac{1}{2}i$ ,  $i = 1(1)4$  are given. Fit these by piecewise cubic Hermite polynomial.

- (a) The velocities of a car running on a straight road at intervals of two minutes are given below:

|                   |   |    |    |    |    |    |    |
|-------------------|---|----|----|----|----|----|----|
| Time (in minutes) | 0 | 2  | 4  | 6  | 8  | 10 | 12 |
| Velocity in Km/hr | 0 | 22 | 30 | 27 | 18 | 7  | 0  |

Apply Simpson's  $\frac{1}{3}$  rule to find the distance covered by the car.

- (b) Evaluate the integral  $I = \int_2^3 \frac{\cos 2x}{1 + \sin x} dx$  using Gauss-Legendre two and three point integration rules.

- (a) The following table gives the angular displacements  $\theta$  (radians) at different intervals of time  $t$  (seconds):

|          |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\theta$ | 0.052 | 0.105 | 0.168 | 0.242 | 0.327 | 0.408 | 0.489 |
| $t$      | 0     | 0.02  | 0.04  | 0.06  | 0.08  | 0.10  | 0.12  |

Calculate the angular velocity at the instant  $t = 0.06$ .

- (b) Compute the values of  $I = \int_0^1 \frac{dx}{1 + x^2}$  by using the trapezoidal rule with  $h = 0.5, 0.25$  and  $0.125$ . Then obtain a better estimate by using Romberg method. Compare your result with the exact value.

5. (a) Using Runge-Kutta method of compute  $y(0.4)$  from  $10 \frac{dy}{dx} = x^2 + y$  by taking  $h = 0.2$ .

(b) Solve the initial value  $\frac{dy}{dx} = -xy^2, y(0) = 2$  to obtain  $y$  at steps of 0.1 each by

- (i) Backward Euler method
- (ii) Midpoint method

6. Find the solution at  $t = 0.3$  for the initial problem  $y' = t - y^2, y(0) = 1$  by Adams-Bas method of order two with  $h = 0.1$ . Determine starting values by using Eulers forward method.

7. Solve the partial differential equation  $\nabla^2 u = x^2 - 1, |x| \leq 1, |y| \leq 1$  with  $u = 0$  on the boundary of a square. Formulate a five difference scheme for the mesh size  $h = \frac{1}{2}$  and solve the difference scheme.

[SXA - S 215 A]

M.Sc. DEGREE EXAMINATION.

Second Semester

Applied Mathematics

Paper II - TECHNIQUES OF APPLIED  
MATHEMATICS - II

(Effective from the admitted batch of 2014-2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

five pl. (a) Find the integral curves of the equations

$$h = \frac{1}{2} \quad \frac{adx}{(b-c)yz} = \frac{bdy}{(c-a)zx} = \frac{cdz}{(a-b)xy}.$$

(b) If  $u$  is a function of  $x, y$  and  $z$  which satisfies the partial differential equation

$$(y-z)\frac{\partial z}{\partial x} + (z-x)\frac{\partial u}{\partial y} + (x-y)\frac{\partial u}{\partial z} = 0. \text{ Show that}$$

$u$  contains  $x, y$  and  $z$  only in combinations  $x+y+z$  and  $x^2 + y^2 + z^2$ .

210A

(c) Convert the problem

$$\frac{d^2y}{dt^2} + \lambda y = f(x), y(0) = 1, y'(0) = 0$$

into integral equation.

(d) Find the inverse Laplace transform of

$$\frac{p-1}{(p+3)(p^2+2p+2)}.$$

2. (a) Find the orthogonal trajectories on the  $x^2 + y^2 = z^2 \tan^2 \alpha$  of its intersections with the family of planes parallel to  $z=0$ .

(b) Verify the integrability of the equation

$$\text{solve } (y^2 + yz + z^2)dx + (z^2 + zx + x^2)dy + (x^2 + xy + y^2)dz = 0$$

3. (a) Find the surface which is orthogonal to one parameter system  $z = cxy(x^2 + y^2)$  which passes through the hyperbola  $x^2 - y^2 = a^2, z = 0$ .

(b) Find a complete integral of the equation  $z^2 = pqxy$ .

(a) Solve the equation

$$\frac{\partial^3 z}{\partial x^3} - 2 \frac{\partial^3 z}{\partial x^2 \partial y} - \frac{\partial^3 z}{\partial x \partial y^2} + 2 \frac{\partial^3 z}{\partial y^3} = e^{x+y}.$$

(b) Solve the equation  $pq = x(ps - qr)$

(a) Transform the problem

$$\frac{d^2 y}{dt^2} + y = x, \quad y(0) = 1, \quad y'(1) = 0 \quad \text{to a Fredholm}$$

integral equation.

(b) Solve  $y(x) = 1 + \lambda \int_0^1 (1 - 3xt) y(t) dt$ .

(a) Use the convolution theorem to find

$$L^{-1} \left\{ \frac{p^2}{(p^2 + 4)^2} \right\}$$

(b) Solve  $(D^4 + 2D^2 + 1)y = 0$  where  $y(0) = 0$ ,

$y'(0) = 1$ ,  $y''(0) = 2$  and  $y'''(0) = -3$  using

Laplace transform.

7. (a) Find the Fourier transform of

$$F(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases} \text{ and hence evaluate}$$

$$\int_{-\infty}^{\infty} \frac{\sin pa \cos px}{p} dp.$$

(b) Using Fourier transform to solve  $\frac{\partial U}{\partial t}$   
for  $x > 0, t > 0$ , subject to the condition  
(i)  $U = 0$  when  $x = 0, t > 0$ ,

(ii)  $U = \begin{cases} 1, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases}$  when  $t = 0$

[SXA – S 208 A]

M.Sc. DEGREE EXAMINATION.

Second Semester

Applied Mathematics

Paper I — COMPLEX ANALYSIS

(Effective from the admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carry equal marks.

- (a) Let  $f(z) = f(re^{i\theta}) = \ln r + i\theta$ ,  $r > 0$  and  $-\pi < \theta < \pi$ . Show that  $f$  is analytic in the domain indicated. Find  $f'(z)$ .
- (b) If  $f$  is an entire function such that  $|f(z)| \geq 1$  for all  $z$ , then show that  $f$  is constant.
- (c) Find the Laurent series for  $f(z) = \frac{1}{z^4(1-z)^2}$  that involves powers of  $z$  and is valid for  $|z| > 1$ .
- (d) Find the image of the horizontal strip  $0 < y < z$  under  $w = \frac{z}{z-i}$ .

2. (a) Let  $f = u + iv$  be an analytic function in domain  $D$ . Suppose for all  $z \in D$ ,  $|f(z)| = k$  where  $k$  is a constant. Then show that  $f$  is constant on  $D$ .
- (b) Evaluate  $\int \bar{z} dz$  along
- the semicircular path from  $-1$  to  $1$  in the upper half of  $z$  plane and
  - the polygonal path with vertices  $-1+i, 1+i$  and  $1$ .
3. (a) State and prove the Cauchy-Goursat theorem.
- (b) State Cauchy's integral formula. Using it evaluate  $\oint_C \frac{z}{z^2 - 3z + 2} dz$  where  $|z - 2| = \frac{1}{2}$ .
4. (a) State the Taylor's theorem, find the series for  $f(z) = \frac{1-z}{z-3}$  centered at  $z=0$  and state where it converges.
- (b) Let  $f$  be analytic and have a zero of order  $k$  at  $z_0$ . Show that
- $f'$  has a zero of order  $k-1$  at  $z_0$
  - $\frac{f'}{f}$  has a simple pole at  $z_0$ .

5. (a) State and prove the Cauchy's residue theorem.

(b) Using residue theory, evaluate

$$\int_0^{2\pi} \frac{\cos 2\theta}{13 - 12 \cos \theta} d\theta.$$

(a) Use residues to find the Cauchy principal value of  $\int_{-\infty}^{\infty} \frac{x \sin x}{x^4 + 4} dx$ .

(b) State and prove the Rouche's theorem. Deduce the fundamental theorem of algebra from it.

(a) Find the bilinear transformation  $w = s(z)$  that maps the points  $z_1 = i$ ,  $z_0 = 0$  and  $z_3 = i$  onto  $w_1 = -1$ ,  $w_2 = i$  and  $w_3 = 1$  respectively.

(b) Show that the transformation  $w = \frac{z^2 - 1}{z^2 + 1}$  maps the portion of the first quadrant  $x > 0$ ,  $y > 0$  that lies outside the circle  $|z| = 1$  onto the first quadrant  $u > 0$ ,  $v > 0$ .

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**[SXA – S 210 A]**

M.Sc. DEGREE EXAMINATION.

Second Semester

Applied Mathematics

Paper V – ADVANCED NUMERICAL METHODS

(Effective from admitted batch of 2014–2015)

Time : Three hours

Maximum : 80 marks

Answer any FIVE questions.

First question is compulsory.

All questions carries equal marks.

- (a) Find the values of  $a_0$  and  $a_1$  so that  $Y = a_0 + a_1x$  fits the data given here under:

|       |     |     |     |     |     |
|-------|-----|-----|-----|-----|-----|
| $x :$ | 0   | 1   | 2   | 3   | 4   |
| $y :$ | 1.0 | 2.9 | 4.8 | 6.7 | 8.6 |

- (b) Determine the maximum error in evaluating  $\int_0^{\pi/2} \cos x dx$  by Simpson's rule using 4 subintervals.

(c) Given  $\frac{dy}{dx} - 1 = xy$  and  $y(0) = 1$  obtain series for  $y(x)$  and compute  $y(0.1)$  correct to four decimal places.

(d) Classify the type of the following differential equation  $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2) \frac{\partial^2 u}{\partial y^2}$   
 $-\infty < x < \infty, -1 < y < 1$ .

2. (a) Certain corresponding values of  $\log_{10} x$  are given below:

|                 |        |        |        |        |
|-----------------|--------|--------|--------|--------|
| $x :$           | 300    | 304    | 305    | 306    |
| $\log_{10} x :$ | 2.4771 | 2.4829 | 2.4843 | 2.4855 |

Find  $\log_{10} 310$  by Lagranges interpolation

(b) Suppose  $f_i = x_i^{-2}$  and  $f_i^1 = -2x_i^{-3}$ ,  
 $x_i = \frac{1}{2}i$ ,  $i = 1(1)4$  are given. Fit these by piecewise cubic Hermite polynomials

- (a) The velocities of a car running on a straight road at intervals of two minutes are given below:

|                   |   |    |    |    |    |    |    |
|-------------------|---|----|----|----|----|----|----|
| Time (in minutes) | 0 | 2  | 4  | 6  | 8  | 10 | 12 |
| Velocity in Km/hr | 0 | 22 | 30 | 27 | 18 | 7  | 0  |

Apply Simpson's  $\frac{1}{3}$  rule to find the distance covered by the car.

- (b) Evaluate the integral  $I = \int_2^3 \frac{\cos 2x}{1 + \sin x} dx$

using Gauss-Legendre two and three point integration rules.

- (a) The following table gives the angular displacements  $\theta$  (radians) at different intervals of time  $t$  (seconds):

|          |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\theta$ | 0.052 | 0.105 | 0.168 | 0.242 | 0.327 | 0.408 | 0.489 |
| $t$      | 0     | 0.02  | 0.04  | 0.06  | 0.08  | 0.10  | 0.12  |

Calculate the angular velocity at the instant  $t = 0.06$ .

- (b) Compute the values of  $I = \int_0^1 \frac{dx}{1 + x^2}$  by using

the trapezoidal rule with  $h = 0.5, 0.25$  and  $0.125$ . Then obtain a better estimate by using Romberg method. Compare your result with the exact value.

5. (a) Using Runge-Kutta method of order four, compute  $y(0.4)$  from  $10 \frac{dy}{dx} = x^2 + y^2$ ,  $y(0) = 1$ , by taking  $h = 0.2$ .

(b) Solve the initial value problem  $\frac{dy}{dx} = -xy^2$ ,  $y(0) = 2$  to obtain  $y$  at  $x = 0.1$  in steps of 0.1 each by

- (i) Backward Euler method
- (ii) Midpoint method

6. Find the solution at  $t = 0.3$  for the initial value problem  $y' = t - y^2$ ,  $y(0) = 1$  by Adams-Basforth method of order two with  $h = 0.1$ . Determine starting values by using Eulers forward method.

7. Solve the partial differential equation  $\nabla^2 u = x^2 - 1$ ,  $|x| \leq 1, |y| \leq 1$  with  $u = 0$  on boundary of a square. Formulate a five point difference scheme for the mesh size  $h = \frac{1}{2}$  and solve the difference scheme.

**[SX – S 467]**

**M.A./M.Sc. DEGREE EXAMINATION.**

**Fourth Semester**

**Mathematics**

**MEASURE AND INTEGRATION**

(With Effect from the admitted batch of 2014–2015)

**Time : Three hours**

**Maximum : 80 marks**

Attempt FIVE questions. Question No. 1 is compulsory.  
It consists of 8 short answer questions. Each question  
carries 2 marks. All of them.

