

B.SC. (NON – MEDICAL) – 4TH SEMESTER EXAMINATION, MAY-2016
SUBJECT- SEQUENCE AND SERIES (PAPER CODE - 09010401)

Time: 3 Hours

Maximum Marks-40

Instruction:

- Candidate should ensure that they have been provided with correct question paper. Complaints in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No complaint(S) will be entertained thereafter.
- Attempt five questions in all. Question No. 1 is compulsory. Attempt remaining four questions out of unit II TO III, selecting at least one question from each unit.
- All question carry marks as noted against each question.

Q1. Answer all the following questions:

- (a) Define compactness of set. (2)
 (b) Write Demorgan Bertand test for series. (2)
 (c) Define limiting point of the set. (2)
 (d) Define neighborhood. (2)

UNIT-I

Q2. Prove that every infinite bounded subset of R has a limiting point in R . (8)

OR

Q3. Prove that $A \subset R$ is compact iff it is closed and bounded. (8)

UNIT-II

- Q4.** (a) Necessary and sufficient condition for the convergence of a monotonic sequence is that it is bounded. (8)
 (b) Every convergent sequence has a unique limit. (8)

OR

- Q5.** (a) State and prove Logarithmic test. (4)
 (b) State and prove Cauchy's nth Root test. (4)

UNIT-III

Q6. (a) Test for convergence of the series (4)

$$\frac{1}{(\log 2)^p} + \frac{1}{(\log 3)^p} + \frac{1}{(\log 4)^p} + \dots + \frac{1}{(\log n)^p} + \dots$$

(b) Test the convergence of the series: (4)

$$1 + \frac{\alpha}{\beta}x + \frac{\alpha(\alpha+1)}{\beta(\beta+1)}x^2 + \frac{\alpha(\alpha+1)(\alpha+2)}{\beta(\beta+1)(\beta+2)}x^3 + \dots$$

OR

- Q7.** (a) State and prove Abel's Test. (4)
 (b) Define absolute convergence of a series and also state and prove Dirichlet's theorem. (4)

B.Sc. (Non – Medical) 4th Semester examination, May-2016
Subject- Special Functions & Integral Transforms (Paper code – 09010402)

Time: 3 Hours

Maximum Marks-40

Instruction:

1. Candidate should ensure that they have been provided with correct question paper. Complaints in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No compulsory shall be entertained thereafter.
2. Attempt five questions in all. Question No. 7 is compulsory. Attempt remaining four questions out of unit I to III, selecting at least one question from each unit.
3. All question carry marks as noted against each question.

UNIT- 1

Q1. (a) Prove that $\beta(m, n) = \beta(m + 1, n) + \beta(m, n + 1)$. (4)

(b) Prove the following :

$$\frac{\beta(m+1, n)}{m} = \frac{\beta(m, n+1)}{n} = \frac{\beta(m, n)}{m+n} \text{ or } \beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{m+n} \quad (4)$$

OR

- Q2. (a) Explain the generalized Power series solution for ODESO with variable Coefficients. What do you mean by singular points of an ODESO?
 (c) Obtain the generalized series solution of DE: $3xy'' + 2y' + y = 0$.

UNIT – II

Q3. (a) Show that $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$ (4)

(b) Prove the generating function relation of Hermite polynomial (4)

$$e^{2xt-t^2} = \sum_{n=0}^{\infty} \frac{H_n(x)}{n!} \cdot t^n$$

Or

$$(n+1) P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$$

OR

Q4. (a) From Rodriguez formula of $P_n(x)$, find the value of $P_3(x)$ (4)

(b) Using Rodriguez formula of $P_n(x)$, show that $\int_{-1}^1 P_n(x) dx = 0$ (4)

UNIT – III

Q5. (a) Define Fourier sine and cosine transform of $f(x)$ for $0 < x < \infty$. If $F(s)$ is the Fourier transform of $f(x)$, then $\frac{1}{a} F\left(\frac{s}{a}\right)$ is the Fourier transform of $F(ax)$. (4)

(b) If $F(s) = L[f(x)]$ then find $L[f''(x)]$. (4)

OR

- Q6. (a) Define the Laplace transform. Show that $f(t) = t^2$ is of exponential order as $t \rightarrow \infty$. Obtain the LT of $t \sin wt$ and $\frac{(\sin at)}{t}$. (4)
- (b) Solve the I.V.P: $(D^2 + 1)y = t^2 + 2t$ where $y(0) = 4$, $y'(0) = 2$. (4)

UNIT – IV

- Q7. (a) Find the Laplace transform of $f(t) = t \cos 4t$. (2)
- (b) Show that $P_n(0) = 0$ for n odd. (2)
- © Express $J_2(x)$ in terms of $J_1(x)$ and $J_0(x)$ (2)
- (d) Evaluate $L[f(x)]$ if $f(t) = \begin{cases} (t-1)^2, & \text{if } t > a \\ 0, & \text{if } 0 < t < a \end{cases}$ (2)

B.SC. (NON-MEDICAL)–4TH SEMESTER EXAMINATION, MAY- 2016**[PROGRAMMING IN C AND NUMERICAL METHODS; PAPER CODE: 09010403]****Time: 03:00 Hrs.****Max. Marks: 40****Instructions:-**

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting atleast one from each Unit.
4. Draw diagram wherever required.

1. Describe the following: (4x2=8)
 - (a) Strings
 - (b) Pointers
 - (c) Arithmetic operators
 - (d) Model of a computer

UNIT-I

2. (a) Write an algorithm to find out the roots of a quadratic equation. (4)
(b) Describe flow charts? Design a flow chart for program of multiplication of two numbers. (4)
3. (a) What are the functions? Explain the categories (types) of functions. (4)
(b) What do you mean by operators explain different types of operators available in c. (4)

UNIT-II

4. (a) What is decision control structure and loop control structure? (4)
(b) Write a program to find out whether a number input by you is prime or not. (4)
5. (a) What are the array? Explain their types. (4)
(b) Write a program to find out the greatest element from an array? (4)

UNIT-III

6. (a) What do you mean by string? Explain any 5 library function of string. (4)
(b) Find a root of the equation $x^3 - 4x - 9 = 0$ using Bisection method between 2 and 3 correct to three decimal places. (4)
7. (a) What are the structures? How do we declare them explain with the help of an example. (4)
(b) Find a real root of the equation $x = e^{-x}$ using Newton-Raphson method. (4)

Sr. No. 4039

Roll No. _____

B.SC. (NON-MEDICAL)–4TH SEMESTER EXAMINATION, MAY- 2016

[OSCILLATIONS & WAVE THEORY; PAPER CODE: 09010404]

Time: 03:00 Hrs.

Max. Marks: 40

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting atleast one from each Unit.
4. Draw diagram wherever required.

1. (a) Write the formula and the meaning of each term involved in time period of simple, compound and torsional pendulum. (2)
(b) Discuss the basic principle for producing the ultrasonic waves using piezoelectric crystals. (2)
(c) Define gravity waves and ripples. (2)
(d) With a neat and clean diagram describe two coupled oscillators. (2)

UNIT-I

2. (a) What is the difference between simple and torsional pendulum. Write and solve the differential equation for simple pendulum to find its time period. (5)
(b) Find the velocity, acceleration and energy of a simple harmonic oscillator. (3)
3. (a) Two masses m_1 and m_2 are connected by spring of constant k and resting on a frictionless table. Now this system is slightly stretched, show that it executes a simple harmonic motion. Also find the expression for its time period. (6)
(b) A light spring of stress-free length a_0 is suspended from a point. It carries a mass m at its lower free end which stretches it through a distance l . Show that in vertical direction it oscillates simple harmonically with frequency: $\nu = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$. (2)

UNIT-II

4. What do you understand by damping in harmonic oscillators? Find the expressions for displacement and frequency when a damping force proportional to velocity is applied on a harmonic oscillator. (8)
5. What do you mean by Lissajous figures? A particle is acted upon simultaneously by two simple harmonic motions of same frequency ω but having displacements in two perpendicular directions such that

$$x = a \sin(\omega t + \varphi_1)$$

$$y = b \sin(\omega t + \varphi_2)$$

Discuss the resultant motion both in terms of equations and figures for phase differences $\delta = \varphi_1 - \varphi_2 = 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}$ and 2π . (8)