In each unit the candidate is required to answer  
ONE question. All questions carry equal marks.

1. (a) Show that if  $m * E = 0$ , then  $E$  is measurable.
- (b) Write the statement of Egoroff's theorem.
- (c) Define simple function and Lebesgue integral function.
- (d) Write the statements of Lebesgue convergence theorem and establish the Riemann-Lebesgue theorem.

- (e) If  $f$  is absolutely continuous on  $[a, b]$ , show that it is of bounded variation on  $[a, b]$ .
- (f) Define functions of Bounded variation.
- (g) Write the statement of Holders Inequality.
- (h) Write the statement of Riesz-Fischer theorem.

## UNIT I

2. (a) Show that the interval  $(a, \infty)$  is measurable.
- (b) Show that each Borel set is measurable in particular each open set and each closed set is measurable.

Or

3. Let  $E$  be a measurable set of finite measure. Let  $\{f_n\}$  a sequence of measurable functions converge to a real valued function  $f$  a.e on  $E$ . Then show that for every  $\epsilon > 0$  and  $\delta > 0$ , there exists a set  $A \subset E$  with  $MA < \delta$  and an  $N$  such that all  $x \notin A$  and all  $n \geq N$ ,  $|f_n(x) - f(x)| < \epsilon$ .

## UNIT II

4. (a) State and prove Bounded Convergence theorem.
- (b) State and prove Monotone convergence theorem.

5. State and prove Fatou's Lemma.

- (a) Let  $f$  be a non-negative function which is integrable over a set  $E$ . Then show that given  $\varepsilon > 0$  there is a  $\delta > 0$  such that for every set  $A \subset E$  with  $MA < \delta$ , we have

$$\int_A f < \varepsilon.$$

### UNIT III

6. State and prove Vitali Lemma.

Or

7. (a) Let  $f$  be an integrable function on  $[a, b]$ ,

and suppose that  $F(x) = F(a) + \int_a^x f(t) dt$ .

Then show that  $F'(x) = f(x)$  for almost all  $x$  in  $[a, b]$ .

- (b) Show that a function  $F$  is an indefinite integral if and only if it is absolutely continuous.

## UNIT IV

8. (a) State and prove Minkowski inequality.  
(b) Let  $f \in L^P$ . Then show that  $\Delta$ -approximant  $\phi_\Delta$  to  $f$  converges to  $L^P$  i.e.,  $\|f - \phi_\Delta\| \rightarrow 0$ , as the length  $\delta$  of longest sub-interval in  $\Delta$  approaches zero.

Or

9. State prove Riesz-Representation theorem.

[SX – S 228]

M.A./M.Sc. DEGREE EXAMINATION

Second Semester

Mathematics

GRAPH THEORY AND ADVANCED CODING  
THEORY

(For Affiliated Colleges only)

(Effective from the admitted batch of 2014–2015)

1. Time : Three hours Maximum : 80 marks

Answer ONE questions from each Unit each question carries 16 marks.

Question No. 1 is Compulsory. It consists of 8 short answer questions (each carrying 2 marks) and answer all of them.

1. (a) Show that in a simple graph,  $\epsilon \leq \binom{n}{2}$  where  $\epsilon$  is number of edges and  $n$  is the number of vertices in  $G$ .
- (b) What is a spanning tree?
- (c) Define an Euler graph. Give an example.
- (d) Write Prim's algorithm.
- (e) Define t-error correcting code.

- (f) If  $w = 00110$  is received over a BSC with  $P = 0.96$ , then which of the following words was most likely sent? (a) 10100, (b) 01001, (c) 01101.
- (g) Find the basis for the linear code  $C$  when  $S = \{11101, 10110, 01011, 11010\}$ . (b)
- (h) Prove that equivalent linear codes have the same length, dimension and distance. (b)

## UNIT I

2. (a) Prove that a graph is bipartite if and only if it contains no odd cycles. (a)
- (b) Prove that a forest of  $K$  trees which has total  $n$  vertices has  $(n - K)$  edges. (b)

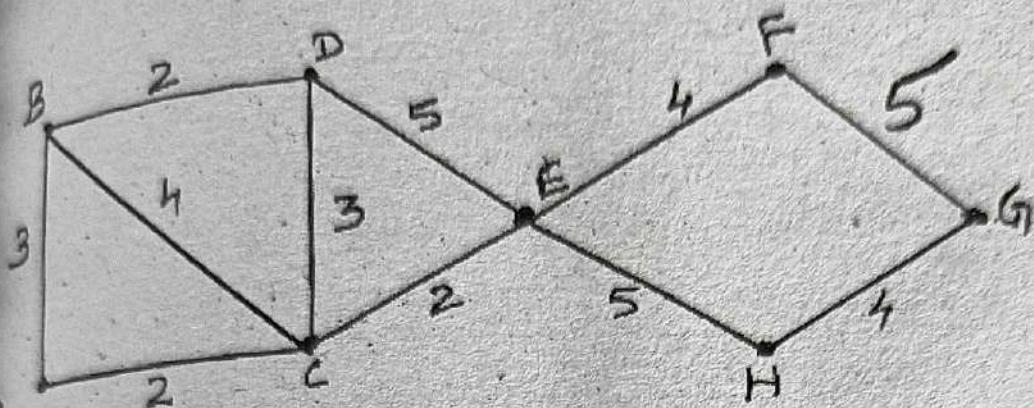
Or

3. (a) Prove that a graph  $G$  with  $n$  vertices,  $m$  edges and no circuits is connected. (a)
- (b) Show that the vertex connectivity of graph  $G$  can never exceed the edge connectivity of  $G$ . (b)

## UNIT II

4. (a) Show that a connected graph  $G$  is an Eulerian graph if and only if all vertices of  $G$  are of even degree. (b)
- (b) Show that in a complete graph with  $n$  vertices there are  $(n-1)/2$  edge disjoint Hamiltonian circuits, if  $n$  is an odd number  $\geq 3$ . (b)

- (a) Use Kruskal's algorithm to find a minimal spanning tree for the relation given by the following graph.



- (b) Prove that  $G$  has a Hamiltonian circuit if each vertex of  $G$  has degree greater than or equal to  $n/2$ .

### UNIT III

- (a) Suppose we have a BSC with  $Y_2 < P < 1$ . Let  $V_1$  and  $V_2$  be code words and  $W$  be a word each of length  $n$  suppose  $V_1$  and  $W$  disagree in  $d_1$  positions and  $V_2$  and  $W$  disagree in  $d_2$  positions then prove that  $\phi_P(V_1, W) \leq \phi_P(V_2, W)$  if and only if  $d_1 \geq d_2$ .

- (b) Show that code  $C$  of distance  $d$  will detect all error patterns of weight less than or equal to  $d-1$ .

Or

7. (a)  $|M| = 2, n = 3$  and  $C = \{001, 101\}$  of V was sent, construct IMLD Table and when IMLD incorrectly conclude that 101 was sent?
- (b) Which error patterns will the code correct?

## UNIT IV

8. (a) Define linear independence and dependence. Test the set  $S = \{110, 011, 101, 111\}$  for linear dependence.
- (b) Show that a matrix  $H$  is a parity check matrix for some linear code  $C$  if and only if the columns of  $H$  are linearly independent.

Or

9. (a) List all the cosets of the linear code  $C$ . Generator matrix is given  
 $G = \begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$ .
- (b) Construct the SDA table for the linear code  $C = \{0000, 1001, 0101, 1100\}$  and decode the words 1110, 0011.

[SX - S 471]

M.A./M.Sc. DEGREE EXAMINATION.

Fourth Semester

Mathematics

LATTICE THEORY - II

(With Effect from the admitted batch of 2014–2015)

Maximum : 80 marks

Time : Three hours

Answer ONE question from each unit each question  
carries 16 marks.

Question No. 1 is compulsory. It consists of 8 short  
answer questions (each carrying 2 marks)

(a) Prove that every Boolean is commutative  
and is of characteristic  $z$ .

(b) Prove that in any Boolean Algebra,

$$x \leq y \Leftrightarrow x \wedge y' = 0 \Leftrightarrow x' \vee y = 1$$

(c) Define Birkhoff lattice with example.

(d) Define a semimodular lattice.

- (e) Let  $R$  be a proper sublattice of  $L$ , prove that  $R$  is prime ideal if and only if  $L - R$  is a prime ideal.
- (f) Define principal ideal, dual principal ideal and ideal chain.
- (g) Give an example of a distributive lattice which is not sectionally complemented.
- (h) Prove that every maximal ideal in a distributive lattice is prime.

### UNIT - I

2. (a) Prove that every complete Boolean algebra is infinitely distributive.
- (b) Show that a valuation  $V$  of a Boolean algebra is additive if and only if  $V(0) = 0$ .

Or

3. (a) Prove that every Boolean algebra is a Boolean ring.
- (b) Let  $B$  be a Boolean algebra. Then prove that  $\text{med}(a' b' c') = (\text{med}(a, b, c))'$ .

## UNIT - II

(a) Prove that a relatively atomic lattice is semi modular if and only if it satisfies the lower covering condition.

(b) Prove that on the set of atoms of a semi modular lattice bounded below, the relation  $\theta$  defined by  $P \theta \{P_1, P_2 \dots P_m\} \Leftrightarrow P \leq P_1 \vee P_2 \vee \dots \vee P_m$  is a liner dependence.

Or

If an element ' $r$ ' of a semi complemented semi-modular lattice  $L$  has a maximal proper semi-complement  $m$ , then show that  $L$  has a greatest element and  $m$  is the complement of  $r$ .

## UNIT - III

6. (a) Show that the necessary and sufficient condition for every ideal and dual ideal of a lattice  $L$  is a convex sublattice of  $L$ .
- (b) If for an ideal  $A$  and element ' $a$ ' of a lattice  $L$  there holds  $A \leq (a]$  in  $Z(L)$ , then show that there exists an ideal  $B$  in  $L$  such that  $A \leq B < (a]$  in  $Z(L)$ .

Or

7. (a) Prove that the ideal lattice ( $L$ ) of a lattice is distributive iff  $L$  is distributive.
- (b) Prove that every Boolean algebra isomorphic to a field of sets.

#### UNIT - IV

8. (a) Show that the congruence lattice of a lattice is distributive, moreover, it infinitely meet distributive.
- (b) Show that in a section complements lattice every ideal constitutes the kernal of almost one congruence relation.

Or

9. State and prove Schreiber refinement theorem.
-

**(SX - S 411)(C-19)**

**M.Sc. DEGREE EXAMINATION.**

**Fourth Semester**

**M.A/M.Sc. Mathematics**

**PARTIAL DIFFERENTIAL EQUATIONS**

**(Effective from the admitted batch of 2018-2019)**

**(For the Academic year 2020-2021 only)**

**Time : 3 hours**

**Maximum : 80 marks**

1. Question No. 1 is compulsory. It consists of 8 short answer questions. All of them and each question carries 2 marks.
2. Question No. 2 is compulsory. It consists of 6 questions answer each question carries 4 marks. Answer any 4 of them.
3. Answer one questions from each unit each question carry 16 marks.
4. Answer all the following :
  - (a) Define general integral
  - (b) Show that  $z = ax + \left(\frac{y}{a}\right) + b$  is a complete integral of  $pq = 1$ .

- (c) Find the general integral of  $yzp + zxq = xy$ .
- (d) Verify the p.d.e  

$$yzdx + (x^2y - zx)dy + (x^2z - xy)dz = 0$$
- (e) State the IVP/ BVP of vibration of a string of finite length.
- (f) State green's theorem.
- (g) State any two boundary value problems.
- (h) State the IVP of dirichlet problem for the upper half plane.

2. Answer any FOUR of the following:

- (a) Eliminate the arbitrary function F from the p.d.e  $F(x+y, x-\sqrt{z})=0$ .
- (b) Find a complete integral of the p.d.e  

$$z = px + qy + pq$$
- (c) Describe the three canonical forms for the three types of second order linear p.d.e
- (d) Reduce the equation  $uxx - x^2uyy = 0$  to canonical form.
- (e) Show that the solution of dirichlet problem it exists is unique.
- (f) Solve the Newmann problem for the upper half plane.

## UNIT- I

Show that the necessary and sufficient condition that the p.d.e.

$\vec{X} \cdot dr = P(x, y, z)dx + Q(x, y, z)dy + R(x, y, z)dz = 0$  be integrable is that  $(\vec{X} \cdot \text{cum } \vec{X}) = 0$ .

Or

(a) Find a complete integral of

$$F = (p^2 + q^2)y - qz = 0.$$

(b) Find a complete integral of the equation

$$P^2x + q^2y = Z \text{ by Jacobi's method.}$$

## UNIT- II

Derive d' Alemberts solution for one dimensional wave equation.