UNIT-III

6. (a) What are dispersive and non dispersive mediums? Establish a connection between group velocity (v_g) and phase velocity (v_p). Show that for non dispersive medium:
 $v_p = v_g$ (5)
- (b) Discuss the detection process for ultrasonic waves. (3)
7. (a) Derive an expression for speed of longitudinal waves in a fluid. Also give examples of longitudinal wave propagation in a fluid. (5)
- (b) Describe the formation of standing waves. What are nodes and anti-nodes? Show that distance between any two consecutive nodes and antinodes is $\lambda/2$. (3)

B.SC. (NON- MEDICAL) 4TH SEMESTER EXAMINATION, MAY-2016
SUBJECT- STATISTICAL MECHANICS (Paper code - 09010405)

Time: 3 Hours

Maximum Marks-40

Instruction:

1. Candidate should ensure that they have been provided with correct question paper. Complaints in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No compulsory shall be entertained thereafter.
2. Attempt five questions in all. Question No. 1 is compulsory. Attempt remaining four questions out of unit II TO III, selecting at least one question from each unit.
3. All question carry marks as noted against each question.

Q1. Answer all the following questions:

- (a) What are constraints? Give examples. (2)
- (b) How does free electron gas differ from ordinary gas? (2)
- (c) How do you defined Fermi energy and Fermi level at absolute zero? (2)
- (d) Distinguish between boson and fermions. (2)

UNIT-I

- Q2.** (a) Find the chance of showing a total of less than 10 in a single throw of two dice. (4)
- (b) Explain a priori and statistical probabilities. Derive relation between two. (4)

OR

- Q3.** (a) Devise the relation for probability P_x of a microstate having a deviation x from the probability P_{max} of the most probable microstate from a distribution of n distinguishable particles in a two identical compartments. (6)
- (b) Differentiate between event and trial with example. (2)

UNIT-II

- Q4.** (a) Show that the entropy of a system is proportional to the logarithm of probability of that system. (4)
- (b) Calculate the number of modes in a chamber of volume 100 c.c. in the wave length range 6000 to 6004 Å . (4)

OR

- Q5.** (a) Using B-E distribution law, derive Planck's law for black body radiation. (4)
- (b) Write down the postulates of B-E-statistics. Derive the distribution of particles governed by B-E-statistics. (4)

UNIT-III

- Q6.** (a) Calculate the number of different arrangements of 8 bosons among 4 cells of equal a priori probability. (3)
- (b) Starting from basic assumptions, derive Fermi-Dirac distribution law. (5)

OR

- Q7.** (a) What is the anomaly in specific heat of metal and how this anomaly is removed? (4)
- (b) Deduce Bose-Einstein's distribution formula and explain the phenomenon of Bose- Einstein condensation. (4)

B.SC. (NON- MEDICAL) 4TH SEMESTER EXAMINATION, MAY-2016
SUBJECT- INORGANIC CHEMISTRY - IV (Paper code - 09010408)

Time: 3 Hours

Maximum Marks-40

Instruction:

1. Candidate should ensure that they have been provided with correct question paper. Complaints in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No compulsory shall be entertained thereafter.
2. Attempt five questions in all. Question No. 1 is compulsory. Attempt remaining four questions out of unit II TO III, selecting at least one question from each unit.
3. All question carry marks as noted against each question.

- Q1.** Answer all the following question: (4x2=8)
- (a) Why actinides are called f-block elements?
 - (b) What is meant by lanthanide contraction?
 - (c) What is meant by qualitative analysis?
 - (d) How do you detect nitrate NO_3 radical in presence of nitrite radical NO_2 ?

UNIT-I

- Q2.** State the difference in characteristics of lanthanides and actinides- in terms of oxidation states, magnetic properties and ionic radii. (8)

OR

- Q3.** Explain why? (4X2=8)
- (a) $\text{La}(\text{HO})_3$ is more basic than $\text{Lu}(\text{OH})_3$
 - (b) Lanthanides are almost colorless while most of the actinides are colored

UNIT-II

- Q4.** (a) How do you detect Co^{2+} in presence of Ni^{2+} ? (4X2=8)
(b) How do you remove phosphate radical (PO_4^{3-}) during analysis of Gr III cations?