Or

Show that the solution of the following problem if its exists is unique.

$$u_{tt} - c^2 u_{xx} = F(x, t) \quad 0 < x < l, t > 0.$$

$$u_{(x_0)} = f(x), u_t(x_0) = g(x), 0 \leq x \leq l$$

$$u_{(n,t)} = u(l, t) = 0 \quad t \geq 0.$$

## UNIT- III

7. Show that the solution for the Dirichlet problem for a circle of radius  $a$  is given by the Poisson integral formula.

Or

8. (a) State and prove Harnack's theorem.  
(b) Derive Green's function  $G(x,y,z)$  Laplace equation.
-

[SX - S 479]

M.Sc. DEGREE EXAMINATION.

Fourth Semester

M.A/M.Sc. Mathematics

MEASURE AND INTEGRATION

(Effective from the admitted batch of 2018-2019)

Time : 3 hours

Maximum : 80 marks

Answer ONE question from each unit and each question carry 16 marks.

Question No. 1 is compulsory. It consists of 8 short answer questions and each

Question carries 2 marks. Answer all of them.

- (a) Prove that the set  $[0,1]$  is not countable.
- (b) If  $f$  and  $g$  are two measurable real-valued functions defined on the same domain then prove that  $f + g$  is also measurable.
- (c) Show that if  $f(x) = \begin{cases} 0 & \text{if } x \text{ is irrational} \\ 1 & \text{if } x \text{ is rational} \end{cases}$ ,  
then  $R \int_a^{-b} f(x) dx = b - a$  and  $R \int_{\bar{a}}^b f(x) dx = 0$ .

(d) Show that if  $f$  is integrable over  $E$ , then so is  $|f|$  and  $\left| \int_E f \right| \leq \int_E |f|$ .

(e) Prove that if  $f$  is absolutely continuous on  $[a, b]$  then it is of bounded variation on  $[a, b]$ .

(f) Define convex function and give an example.

(g) Prove that every convergent sequence is a Cauchy sequence.

(h) Let  $1 \leq p \leq \infty$ . prove that  $(a+tb)^p \geq a^p + ptba^{p-1}$  for  $a \geq 0, b \geq 0, t \geq 0$ .

## UNIT - I

2. (a) Prove that the interval  $(a, \infty)$  is measurable.

(b) Let  $\{E_n\}$  be an infinite decreasing sequence of measurable sets. Let  $m(E_1)$  be finite. Then prove that  $m\left(\bigcap_{i=1}^{\infty} E_i\right) = \lim_{n \rightarrow \infty} m(E_n)$ .

Or

3. (a) Prove that there exists a non measurable set.

(b) State and prove Egoroff's theorem.

## UNIT - II

4. (a) Let  $Q$  and  $\psi$  be simple functions which vanish outside a set of finite measure. Then prove that  $\int(a\varphi + b\psi) = a\int\varphi + b\int\psi$ , and if  $\varphi \geq \psi$  then  $\int\varphi \geq \int\psi$ .
- (b) State and prove Fatou's lemma.

Or

5. (a) Let  $f$  be a non negative function which is integrable over a set  $E$ . Then prove that for a given  $\epsilon > 0$  there is a  $\delta > 0$  such that for every set  $A \subset E$  with  $m(A) < \delta$ , we have
- $$\int_A f < \epsilon.$$

- (b) Let  $\{f_n\}$  be a sequence of measurable functions that converges in measure to  $f$ . Then prove that there is a subsequence  $\{f_{n_k}\}$  that converges to  $f$  almost everywhere.

## UNIT - III

6. (a) Prove that a function  $f$  is of bounded variation on  $[a, b]$  if and only if  $f$  is the difference of two monotone real valued functions on  $[a, b]$ .

(b) If  $f$  is bounded and measurable on  $[a, b]$  and  
 $F(x) = \int_a^x f(t)dt + F(a)$  then prove that

$$F'(x) = f(x) \text{ for almost all } x \text{ in } [a, b].$$

Or

7. (a) If  $f$  is absolutely continuous on  $[a, b]$  and  $f'(x) = 0$  a.e. then prove that  $f$  is constant.  
 (b) If  $\varphi$  is a continuous function on  $(a, b)$  and if one derivative (say  $D^+$ ) of  $\varphi$  is non decreasing then prove that  $\varphi$  is convex.

#### UNIT - IV

8. (a) State and prove Holder inequality.  
 (b) Prove that a normed linear space is complete if and only if every absolutely summable series is summable.
- Or
9. (a) Let  $FEL^p$ . Then prove that the  $\Delta$ -approximant  $\varphi_\Delta$  to  $f$  converges to  $L^p$  i.e.,  $\|f - \varphi_\Delta\| \rightarrow 0$ , as the length  $\delta$  of the longest subinterval in  $\Delta$  approaches zero.  
 (b) Prove that each function  $g$  in  $L^q$  defines a bounded linear functional  $F$  on  $L^p$  by  $F(f) = \int fg$ . Also prove that  $\|F\| = \|g\|_q$ .

**[SX – S 131]**

M.A./M.Sc. DEGREE EXAMINATION.

First Semester

Mathematics

**LINEAR ALGEBRA – I**

(Effective from the admitted batch of 2018–2019)

Time : Three hours

Maximum : 80 marks

Answer One questions from each unit and each question carry 16 marks.

Question No.1 is compulsory. It consist of 8 short answer questions and each question carries 2 marks.  
answer ALL of them.

- (a) Define the terms
  - (i) T-Conductor of A into W
  - (ii) T-annihilator
- (b) Define the terms
  - (i) Characteristic value
  - (ii) Characteristic vector
- (c) Define cyclic vector with example.
- (d) Define and explanation about projection.

(e) Let A be a complex  $3 \times 3$  matrix

$$A = \begin{bmatrix} 2 & 0 & 0 \\ a & 2 & 0 \\ b & c & -1 \end{bmatrix}$$

Show that A is similar to a diagonal matrix if and only if  $a = 0$ .

(f) Define the normal form.

(g) Define bilinear form. Give one example.

(h) Define the terms

(i) Lorentz transformation

(ii) Lorentz group.

## UNIT I

2. Let T be a linear operator on a finite dimensional space V and let C be a scalar. Then show that the following are equivalent.

(a) C is a characteristic value of T

(b) The operator  $(T - CI)$  is singular

(c) Let  $(T - CI) = 0$

Let  $F$  be a commuting family of triangulable linear operators on  $V$ . Let  $\omega$  be a proper subspace of  $V$  which is invariant under  $F$ . Then show that there exists a vector  $\alpha$  in  $V$  such that

- (a)  $\alpha$  is not in  $\omega$ .
- (b) For each  $T$  in  $F$ , the Vector  $T\alpha$  is in the subspace spanned by  $\alpha$  and  $\omega$ .

## UNIT II

State and prove primary-Decomposition theorem.

Or

State and prove generalized cayley-Hamilton theorem.

## UNIT III

Let  $M$  be an  $m \times n$  matrix with entries in the polynomial algebra  $F[x]$ . Then show that  $M$  is equivalent to a matrix  $N$  which is in normal form.

Or

Let  $F$  be a sub field of the field of complex numbers, let  $V$  be a finite-dimensional vector space over  $F$ , and let  $T$  be a linear operator on  $V$ . Then show that there is a semi-simple operator  $S$  on  $V$  and a nilpotent operator  $N$  on  $V$  such that

- (a)  $T = S + N$
- (b)  $SN = NS$ .

## UNIT IV

8. Let  $V$  be an  $n$ -dimensional vector space over the field of real numbers, and let  $f$  be a symmetric bilinear form on  $V$  which has rank  $r$ . Then show that there is an ordered basis  $\{\beta_1, \beta_2, \dots, \beta_n\}$  for  $V$  such that the matrix of  $f$  is diagonal and that  $f(\beta_j, \beta_j) = \pm 1, j = 1, \dots, r$ . Further more number of basis vectors  $B_j$  for  $f(B_j, B_j) = 1$  is independent of the choice of basis.

Or

9. (a) If  $f$  is a bilinear form on the  $n$ -dimensional vector space  $V$ , then prove that the following are equivalent.

(i)  $\text{Rank } (f) = n$

(ii) For each non-zero  $\alpha$  in  $V$ , there is a  $\beta$  in  $V$  such that  $f(\alpha, \beta) \neq 0$ .

(iii) For each non-zero  $\beta$  in  $V$ , there is an  $\alpha$  in  $V$  such that  $f(\alpha, \beta) \neq 0$ .

- (b) Let  $V$  be an  $n$ -dimensional vector space over the field of real numbers, and let  $f$  be a degenerate symmetric bilinear form on  $V$ . Then show that the group preserving  $f$  is isomorphic to an  $n \times n$  pseudo-orthogonal group.

**[SCA – S 308]**

M.Sc. DEGREE EXAMINATION.

Third Semester

Chemistry

Specialisation : Analytical Chemistry

Paper – I : SEPARATION METHODS – I

(Effective from the admitted batch of 2009–2010)

Time : Three hours

Maximum : 80 marks

**SECTION A — (4 × 5 = 20 marks)**

Answer ALL questions.

1. (a) Explain the terms –retention time, column capacity and partition isotherm.

Or

- (b) What is gradient elution development?

2. (a) Give the principle of gel filtration chromatography.

Or

- (b) Explain the nature of forces between an adsorbent and a mobile phase.

3. (a) Give the principle of gas chromatography with a neat block diagram.

Or

- (b) What is counter current chromatography?

4. (a) Give the principle and applications of liquid partition chromatography.

Or

- (b) What is reverse phase liquid-liquid chromatography?

### SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Discuss the various factors that influence efficiency a chromatographic column.

Or

- (b) Describe the different methods development in chromatography.

6. (a) Discuss the principle and details instruments used in capillary electrophoresis. Give its applications inorganic compounds.

Or

- (b) Write notes on :

- (i) Column chromatography with detectors

- (ii) Liquid chromatography with detectors

(a) What are inorganic molecular sieves? Give their applications for separation of gases

Or

(b) Discuss the use of GC-MS for selected ion monitoring and environmental analysis.

(a) What are the different types of detectors used in HPLC? What are their merits and demerits? Give the applications of HPLC.

Or

(b) Discuss the technique, sample preparation and applications of LC-MS for drug monitoring.

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[SCA - S 309]

## M.Sc. DEGREE EXAMINATION.

### **Third Semester**

## Chemistry

Specialisation – Analytical Chemistry

## Paper II -QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS – I

(Effective from the admitted batch of 2009–2010)

Time : Three hours Maximum : 80 marks

**Answer ALL questions.**

**SECTION A –(4 × 5 = 20 marks)**

- (a) What are mean and standard deviations?

Or

- (b) Explain the outline of ICH guidelines.

(a) What is sintering process?

Or

- (b) Explain the principle of ultrasonic decomposition technique.

3. (a) What is the requirement for the select oxidants?

(a)

Or

(b) Discuss the role of chloramine analysis.

(b)

4. (a) Describe the method of analysis of group.

Or

(b) How do you analyze thiol group?

(a)

SECTION B – (4 × 15 = 60 marks)

5. (a) Write short note on each of the following:

(i) Youden plot

(ii) Normal distribution

(iii) Good laboratory practices.

Or

(b) Describe the classification of errors. How you minimize errors?

(b)

6. (a) Explain decomposition of samples by fusion.

Or

(b) Explain the method of recrystallization of organic compounds and write short note on its applications.

7. (a) Explain formal, standard and normal potentials in various media.

Or

- (b) Explain the selection of suitable indicators for the following oxidant systems :

- (i) periodate
- (ii) Ce (iv)
- (iii) V (v)
- (iv) Cr (vi)

- (a) Explain methods of determination of following functional groups.

- (i) ketones
- (ii) phenolic hydroxyl group
- (iii) olefins.

Or

- (b) Describe methods of determination of aliphatic and aromatic amines.

**[SCA – S 310]**

**M.Sc. DEGREE EXAMINATION.**

**Third Semester**

**Chemistry**

**Specialisation – Analytical Chemistry**

**Paper III – APPLIED ANALYSIS – I**

**(Effective from the admitted batch of 2009–2010)**

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A – (4 × 5 = 20 marks)**

**Answer ALL questions.**

1. (a) What chemical methods are used for separation of constituents in complex materials?

**Or**

- (b) How do you determine phosphorous content in phosphate rock ore?  
2. (a) How is lime stone analysed for its calcium content?

**Or**

- (b) Give the procedure for the determination of carbon content in steel.

3. (a) Outline the procedure for the determination of lead chromate in paints.

(a)

Or

- (b) Give its method of analysis for total and chloride contents in soaps.

(b)

4. (a) Suggest an analytical method for determination of  $NO_2^-$  in water samples.

(a)

Or

- (b) How do you determine chemical oxygen Demand of a water sample?

#### SECTION B – (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) (i) Give an account of general methods of dissolution of complex materials.

- (ii) Explain how  $Fe(II)$  and  $Fe(III)$  present in an iron ore sample can be determined quantitatively.

Or

- (b) Describe the complete analysis of chrome and Bauxite ores.

(a) Give a detailed account of the analysis of steel for S,P, Mn, Ni and cr contents.

Or

(b) Write notes on

(i) Analysis of refractory materials.

(ii) Analysis of dolomite.

(a) Explain how saponification number, Iodine number and acid number associated with oils are determined.

Or

(b) What is the composition of Portland cement? Discuss the chemical method of analysis of cement sample for all the component.

(a) How do you determine  $PO_4^{3-}$ ,  $NO_3^-$  and  $F^-$  present in water samples.

Or

(b) Give an account of

(i) The types of water pollutants and their effects.

(ii) Determination of  $Fe^{3+}$  and  $Cr^{3+}$  in water samples.

**[SCA – S 311]**

M.Sc. DEGREE EXAMINATION.

Third Semester

Chemistry

Specialisation: Analytical Chemistry

Paper IV – INSTRUMENTAL METHODS OF  
ANALYSIS – I

(Effective from the admitted batch of 2009–10)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

**SECTION A — (4 × 5 = 20 marks)**

1. (a) Write applications of spectrofluorimetry with reference to  $\text{Al}^{3+}$  and chromium salts.

Or

- (b) Explain Beer-Lambert's law.

2. (a) Write short note on non-destructive IR method for the analysis of CO and other organic compounds.

Or

- (b) Explain Raman spectra of CO and  $\text{H}_2\text{O}$ .

3. (a) Explain the mechanism of spin coupling.

7.

Or

(b) Explain the difference between ESR and NMR.

4. (a) What is the principle of mass spectrometry?

Or

(b) Write short note on energy dispersive wavelength dispersive techniques.

8.

### SECTION B — (4 × 15 = 60 marks)

5. (a) Explain the theory and instrumentation of spectrofluorimetry.

Or

(b) Describe the simultaneous determination of dichromate and permanganate ions in solution mixture by using UV spectrophotometer.

6. (a) Write short note on molecular vibration. Explain the theory and instrumentation of IR spectroscopy.

Or

(b) Explain the principle, theory and instrumentation of Raman spectroscopy.

7. (a) Write short note on each of the following:

- (i) Chemical shift
- (ii) Factors affecting chemical shift
- (iii) Spin-spin coupling.

Or

(b) Describe the principle, theory and applications of ESR spectroscopy.

(a) Write short note on the following:

- (i) Types of peaks in mass spectrometry
- (ii) Molecular weight determination
- (iii) Basic instrumentation of mass spectrometer.

Or

(b) Explain principle, theory, instrumentation and applications of XRF.

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**[SC – S 207]**

**M.Sc. DEGREE EXAMINATION.**

**Second Semester**

**Chemistry**

**Paper III — ORGANIC CHEMISTRY — II**

**(Effective from the admitted batch of 2009–2010)**

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A — (4 × 5 = 20 marks)**

**Answer ALL questions.**

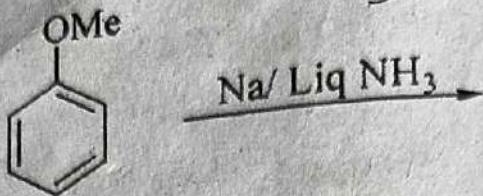
1. (a) Write the mechanism and stereochemistry of the products in E<sub>1</sub> reactions.

**Or**

- (b) Discuss benzyne mechanism with an appropriate example.

2. (a) Complete the following reaction and explain the mechanism.

Bisch



5. (a)

Or

- (b) Write a note on Meerwein-Ponndorf-West reduction.

3. (a) How will you distinguish three isomeric butanols on the basis of mass spectrometry? 1-Butanol, 2-Butanol and 2-Methyl-2-propanol

Or

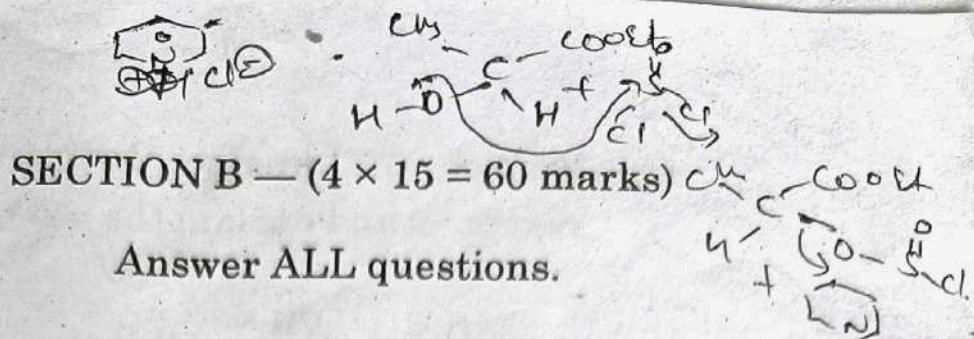
- (b) (i) Explain why NMR spectrum of benzene is observed at a lower field whereas that of acetylene is at high field strength.

- (ii) Suggest the structure of a compound with molecular formula  $C_{10}H_{12}O$  whose mass spectrum shows peaks at 15, 43, 57, 91, 105, and 148.

4. (a) How the structure of Atropine is established?

Or

- (b) What is anomeric effect. Explain with suitable example.

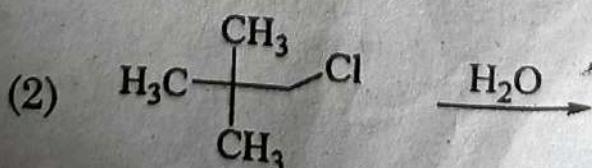
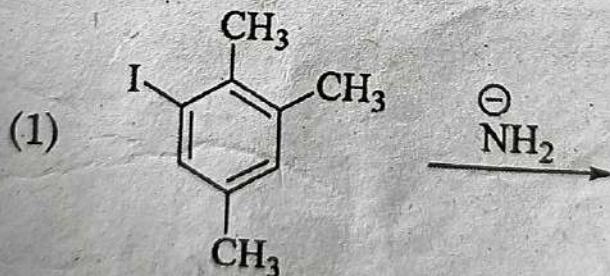


Answer ALL questions.

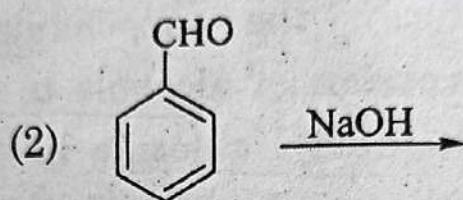
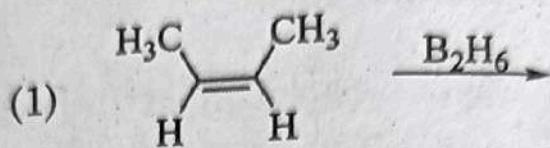
5. (a) (i) Write the effect of substrate and nucleophile in  $S_N2$  reactions.  
 (ii) Deduce the mechanism for the conversion of alcohols to alkyl chlorides with thionyl chloride in the presence of pyridine and in the absence of pyridine.

Or

- (b) (i) Discuss the mechanism of  $E_1CB$  reaction.  
 (ii) Complete the following reactions and explain the mechanism.



6. (a) (i) Predict the product of the following reactions and explain the mechanism.



(ii) Write a note on Stork-enamine reaction.

Or

(b) Explain the mechanism of following reaction.

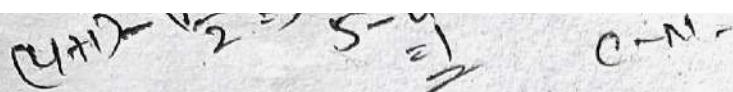
(i) Ene reaction

(ii) Grignard reaction

(iii) Michael addition.

7. (a) An organic compound molecular formula  $(\text{C}_4\text{H}_9\text{NO})$  exhibits the following spectral data.

UV:  $\lambda_{\text{max}}$  220 nm ( $\epsilon_{\text{max}}$  63)



IR : ( $\nu_{\max}$  cm<sup>-1</sup>): 3500(m), 3402 (m), 2960 (w),  
1682 (s), 1610 (s), 1398 (m), 1372 (m),  
700 (br, s), 650 (m).

<sup>1</sup>H-NMR ( $\delta$ ): 1.0 (6H, d), 2.1 (1H, septet),  
 8.08 (2H, brs).

Deduce the structure of the compound.

Or

- (b) Elucidate the structure of a compound with the following spectral characteristics.

UV:  $\lambda$ -max 245 nm.

IR: ( $\nu_{\max}$  cm<sup>-1</sup>): 1710, 1725

Mass(m/z): 10, 87, 85, 43, (base peak), 29

PMR( $\delta$ ): 4.20 (2H, s), 3.5 (2H, q), 2.3(3H, s),  
 1.3 (3H, t)

In addition it exhibits tiny peaks at 5.0 and 12.0

8. (a) (i) Discuss isolation and structural elucidation of Caffeine  
 (ii) Write synthesis of Nicotine. *Reactions*

Or

- (b) (i) How the ring structure of Fructose was established?
- (ii) Write evidence to establish the structure of Quinine.
-

[SC – S 106]

M.Sc. DEGREE EXAMINATION

First Semester

Chemistry

Paper I — GENERAL CHEMISTRY — I

(Effective from the Admitted Batch of 2009–2010)

Time : Three hours

Maximum : 80 marks

PART A — (4 × 5 = 20 marks)

Answer ALL questions.

1. (a) Define Eigen operator and Eigen values.

Or

- (b) Explain the normalization of wave functions.

2. (a) Discuss the factors influencing colour transitions.

Or

- (b) Calculate the deBroglie wavelength of a particle of mass 2.14 g travelling with a linear velocity of 100 cm/sec.

3. (a) Write a note on effect of isotope transition of rotational states.

Or

(b) Explain overtones and combination bands.

4. (a) Explain the selection rules of spectral lines in Raman spectra.

Or

(b) Explain classical theory of Raman effect.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) (i) Explain the normalization and orthogonalisation of the wave function.  
(ii) What is linear operator?

Or

(b) (i) Show that energy operator is Hermitian operator.

(ii) Interpretation of wave function.

6. (a) Derive the wave function for a particle in three dimensional potential box.

Or

(b) Apply a wave function equation to diatomic molecule vibrating like a simple harmonic oscillator.

7. (a) Derive the relation for the rotational energy of diatomic molecule.

Or

(b) (i) Explain Fermi resonance.

(ii) Quantum explanation of Raman spectra.

(a) Discuss the coarse structure of electronic spectra of diatomic molecules.

Or

(b) Write a notes on :

(i) Charge transfer spectra.

(ii) Types of electronic transition in molecules.

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[SC – S 108]

M.Sc. DEGREE EXAMINATION.

First Semester

Chemistry

Paper II — ORGANIC CHEMISTRY – I

(Effective from the admitted batch of 2009–2010)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

UNIT I

1. (a) Explain reason for aromatic character of pyridine, thiophene and cyclopropenyl cation on the basis of Huckel rule. (5)

Or

- (b) Distinguish between Homocyclic and heterocyclic bond fission with example. (5)

2. (a) Explain in detail about the process of formation of carbonium ions esculous cabanions and their stability with reactions. (15)

Or

(b) (i) Explain the difference between aromatic, anti aromaticity with suitable example.

(ii) What is kinetic control? How it is different from Thermodynamic control? Discuss

## UNIT II

6.

3. (a) Explain SN1 reaction with suitable example

Or

(b) Explain the radical substitution of Aromatic Compounds

4. (a) Explain the reaction mechanism of the following

(i) Claisen reaction

(ii) Perkin reaction

(iii) Wittig reaction.

Or

(b) Describe the Cahn-Ingold-Prelog priority rules for nomenclature of R/S and E/Z.

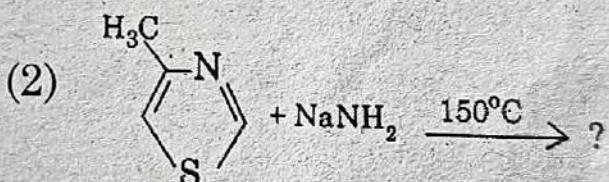
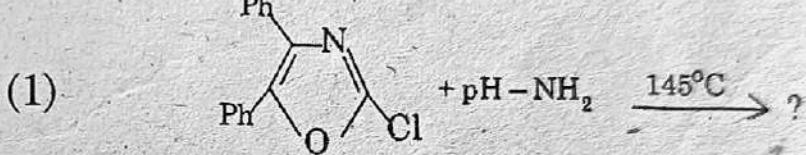
### UNIT III

5. (a) Discuss the electrophilic and nucleophilic substitutions of pyridine. (5)

Or

- (b) Explain the Friedel-Craft and Acylation and Mannich reactions with indole. (5)

6. (a) (i) Write the products in the following reactions and explain the mechanism of their formation. (7)



- (ii) Discuss the phytochemical reaction of  
 (1) Isothiazole  
 (2) Pyrazine. (8)

Or

- (b) Write any two synthetic method and reactions of

- (i) Benzothiophene  
 (ii) Oxazole and  
 (iii) Indole. (15)

## UNIT IV

7. (a) Explain the commercial synthesis  
structural elucidation of Camphor.