OR

- Q5.** Write short notes on: (4X2=8)
- (a) Aqua regia
 - (b) Nessler's Reagent

UNIT-III

- Q6.** (a) State and explain Fajan's rule and its application. (4X2=8)
(b) LiCl is not soluble in water NaCl is, why?

OR

- Q7.** (a) Explain the formation of NaCl using Born- Haber Cycle. (4X2=8)
(b) Explain why melting point of NaCl is higher than CsCl .

Sr. No. 4042

Roll No. _____

B.SC. (NON-MEDICAL)–4TH SEMESTER EXAMINATION, MAY- 2016

[PHYSICAL CHEMISTRY-IV; PAPER CODE: 09010409]

Time: 03:00 Hrs.

Max. Marks: 40

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting atleast one from each Unit.
4. Draw diagram wherever required.

1. Answer all the following: (4x2=8)
 - (a) Why efficiency of any engine cannot be 100%?
 - (b) What is residual entropy?
 - (c) Explain electrochemical series.
 - (d) What is liquid junction potential?

UNIT-I

2. Explain the Carnot cycle and show that why efficiency can never be 100%. (8)
3. (a) What will be the total entropy changes in reversible and irreversible process (5)
(b) Calculate the entropy change for the fusion of 1 mole of a solid which melts at 300 K. The latent heat of fusion is 2.51 kJ mol^{-1} . (3)

UNIT-II

4. (a) Explain activity and activity coefficient of electrolytes. (5)
(b) Explain the applications of electrochemical series. (3)
5. Write short notes on the followings: (4x2=8)
 - (i) Overvoltage
 - (ii) Electrode concentration cell
 - (iii) Polarisation
 - (iv) Liquid junction potential

UNIT-III

6. What are the elements of symmetry in crystallography? Describe each of them briefly. Define the law of symmetry and give a suitable example to support your comment. (8)
7. (a) Derive expression for the distance of separation of the (hkl) planes of an orthogonal system. (4)
(b) Briefly explain the crystal structure of calcium fluoride (4)

B.SC. (NON-MEDICAL)-4TH SEMESTER EXAMINATION, MAY- 2016**[ORGANIC CHEMISTRY-IV; PAPER CODE: 09010410]****Time: 03:00 Hrs.****Max. Marks: 40****Instructions:-**

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting atleast one from each Unit.
4. Draw diagram wherever required.

1. Answer all the followings:

- a) Explain Hooke's law. (2)
- b) What is diazotization. Prepare benzene diazonium chloride from aniline. (2)
- c) Discuss reason of acidity of alpha hydrogen in carbonyl compounds. (2)
- d) Write synthesis of cyclobutane by Freund's method. (2)

SECTION-A

2. (a) What is effect of resonance and inductive effect on vibrational frequency in I.R. Spectroscopy. (3)
(b) Why I.R spectra of maleic acid and fumaric acid differ from each other. Explain. (3)
(c) Discuss briefly the principle of I.R. spectroscopy. (2)
3. (a) Explain expected absorption regions in I.R. Spectrum of toluene. (3)
(b) How will you distinguish between an alcohol and phenol using I.R. Spectroscopy. (3)
(c) Explain briefly overtones and coupling peaks. (2)

SECTION-B

4. (a) Explain mechanism of Hofmann's bromamide reaction. (3)
(b) Discuss Hinsberg's method for separation of primary, secondary and tertiary amines. (3)
(c) Why diazotization is carried below 5 degree Celsius. (2)
5. (a) Discuss mechanism of nitration of benzene. (3)
(b) Why ethyl amine is more basic than aniline. Explain. (3)
(c) Convert benzene diazonium chloride to: (2)
(i) Benzene
(ii) Phenol.

SECTION-C

6. (a) Write notes on: (3+3=6)
(i) Wurtz reaction
(ii) Corey House synthesis.
(b) Discuss Baeyer's strain theory. What are its limitations. (2)
7. (a) Discuss mechanisms of: (3+3=6)
(i) Perkin reaction.
(ii) Benzoin Condensation.
(b) What is aldol condensation. Give its synthetic importance (2)