Or

(b) Write the structural elucidation  
synthesis of Epinine.

8. (a) Write the salient features, struc-  
elucidation and configuration of fructo-  
Mention its anomeric effects.

Or

(b) (i) Explain the differences between  
synthesis and biosynthesis. Describe  
biosynthesis of Genistein.

(ii) Describe the synthesis of Caffeine.

[SC – S 112]

M.Sc. DEGREE EXAMINATION

First Semester

Chemistry

Paper IV — PHYSICAL CHEMISTRY – I

(Effective from the admitted batch of 2011 – 2012)

Time : Three hours

Maximum : 80 marks

PART A — ( $4 \times 5 = 20$  marks)

Answer ALL questions.

1. (a) Derive Classius – Clapeyron equation.

Or

- (b) Discuss the apparent exception to third law of thermodynamics.

2. (a) Define solubilization and micro emulsions.

Or

- (b) Write a brief note on chain configuration of macromolecules.

3. (a) Explain the salt effect.

Or

- (b) Discuss the effect of substituent in Hammett equation.

4. (a) Explain Quantum yield and Quenching effect. 8.

Or

(b) Discuss the electronic transition in molecules.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Define third law of thermodynamics and discuss how do you determine the absolute entropy.

Or

(b) Describe Phase rule and write its deviation.

6. (a) (i) Factors affecting critical micellar concentration.  
(ii) Explain Hydrophobic interaction and Micellization.

Or

(b) What are surface active agents and discuss the classification of surface active agents with examples?

7. (a) Describe general and specific acid-base catalysis.

Or

(b) Explain the effect of ionic strength and derive Debye - Huckels theory.

8. (a) Discuss :

- (i) Delayed Fluorescence.
- (ii) Photochemical primary process.

Or

(b) Explain Actinometry and photo dissociate reaction.

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[SC - S 106]

M.Sc. DEGREE EXAMINATION.

## **First Semester**

## Chemistry

## Paper I – GENERAL CHEMISTRY – I

(Effective from the admitted batch of 2009–2010)

Time : Three hours Maximum : 80 marks

### PART A — ( $4 \times 5 = 20$ marks)

**Answer ALL questions.**

1. (a) Discuss the postulates of quantum mechanics.

Or

- (b) Derive the expression for linear momentum operator.

2. (a) Write a note on factors influencing color transition.

Or

- (b) Write the energy and selection rules of particle in one-dimensional and three dimensional box.

3. (a) Discuss the second order stark effect.

(a)

Or

(b) Explain mutual exclusion principle.

(b)

4. (a) Explain why stokes lines are more intense than anti stokes lines.

(a)

Or

(b) Explain Fermi resonance.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Write a note on :

(i) non – linear operators.

3.

(ii) Commutators of operators.

Or

(b) Discuss :

(i) Interpretation of wave functions.

(ii) Eigen values of Hermitian operator.

(a) Discuss the energy of simple harmonic oscillator.

Or

(b) Describe :

(i) Concept of tunneling.

(ii) Symmetry arguments in deriving the selection rules.

(a) Discuss the rigid – rotor model for the rotational spectra of diatomic molecules.

Or

(b) (i) Describe the simultaneous vibration – rotation spectra of diatomic molecules.

(ii) Define combination bands and overtones.

(a) Discuss the classical and quantum mechanical explanation for Raman spectra.

Or

(b) Describe the vibrational coarse structure for intensity of spectral lines.

**[SC – S 111]**

**M.Sc. DEGREE EXAMINATION.**

**First Semester**

**Chemistry**

**Specialisation – INORGANIC AND ANALYTICAL  
CHEMISTRY**

**Paper II – INORGANIC CHEMISTRY – I**

**(Effective from 2011–2012 admitted batch)**

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A — (4 × 5 = 20 marks)**

**Answer ALL questions.**

1. (a) Predict the geometries of  $\text{PCl}_3$ ,  $\text{SF}_4$  and  $\text{XeF}_4$  using VSEPR theory.

**Or**

- (b) Draw MO energy level diagram for  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and predict its magnetic behaviour.

2. (a) Write a note on isopoly and heteropoly acids.

**Or**

- (b) Explain the structure and bonding of borazole.

3. (a) Write about the postulates of crystal field theory.

Or

(b) Draw and explain the crystal field splitting patterns in square planar, square pyramidal and trigonal bipyramidal geometries.

4. (a) Write a note about quenching of orbital momentum by crystal fields in transition metal complexes.

Or

(b) Write a note on charge transfer spectra.

### SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Explain the bond order and magnetic behaviour of  $\text{N}_2$  and  $\text{N}_2^+$  species using MO theory.

Or

(b) Predict the structure of  $\text{H}_2\text{O}$  molecule using Walsh diagram.

6. (a) Describe the electron counting in boranes.

Or

(b) Discuss the preparation of, structure of, reactions of and bonding in  $\text{N}_3\text{P}_3\text{Cl}_6$ .

7. (a) Derive the term symbols for  $d^8$  metal ion and identify the term symbol for its ground state.

Or

(b) Write the principle and significance of John - Teller effect.

8. (a) Describe the magnetic properties of transition metal complexes.

Or

(b) What are orgel diagrams? Explain the spectral properties of a  $d^3$  metal ion complex with the help of orgel diagram.

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**[SC – S 108]**

M.Sc. DEGREE EXAMINATION.

First Semester

Chemistry

Paper III – ORGANIC CHEMISTRY – I

(Effective from the admitted batch of 2009–2010)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

**UNIT – I**

1. (a) Discuss briefly about mesomeric effect in organic molecules. (5)

Or

- (b) What is carbene and how it is formed? Mention any two important reactions where carbene is involved and write its mechanism. (5)

2. (a) Write a concise account on E<sub>1</sub>, E<sub>1cB</sub> and E<sub>2</sub> reactions. (15)

Or

- (b) (i) Write an account on factors that effect S<sub>N</sub>2 reactions vs E<sub>2</sub> reactions. (15)  
(ii) Discuss briefly the S<sub>N</sub>1 mechanism operative in the hydrolysis of alkyl halides.

## UNIT - II

3. (a) Write the possible conformations of 1,2-dimethyl cyclohexane and indicate their stabilities. (a)

Or

- (b) Write briefly on the optical isomerism of tertiary amines.

4. (a) What are the requirements for a compound to be optically active? Write an account of the optical isomerism exhibited by compounds without asymmetric carbon atoms. (b)

Or

- (b) Discuss the conformational isomers exhibited by

(i) Cyclopentane

(ii) Decalins

(iii) Substituted ethanes.

## UNIT - III

5. (a) Formulate any one method for synthesis of Indole and Discuss any two electrophilic substitution reactions. (c)

Or

- (b) How are the following synthesized?

(i) 2-hydroxy-4-methyl quinoline.

(ii) 6-methoxy isoquinoline.

6. (a) Outline the synthesis of the following. (15)

- (i) Benzofuran
- (ii) Pyrazole
- (iii) Imidazole
- (iv) Oxazole.

Or

(b) (i) Formulate the synthesis of cyanidin and genestein. (15)

(ii) What product or products are obtained in the following reactions?

(1) Pyrazole is sulfonated

(2) Pyridine is heated at  $300^{\circ}\text{C}$  with

KOH

(3) Quinoline is oxidised with  $\text{KMnO}_4$

#### UNIT - IV

7. (a) Outline the synthesis of Quercetin. (5)

Or

(b) Write a note on isolation of natural products. (5)

8. (a) How was the structure of  $\alpha$ -pine established? Give one of its synthesis? (1)

Or

(b) How do you synthesize the following? (1)

(i)  $\alpha$ -terpeneol

(ii) Camphor

(iii) Farnesol.

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**[SC – S 112]**

M.Sc. DEGREE EXAMINATION.

First Semester

Chemistry

Paper IV – PHYSICAL CHEMISTRY – I

(Effective from the admitted batch of 2011–2012)

Time : Three hours

Maximum : 80 marks

**PART A — (4 × 5 = 20 marks)**

Answer ALL questions.

- I. (a) Give thermodynamic derivation of phase rule.

Or

- (b) Explain how absolute entropy of a solid determined with the help of third laws of thermodynamics?

- (a) Explain the terms, micellization and counter ion binding in micelles

Or

- (b) What are different types of polymers? Give examples.

3. (a) Explain the Debye-Hückel theory. What are its limitations? 7. (a)

Or

(b) What are different types of Skraup diagrams in acid-base catalysis?

4. (a) Explain the different type of electronic transitions in molecules.

Or

(b) Describe the principle involved in determination of quantum yield Actinometry. 8.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Derive an expression for the effect of temperature on equilibrium constant.

Or

(b) Derive the Gibbs-Duhem, Duhem-Margules equations.

6. (a) Describe the phase separation and interaction model in micellization.

Or

(b) Describe osmometry and light scattering methods for the determination of molecular weights of polymers.

7. (a) What are primary and secondary salt effects? Derive an expression for the effect of ionic strength on the rate of a reaction.

Or

- (b) Describe the flow and relaxation methods used in the study of fast reactions.  
(a) Derive Stern-Volmer equation.

Or

- (b) Explain the mechanism involved in photo dissociation and photo isomerization reactions.
-

[SC – S 213]

M.Sc. DEGREE EXAMINATION.

Second Semester

Chemistry

Paper III – ORGANIC CHEMISTRY – II

(Effective from the admitted batch of 2019–2020)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

UNIT – I

1. (a) Discuss the Aromaticity of Annulenes with examples. (5)

Or

- (b) Discuss the mechanism of Smile's rearrangement. (5)

2. (a) Write an account on  $S_N\text{-Ar}$  and  $S_N^1\text{-Ar}$  reactions. (15)

Or

- (b) Write a note on the following
- Anti Aromaticity
  - Aromaticity of Tropylium cation
  - Aromaticity of Cyclo peuta dienyl anion

## UNIT - II

3. (a) Discuss the generation and stability of carbocations?

6.

Or

- (b) Explain the mechanism Ene reaction.
4. (a) Write the mechanism of the following rearrangements

(1)

- Bayer villiger Rearrangement
- Wagner meerwin Rearrangement
- Beckmann rearrangement

7.

- Or
- (b) What stork Enamine reaction? Discuss its mechanism and explain it's any three synthetic applications.

(15)

## UNIT - III

5. (a) Write a brief note on Oxochrome (5)

Or

- (b) Define the finger print region explain it's importance in IR spectroscopy. (5)

6. (a) What is Chemical shift and explain the factors effecting chemical shift.

Or

- (b) Write a brief note on the following (15)

(i) Batho chromic shift

(ii) Hypso chromic shift

(iii) Chromophore

## UNIT - IV

7. (a) Discuss the classification of Alkaloids based on Nitrogen heterocyclic ring. (5)

Or

- (b) Give any two methods for the synthesis of  $\alpha$  - amino acid. (5)

8. (a) Write a brief note on the following.
- (i) Merri - field solid phase peptide synthesis
  - (ii) Synthesis and structure of nicotine
- Or
- (b) Write a brief note on primary, secondary and tertiary structures of proteins.
-

Oct - 2021

[SC - S 210]

M.Sc. DEGREE EXAMINATION.

Second Semester

CHEMISTRY

Paper II — INORGANIC CHEMISTRY-II

(Effective from the admitted batch of 2011 -2012)

Time : Three hours

Maximum : 80 marks

SECTION A — (4 × 5 = 20 marks)

Answer ALL questions.

1. (a) Discuss the structure and bonding of  $\text{Re}_2\text{Cl}_8^{2-}$

Or

(b) Explain about zintle ions.

2. (a) Give the synthesis and structure of carbon monoxide

Or

(b) What is the 16 electron rule? Illustrate with suitable example

3. (a) Explain Pearson's theory of hard and acids and bases. (a)

Or

(b) Discuss the trends in stepwise constants. (b)

4. (a) Give an account on acid hydrolysis.

Or

(b) Discuss about inner and outer sphere mechanisms. (c)

### SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Discuss the preparation, Structure and bonding in  $\text{Cr}_2(\text{ROO})_4(\text{H}_2\text{O})_2$ .

Or

(b) Discuss about the polyatomic clusters with examples.

6. (a) Explain the synthesis, structure and reactions of nitric oxide complexes.

Or

(b) Describe the preparation, structure and bonding in ferrocene.

and  
7. (a) Distinguish between stepwise and overall stability constants

Or

nts.  
(b) What are inert and labile complexes. Explain the liability on the basis of valence bond theory.

8. (a) Explain the base hydrolysis of cobalt (III) complexes.

Or

(b) Discuss about complementary and non complementary reactions with examples.

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[SC - S 205]

MSc. DEGREE EXAMINATION.

Chemistry

Second Semester

Paper I - GENERAL CHEMISTRY-II

(Effective from the admitted batch of 2009 - 2010)

Time : Three hours

Maximum : 80 marks

PART A — (4 × 5 = 20 marks)

Answer ALL questions.

1. (a) What is meant by perturbation theory. Give its applications?

Or

- (b) What is variation method and how it is applied to harmonic oscillator.

2. (a) Explain the valence bond approach of hybridization in hydrogen molecule.

Or

- (b) Explain LCAO approximation of hydrogen molecule ion.

3. (a) Discuss about symmetry elements.

Or

(b) Construct the character table for  $C_{3v}$  point group.

4. (a) Give the importance of Microsoft.

Or

(b) Explain about Syntax and its rules.

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) Explain the qualitative treatment of Hartree-fock self consistent field method.

Or

(b) Explain the independent perturbation application to ground state energy of helium atom.

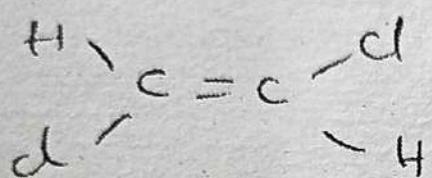
6. (a) Explain the calculation of ionic and covalent bond contributions in hydrogen molecule.

Or

(b) Discuss about electronic transitions in the hydrogen molecule.

7. (a) Describe the classification of molecules into point groups. What are the point groups of the following molecules?

(i)



(ii)  $\text{Socl}_2$

Or

(b) Construct the character table of  $C_{2v}$  point group.

8. (a) What are conditional and unconditional statements? Describe the functions of arithmetic logical and block IF statements.

Or

(b) Discuss about input and output statements.

[SC - S 211]

## M.Sc. DEGREE EXAMINATION.

## **Second Semester**

## Chemistry

## PHYSICAL CHEMISTRY – II

(Effective from admitted batch of 2011-2012)

Time : Three hours Maximum :80 Marks

### PART A — (4 × 5 = 20 marks)

**Answer ALL questions.**

1. (a) Give an account on magnetic properties of molecules.

Or

- (b) Explain the spin -spin interaction.

2. (a) Discuss the significance of 'g'-factor.

Or

- (b) Explain applications of ESR studies in free radicals.

3. (a) Give an account on electrolytic cells with some examples. (a)

Or

(b) How to determine standard potential?

4. (a) Write short note on

(i) Stern model

(ii) Tunneling (b)

Or

(b) Derive Nernst equation for electro potential of cell

PART B — (4 × 15 = 60 marks)

Answer ALL questions.

5. (a) (i) Explain Wiese - Quiery theory of magnetic susceptibility.

(ii) Give an account on chemical shift and its origin.

Or

(b) (i) How to measure the magnetic susceptibility?

(ii) Explain the NMR structure elucidation of styrene.

cells

6.

(a) (i) Explain hyperfine interactions with some examples.

al?

(ii) Discuss the significance of line shapes and line widths in ESR spectroscopy.

Or

(b) (i) Discuss the instrumentation of ESR spectroscopy.

lectro

(ii) Explain the applications of ESR studies in metal complexes.

ory

7. (a) Define concentration cells? Derive an expression for EMF of concentration cell without transference.

ft an

Or

(b) (i) How does the iron (III) and iron (II) phenanthroline couple? Shows the effect of complexation on the redox potential.

211

(ii) Give an account on fuel cells.

8. (a) (i) Explain electrical double layer .
- (ii) Discuss the structure of electri~~f~~  
interferences with reference to para  
plate model.

Or

- (b) (i) Explain experimental technique involved in voltammetry.
- (ii) Give an account on Exchange Current density.
-

[SC – S 112]

M.Sc. DEGREE EXAMINATION.

First Semester

Chemistry

Paper IV — PHYSICAL CHEMISTRY — I

(Effective from the admitted batch of 2011–2012)

Time : Three hours

Maximum : 80 marks

PART A — ( $4 \times 5 = 20$  marks)

Answer ALL questions.

1. (a) Explain the significance of Nernst heat theorem.

Or

- (b) Give an account on vant Hoff equation.

2. (a) Explain electrically conducting and fire resistant polymers.

Or

- (b) Describe the thermodynamics of micellization.

3. (a) Give an account on collision theory.

Or

(b) Discuss the flow methods for fast reactions.

4. (a) Describe E type and P type delayed fluorescence.

Or

(b) Write about types of photochemical reactions.

PART B — ( $4 \times 15 = 60$  marks)

Answer ALL questions.

5. (a) (i) Write an account of Clapeyron equation.

(ii) Third law of thermodynamics.

Or

(b) Define partial molar quantity and discuss the different methods of determination.

6. (a) How do you determine the molecular weight of polymers by viscometry and light scattering methods.

Or

(b) Write a note on

(i) Reverse micelles

(ii) Liquid crystal polymers

(iii) Chain configuration of macromolecules.

7. (a) Discuss the theories of reaction rates.

Or

(b) Explain

- (i) Relaxation methods for fast reactors
- (ii) Consecutive reactors
- (iii) Parallel reactors.

8. (a) Define quenching effect and derive stern volmer equation.

Or

- (b)
- (i) How do you determine quantum yield?
  - (ii) Derivation of fluorescence quantum yield.
-

# [SCO – S 301] (C-19)

M.Sc. DEGREE EXAMINATION.

Third Semester

Chemistry

Specialisation : Organic Chemistry

Paper I – ORGANIC REACTION MECHANISMS – I  
& PERICYCLIC REACTIONS

(For the Academic year 2020-2021 Only)

(Effective from the admitted batch of 2019 – 2020)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

1. (a) Discuss Hoffmann elimination with example. (5)

Or

- (b) Discuss the mechanism Sandmayer reaction.

2. (a) Explain the following:

(i) Hydroxylation at aromatic carbon.

(ii) Formation of cyclic ethers with lead tetra acetate.

(iii) Effect of leaving group in  $E_2$  elimination reaction. (15)

Or

- (b) Discuss the following with examples
- (i) Stereochemistry of eliminations  
cyclic and acyclic reactions.
  - (ii) Effect of solvent on reactivity in radical substitution mechanism.

3. (a) Write the mechanism of Reformatsky reaction.

Or

- (b) Discuss the mechanism of Michael reaction.

4. (a) Write an account on the following:
- (i) Addition reactions involving nucleophiles and free radicals.
  - (ii) Birch Reduction.

Or

- (b) Discuss the following with example
- (i) Reduction of Carbonyl compounds and Carbonylic acids.
  - (ii) Synthesis and applications of Grignard's reagent.

5. (a) Sketch molecular orbital diagrams of 1,3,5-hexatriene. (5)

Or

(b) Discuss 2+2 cycloaddition reactions with examples.

6. (a) Write the mechanism of the following rearrangements. (15)

(i) Claisen rearrangement

(ii) Cope rearrangement

Or

(b) Write an account on  $4n+2 \pi$  electrons electrocyclic reactions.

7. (a) Discuss the mechanism of saytzeff elimination with example. (5)

Or

(b) Discuss the mechanism of Hydroboration with example.

8. (a) Write an account on (3,3) and (5,5) sigmatropic rearrangements. (15)

Or

(b) Discuss the mechanism of  $E_1$  and  $E_1CB$  reactions with examples.

*Nov 021*

[SCO - S 302](C-19)

M.Sc. DEGREE EXAMINATION.

Third Semester

Chemistry

Specialisation : Organic Chemistry

Paper II — ORGANIC SPECTROSCOPY

(For the Academic Year 2020–2021 only)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

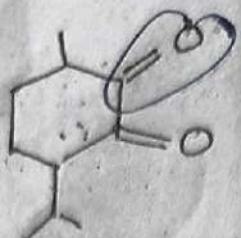
1. (a) Explain the following : (5)  
(i) Chromophore  
(ii) Auxochrome,

Or

- (b) Explain the characteristic vibrational frequencies of alkenes.

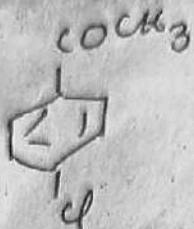
2.

(a) (i)



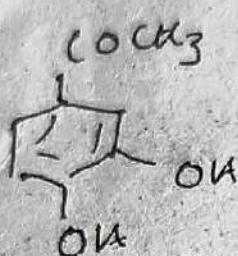
(a)

(ii)



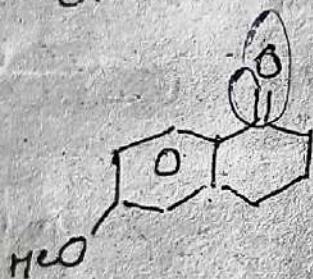
(b)

(iii)



(a)

(iv)

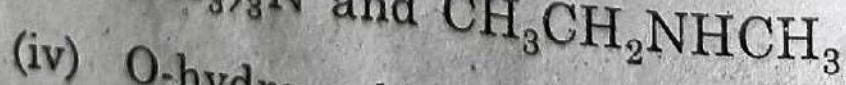
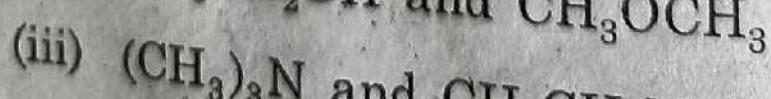
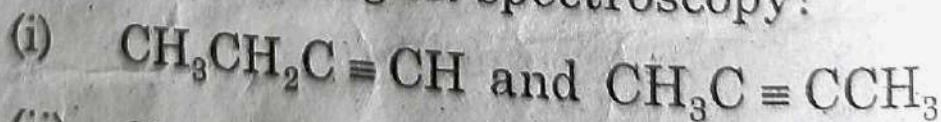


Calculate the  $\lambda_{\text{max}}$  of the above compounds.

(b)

Or

(b) How will you distinguish the following compounds using IR spectroscopy?



benzaldehyde.

3. (a) Write a brief note on spin-spin coupling. (5)

Or

(b) What is deuterium exchange? Explain its importance in NMR spectroscopy.

4. (a) Write a brief note on the following : (15)

- (i) Lanthanide shifts reagents
- (ii) Double resonance.

Or

(b) Explain the  $^1\text{H}$  NMR spectra of DMF and cyclohexane at various temperatures.

5. (a) Explain Retro Diels-Alder reaction with example. (5)

Or

(b) Discuss the fragmentation pattern of alkanes with examples.

6. (a) Explain the general fragmentation processes of aldehydes, Ketones and Esters. (15)

Or

(b) What is isotope abundance? Explain the general fragmentation pattern of alkyl chlorides and alkyl bromides.

7. (a) How do you determine the strength of hydrogen bonding? Explain.

Or

(b) What is NOE? Explain.

8. (a) Write a brief note on vicinal coupling constant and anisotrophic effect.

Or

(b) Discuss the characteristic vibration frequencies of the following :

- (i) Conjugated carbonyl compounds
  - (ii) Anhydrides
  - (iii) Carboxylic acids.
-

March 2021

[SCO - S 303] (C-19)

M.Sc. DEGREE EXAMINATION

Third Semester

Chemistry

Specialisation — Organic Chemistry

Paper III — ORGANIC SYNTHESIS

(For the Academic Year 2020–2021 only)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

1. (a) Give any two methods for direct alkylation of Imines. (5)

Or

- (b) What is Heck reaction? Explain its mechanism with suitable examples.

2. (a) What are organo palladium reagents? Give any three synthetic applications. (15)

Or

- (b) Discuss the synthesis and synthetic applications of organo-copper reagents.

3. (a) Discuss the pyrolytic eliminations.

Or

(b) Give any two methods for the generation of alkenes from hydrazones.

4. (a) Explain the mechanism of the following reactions:

(i) Sulphoxide sulphonate

(ii) Wittig rearrangement.

Or

(b) Write an account on  $\beta$ -elimination reactions.

5. (a) What is Vulcanization? Explain with example.

Or

(b) What is condensation polymerization? Explain with example.

6. (a) Discuss the mechanism of the following reactions with examples.

(i) Barton reaction

(ii) Hoffmann hoeffer - Freytag reaction.

Or

(b) Discuss the definition, synthesis and applications of Radical polymerization.

(a) Give any two methods for the direct alkylation of hydrozone anions. (5)

Or

(b) Discuss the Ziegler-Natta polymerization with example.

(a) What is Umpolung reaction? Explain with any three examples. (15)

Or

(b) Describe the synthesis and synthetic applications of organo-nickel reagents.

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[SCO – S 304] (C–19)

M.Sc. DEGREE EXAMINATION.

Third Semester

Chemistry

Specialisation: Organic Chemistry

Paper IV — CHEMISTRY OF NATURAL PRODUCTS

(For the Academic Year 2020–2021 only)

Time : Three hours

Maximum : 80 marks

Answer ALL questions.

- (a) Write the structure and biological properties of chloramphenicol. (5)

Or

- (b) Write the structure and biological properties of Penicillin – G.

- (a) Discuss the synthesis of Streptomycin. (15)

Or

- (b) Explain the structure elucidation of Cephalosporin-C.

3. (a) Write the biological properties and structure of taxol.

Or

(b) Explain the classification of Terpenes.

4. (a) Discuss the structure elucidation of  $\beta$ -Amyrin.

Or

(b) Write the total synthesis of Forskolin.

5. (a) Write the structure and biological properties of Reserpine.

Or

(b) Discuss the degradative products of Vincristine.

6. (a) Explain the total synthesis of Morphine. (15)

Or

(b) Discuss the structure elucidation of Reserpine.

7. (a) Write the structure and biological properties of Cephalosporin - C. (5)

Or

(b) Write the structure and biological properties of Forskolin.

g. (a) Explain the total synthesis of  $\beta$ -Amyrin.  
(15)

Or

(b) Discuss the total synthesis of Reserpine.

**[SCO – S 401] (C – 19)**

**M.Sc. DEGREE EXAMINATION.**

**Fourth Semester**

**Chemistry**

**Specialisation : Organic Chemistry**

**Paper I — MODERN SYNTHETIC METHODOLOGY  
IN ORGANIC CHEMISTRY**

**(Effective from admitted batch of 2009–2010)**

**(For the Academic year 2020 – 2021 only)**

**Time : Three hours**

**Maximum : 80 marks**

**Answer ALL questions.**

**Each question carries equal marks.**

1. (a) Write the mechanism of the following : (16)
- (i) Henry reaction
  - (ii) Sakurai reaction
  - (iii) Brook rearrangement
  - (iv) Suzuki reaction.

**Or**

- (b) Explain the following
- (i) Biginelli reaction
  - (ii) Ring Closing Metathesis (RCM).

2. (a) Describe the oxidation reaction of the following  
(i) Alkenes to epoxides  
(ii) Alkenes to carbonyl compounds via bond cleavage reactions.

Or

- (b) Write a note on  
(i) Oxidation of phenols  
(ii) Ketones to esters.
3. (a) Explain the following :  
(i) Heterogeneous hydrogenation  
(ii)  $\text{NaBH}_4$  and DIBAL - H.

Or

- (b) Describe the following  
(i) Homogeneous hydrogenation  
(ii) Zinc based reduction and  $\text{LiAlH}_4$ .

(a) Discuss the following concepts (16)

(i) Hantzsch reaction

(ii) Grubb's I<sup>st</sup> and 2<sup>nd</sup> generation catalyst.

Or

(b) Explain the following

(i) Hydroboration-oxidation

(ii) Noyori asymmetric hydrogenation.

Answer any FOUR from the following questions.

(16)

(a) Write a note on kulinkovich reaction

(b) Give a mechanism of negishi reaction

(c) What is TEMPO reagent? Explain them

(d) Describe Wacker oxidation with an example

(e) Explain Acyloin formation give an example

(f) Discuss about Red-Al reagent.

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[SCO - S 403] (C-19)

M.Sc. DEGREE EXAMINATION.

Fourth Semester

Chemistry

Specialisation : Organic Chemistry

Paper III — DESIGNING ORGANIC SYNTHESIS AND  
SYNTHETIC APPLICATIONS OF ORGANOBOORANES

(Effective from the admitted batch of 2009–2010)

(For the Academic Year 2020–2021 only)

Time : Three hours

Maximum : 80 marks

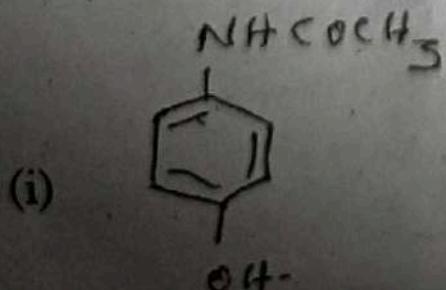
Answer ALL questions.

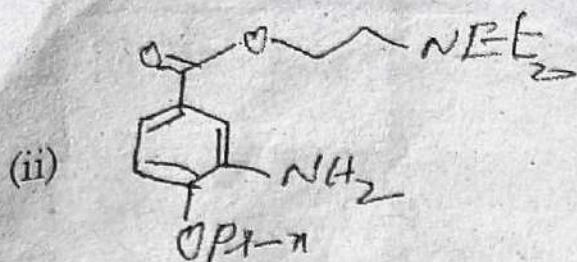
(a) Explain the following terms with examples:(16)

- (i) Synthon
- (ii) FGI

Or

(b) Give the order of events in retrosynthesis of  
the following





2. (a) Describe in detail the one groups "C-C" and "C-X" disconnections with respect to "Alcohols".

Or

- (b) Explain the carbonyl condensations in the following compounds

- (i) Oxanamide  
 (ii) Mevalonic acid

3. (a) Explain the Versatility of organoboranes with examples.

Or

- (b) Describe the synthesis and applications of the following

- (i) Disiamylborane

- (ii) Diisopinocampheylborane.

4. (a) Discuss the principles involved in protection of "Alcohols" and "Carbonyl compounds".

- (b) Explain two groups "C-X" disconnections of the following
- (i) 1,1-difunctionalised
  - (ii) 1,2-difunctionalised
  - (iii) 1,3-difunctionalised compounds with examples.

Answer any FOUR from the following questions : (16)

- (a) Explain "Chemoselectivity" with examples.
  - (b) Write about two groups "C-C disconnections with respect to 1,5-difunctionalised compounds.
  - (c) Give the preparation of "Theetylborane" with a synthetic application.
  - (d) What is "cyanoboration"? Give one synthetic application.
  - (e) Explain the importance of "Convergent synthesis" with an example.
  - (f) What is "Synthetic Equivalent"? Explain its significance.
-

**[SCO – S 402] (C-19)**

**M.Sc. DEGREE EXAMINATION.**

**Fourth Semester**

**Chemistry**

**Specialisation – Organic Chemistry**

**Paper II – ORGANIC SPECTROSCOPY**

**(Effective from the admitted batch of 2009–2010)**

**(For the Academic Year 2020-21 only)**

**Time : Three hours**

**Maximum : 80 marks**

**Answer ALL questions.**

1. (a) What are factors affecting the chemical shifts values of  $^{13}\text{CNMR}$ ? (16)

**Or**

- (b) Explain broad band decoupled spectra of the following compounds.

- (i) 2-butanone
- (ii) 2-phenyl ethanoate
- (iii) 1-chloro propane.

Ans

2. (a) Give detailed explanation of Hyperfine splitting in ESR spectroscopy with suitable examples.

(a)

Or

- (b) Explain the importance of Homo and Hetero cosy with suitable examples.

(b)

3. (a) (i) Write a note on axial haloketone rule.  
(ii) Write absolute configuration of R(+)-3-methyl cyclohexanone by the application of octant rule.

(16)

Or

- (b) Sketch the ORD curve of 3-cholestanone and mention the salient features.

4. (a) Write a note on :

- (i) CW-NMR  
(ii) NMR solvents.

(16)

Or

- (b) Write a note on :

- (i) HMBC  
(ii) Sample preparation.

Answer any FOUR from the following questions.

(16)

- (a) Discuss the  $^1\text{H}$  NMR spectrum of  $\text{CF}_3 - \text{CH}_3$ .
- (b) Explain the DEPT spectra of
- $$\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH} - \overset{\text{O}}{\underset{||}{\text{C}}} - \text{CH}_3$$
- (c) How can you differentiate cis and trans stilbenes by  $^1\text{H}$  NMR spectrum?
- (d) Predict the number of signals, multiplicity and S values of  $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{Br}$ .
- (e) Define positive and negative cotton effect curves with suitable examples.
- (f) Which of the following will show ESR spectrum?
- $\text{H}$
  - $\text{H}_2$
  - $\text{Na}^+$
  - $\text{Cl.}$

**[SCO – S 401] (C – 19)**

**M.Sc. DEGREE EXAMINATION.**

**Fourth Semester**

**Chemistry**

**Specialisation : Organic Chemistry**

**Paper I — MODERN SYNTHETIC METHODOLOGY  
IN ORGANIC CHEMISTRY**

**(Effective from admitted batch of 2009–2010)**

**(For the Academic year 2020 – 2021 only)**

**Time : Three hours**

**Maximum : 80 marks**

**Answer ALL questions.**

**Each question carries equal marks.**

- I. (a) Write the mechanism of the following : (16)
- (i) Henry reaction
  - (ii) Sakurai reaction
  - (iii) Brook rearrangement
  - (iv) Suzuki reaction.

**Or**

- (b) Explain the following
- (i) Biginelli reaction
  - (ii) Ring Closing Metathesis (RCM).

2. (a) Describe the oxidation reaction of the following (16)

(i) Alkenes to epoxides

(ii) Alkenes to carbonyl compounds with bond cleavage reactions.

Or

(b) Write a note on

(i) Oxidation of phenols

(ii) Ketones to esters.

3. (a) Explain the following : (16)

(i) Heterogeneous hydrogenation

(ii)  $\text{NaBH}_4$  and DIBAL - H.

Or

(b) Describe the following

(i) Homogeneous hydrogenation

(ii) Zinc based reduction and  $\text{LiAlH}_4$ .

(a) Discuss the following concepts (16)

(i) Hantzsch reaction

(ii) Grubb's 1<sup>st</sup> and 2<sup>nd</sup> generation catalyst.

Or

(b) Explain the following

(i) Hydroboration-oxidation

(ii) Noyori asymmetric hydrogenation.

Answer any FOUR from the following questions.

(16)

(a) Write a note on kulinkovich reaction

(b) Give a mechanism of negishi reaction

(c) What is TEMPO reagent? Explain them

(d) Describe Wacker oxidation with an example

(e) Explain Acyloin formation give an example

(f) Discuss about Red-Al reagent.

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**[ SCO - S 406 ]**  
**M.Sc. DEGREE EXAMINATION**  
**Chemistry**  
**Specialization: Organic Chemistry**  
**Fourth Semester**  
**Paper - I**  
**ORGANIC REACTION MECHANISMS - II**  
**AND ORGANIC PHOTOCHEMISTRY**  
**(Effective from the admitted batch of 2009-2010)**

Time : 3 hours

Max. Marks : 80

*Answer ALL questions.*

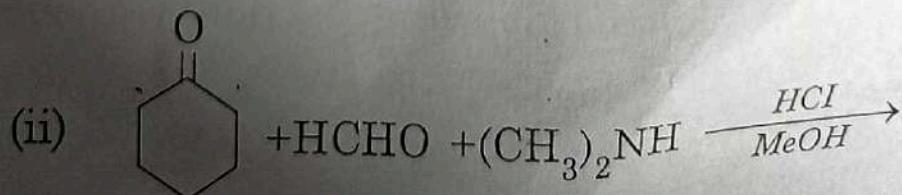
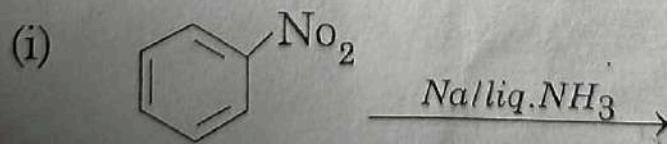
**UNIT - I**

1. (a) Describe the mechanism of Hoffman elimination reaction. (5)

(OR)

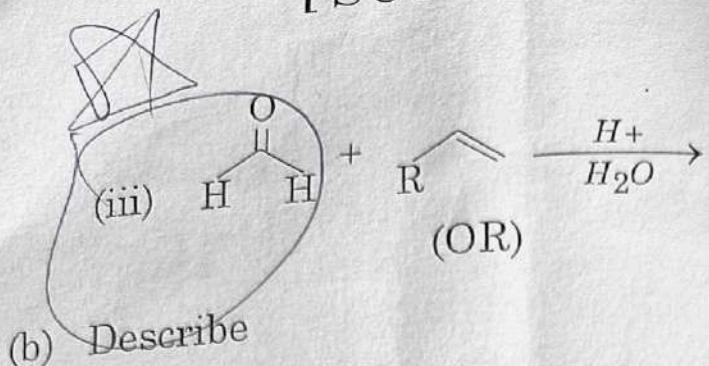
- (b) Discuss the preparation and use of Grignard reagents in organic synthesis.

2. (a) Predict the products of the following reactions with mechanism. (15)



(P.T.O.)

[ SCO - S 406 ]



(b) Describe

- (i) Pyrolytic elimination
- (ii) Michael reaction
- (iii) Tollens reaction with appropriate examples

## UNIT - II

3. (a) Discuss the mechanism of  $\alpha$ -ketone rearrangement. (5)

(OR)

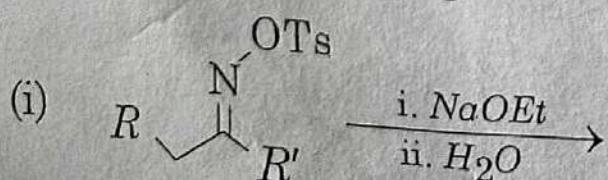
(b) Write a note on Baeyer-Villiger rearrangement.

4. (a) Describe the principle and mechanism of (15)

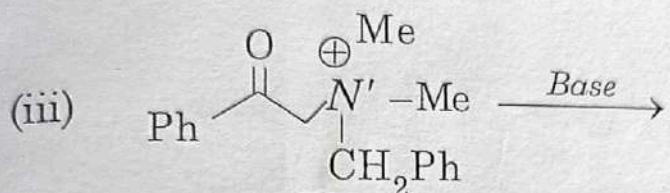
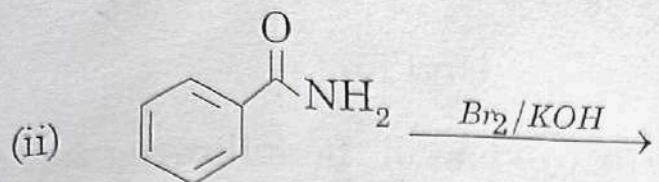
- (i) Tiffeman Demzanov rearrangement
- (ii) Wittig rearrangement
- (iii) Wagner Meerwin rearrangement

(OR)

(b) Complete the following reactions with mechanism.



[ SCO - S 406 ]



### UNIT - III

5. (a) Explain the terms Intersystem crossing and Fluorescence. (5)

(OR)

- (b) Describe the use of quenching experiments in photochemistry.

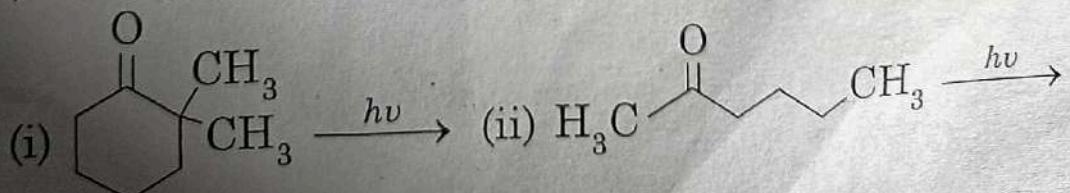
6. (a) Discuss (15)

(i) Paterno-Buchi reaction

(ii) Photosensitization with appropriate examples.

(OR)

- (b) Complete the following reactions with mechanism.



- (iii) Explain singlet and triplet states with Jablonski diagram.

(P.T.O.)

[SMB – S 208]

M.Sc. DEGREE EXAMINATION.

Second Semester

Microbiology

CELL BIOLOGY AND ENZYMOLOGY

(Effective from the admitted batch of 2015–2016)

Time : Three hours

Maximum : 80 marks

SECTION A — (5 × 4 = 20 marks)

1. Write short notes on any FIVE of the following:

- (a) Halo bacterial photosynthesis.
- (b) Structure and function of chloroplast.
- (c) MAP kinase
- (d) G-Protein coupled receptor (GPCR)
- (e) Abzymes
- (f) Co enzymes
- (g) Criteria for testing enzyme purity
- (h) Lysozyme

**SECTION B — (4 × 15 = 60 marks)**

**Answer ALL questions.**

2. (a) Describe oxygenic and anoxygenic photosystems.

**Or**

- (b) Discuss about various nutrient transport systems. Eff

3. (a) Describe in detail about protein kinases.

**Or**

- (b) Write an essay on 'Map' kinases pathway.

4. (a) Outline the enzyme classification and nomenclature.

**Or**

- (b) Discuss about different enzymes assays.

5. (a) Write an essay on "enzyme immobilization".

**Or**

- (b) Explain about Hemoglobin and myoglobin.

[SMB - S 301] (C-19)

March  
2021

M.Sc. DEGREE EXAMINATION.

Third Semester

Microbiology

MOLECULAR BIOLOGY

(Effective from the admitted batch of 2019-2020)

(For the Academic Year 2020-2021 only)

Time : Three hours

Maximum : 80 marks

SECTION A — (4 × 5 = 20 marks)

Write short notes on any FOUR of the following.

- (a) Jumping genes
- (b) Split genes
- (c) DNA ligases
- (d) Spliceosome mediated splicing
- (e) Decoding system
- (f) Protein channeling.

SECTION B — (4 × 15 = 60 marks)

Answer ALL questions.

(a)

2. (a) Elaborate on the transformation, Bl
- and Ivanovsky experiments.

(b)

Or

- (b) Write about chemical carcinogens  
chromosomal anomalies.

3. (a) Describe the mechanisms of DNA repl  
in Eukaryotes.

Or

- (b) Elucidate the mechanism of Transcrip  
Prokaryotes.

4. (a) Give an account on Nirenberg and Ma  
experiments for Deciphering of Genetic

Or

- (b) Explain the steps involved in p  
synthesis.

(a) Discuss about DNA-polymerases in prokaryotes and RNA-polymerases in Eukaryotes.

Or

(b) Describe the mechanism of protein translocation.

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**[SMB – S 302](C-19)**

**M.Sc. DEGREE EXAMINATION.**

**Third Semester**

**Microbiology**

**MEDICAL MICROBIOLOGY**

**(Effective from the admitted batch of 2019–2020)**

**(For the Academic year 2020-21 only)**

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A — (4 × 5 = 20 marks)**

**1. Write short notes on any FOUR of the following.**

- (a) Spirochoetes.**
- (b) Strepto coccus.**
- (c) Aspergillosis.**
- (d) Entamoeba histolytica.**
- (e) Sulfonamides.**
- (f) Ribavirin.**

SECTION B — ( $4 \times 15 = 60$  marks)

Answer ALL questions.

2. (a) Give an account on Normal microbial flora of human body.  
Or  
(b) Describe the pathology and lab diagnosis of mycobacterium tuberculosis.
3. (a) Explain the pathology and Labdiagnosis of Epidermophycosis and Leishmaniasis.  
Or  
(b) Describe the pathology and Labdiagnosis of Enterobiasis and Anchyllostomiasis.
4. (a) Elucidate the mechanism of drug resistance in Bacteria.  
Or  
(b) Discuss in detail about the role of vectors in disease transmission.
5. (a) Write the description and pathology of diseases caused by salmonellatyphi and Giardia lamblia.  
Or  
(b) Give an account on need and significance of Epidemiological investigations to identify a disease.

**[SMB – S 303](C-19)**

M.Sc. DEGREE EXAMINATION.

Third Semester

Microbiology

**BIOSTATISTICS AND BIOINFORMATICS**

(Effective from the admitted batch of 2019-2020)

(For the Academic year 2020-2021 only)

Time : Three hours

Maximum : 80 marks

**SECTION A — (4 × 5 = 20 marks)**

1. Write short notes on any FOUR of the following:

- (a) Bayes theorem
- (b) Chi square test
- (c) HTML
- (d) PAM
- (e) Frequent assembly
- (f) Comparative Genomics

SECTION B — ( $4 \times 15 = 60$  marks)

Answer ALL questions.

2. (a) Discuss in detail about correlation and linear regression.

Or

- (b) Explain the measures of central tendency and Distribution.

3. (a) How to perform the pairwise sequence alignment using dynamic programming. Tip

Or

- (b) Give an account on Multiple sequence alignment.

4. (a) Elucidate the clustering methods and character based methods for construction of Phylogenetic tree.

Or

- (b) Explain the different approaches of Gene prediction.

5. (a) What is ANOVA? Mention its significance in Biological experiments.

Or

- (b) Write an account on Biological databases.

**[SMB – S 304] (C-19)**

**M.Sc. DEGREE EXAMINATION.**

**Third Semester**

**Microbiology**

**MOLECULAR BIOTECHNOLOGY**

(Effective from the admitted batch of 2019–2020)

(For the Academic Year 2020-2021 only)

Time : Three hours

**Maximum : 80 marks**

**SECTION A — (4 × 5 = 20 marks)**

1. Write short notes on any FOUR of the following.

- (a) Southern blotting
- (b) PCR types
- (c) Homopolymer tailing
- (d) Isolation of poly m-RNA
- (e) Bacterial expression system
- (f) Biosensors.

**SECTION B — (4 × 15 = 60 marks)**

**Answer ALL questions.**

2. (a) Explain the methods of DNA sequencing.

**Or**

- (b) Discuss the principle and procedure of DNA finger printing technique and its applications.

24

3. (a) Elucidate the structural and function analysis of recombinants.

Or

- (b) Write an essay on cloning strategies.

4. (a) Describe the expression of cloned genes plant and animal cells.

Or

- (b) Give a short notes on genetic diseases humans and explain how gene therapy helps to accelerate.

5. (a) Discuss on the types and applications restriction endonucleases.

Or

- (b) What is Nano technology? Mention its significance in the field of medicine and can be used in diagnostics.
-

**[SMB – S 207]**

**M.Sc. DEGREE EXAMINATION.**

**Second Semester**

**Microbiology**

**MICROBIAL PHYSIOLOGY AND METABOLISM**

(Effective from the admitted batch of 2015 – 2016)

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A – (5 × 4 = 20 marks)**

1. Write short notes on any FIVE of the following

- (a) Anaerobes
- (b) Saprophytic parasites
- (c) Gluconeogenesis
- (d) Butanol fermentations
- (e) Urea cycle
- (f) Transamination
- (g) Biosynthesis of triacyl glycerols
- (h) Catabolism of purines

**SECTION B – (4 × 15 = 60 marks)**

**Answer ALL questions.**

2. (a) Discuss about 'bioluminesceule' microorganisms.

**Or**

- (b) Comment on aerobic respiration in bacteria.

3. (a) Describe the 'HMP' pathway.

**Or**

- (b) Give a detailed account on biochemical mechanisms of ethanol and butanol.

4. (a) Narrate a brief account on biosynthesis of aminoacids and their regulation with emphasis on tryptophan.

**Or**

- (b) Comment on porphyrin biosynthesis and catabolism.

5. (a) Write a brief account on microbial metabolism of 2, 4 – D with emphasis on the role of oxygenases.

**Or**

- (b) Briefly discuss about biosynthesis of purine and pyrimidine nucleotides.

**[SMB – S 209]**

**M.Sc. DEGREE EXAMINATION.**

**Second Semester**

**Microbiology**

**MOLECULAR AND MICROBIAL GENETICS**

**(Effective from the admitted batch of 2015–2016)**

**Time : Three hours**

**Maximum : 80 marks**

**SECTION A — (5 × 4 = 20marks)**

**1. Write short notes on any FIVE of the following**

- (a) Multigene families
- (b) Drosophila as model organism
- (c) Hybridization in yeast
- (d) R-plasmids
- (e) Mutational hot spots
- (f) Photo-reactivation
- (g) r II locus
- (h) Conjugation.

SECTION B — ( $4 \times 15 = 60$  marks)

Answer ALL questions.

2. (a) Write about 'Organization of genomes'.

Or

- (b) Explain complementation test and functional allelism.

3. (a) Give a detailed account on transposable elements.

Or

- (b) Explain  $T_i$  plasmid organization and the role of  $T_i$  plasmid in pathogenesis.

4. (a) Write an elaborate account on mutagens.

Or

- (b) Describe site directed mutagenesis.

5. (a) Write an essay on mapping of bacterial chromosome by interrupted mating.

Or

- (b) Briefly narrate about Tetrad analysis in neurospora.

**[SMB – S 209]**

**M.Sc. DEGREE EXAMINATION.**

**Second Semester**

**Microbiology**

**MOLECULAR AND MICROBIAL GENETICS**

(Effective from the admitted batch of 2015–2016)

Time : Three hours

Maximum : 80 marks

**SECTION A — (5 × 4 = 20marks)**

1. Write short notes on any FIVE of the following

- (a) Multigene families
- (b) Drosophila as model organism
- (c) Hybridization in yeast
- (d) R-plasmids
- (e) Mutational hot spots
- (f) Photo-reactivation
- (g) r II locus
- (h) Conjugation.

**SECTION B — ( $4 \times 15 = 60$  marks)**

**Answer ALL questions.**

2. (a) Write about 'Organization of genomes'.

**Or**

- (b) Explain complementation test and functional allelism.

3. (a) Give a detailed account on transposable elements.

**Or**

- (b) Explain  $T_i$  plasmid organization and the role of  $T_i$  plasmid in pathogenesis.

4. (a) Write an elaborate account on mutagens.

**Or**

- (b) Describe site directed mutagenesis.

5. (a) Write an essay on mapping of bacterial chromosome by interrupted mating.

**Or**

- (b) Briefly narrate about Tetrad analysis in neurospora.