

**B.SC.(NON-MEDICAL)- 4th SEMESTER EXAMINATIONS, OCTOBER-2017
(SUBJECT-SEQUENCE AND SERIES ; PAPER CODE- 09010401)**

Time : 03:00 Hours

Maximum Marks – 40

Instruction :

1. Write your Roll No. on the question paper.
2. 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 complaints shall be entertained thereafter.
3. Attempt five question in all. Question No.01 is compulsory. Attempt at least one question from each unit.
4. Draw diagram whenever required.

Q1 . Answer all the following:-

- a) Define a sequence. Give an example of a sequence whose range is finite. (2)
- b) Define an Adherent point and Limit point of a set. (2)
- c) Define Neighborhood of a point. Show that an open interval is a *nb*d of each of its points. (2)
- d) Show that every convergent sequence is bounded. (2)

UNIT-I

- Q2 .** a) If S and T be any two subsets of R . Then show the followings: (4)
- i. $D(S \cap T) \subset D(S) \cap D(T)$
 - ii. $D(S \cup T) = D(S) \cup D(T)$
- b) State and prove Bolzano Weierstrass theorem. (4)

OR

- Q3 .** a) State and prove Heine Borel theorem. (4)
- b) Prove the followings: (4)
- i. Show that any superset of a *nb*d of a point is also a *nb*d of that point.
 - ii. Show that the set $S = \{ x: 0 < x < 1, x \in R \}$ is open but not closed. (4)

UNIT-II

- Q4 .** a) Discuss the convergence of the series: $a + ax + ax^2 + ax^3 + ax^4 \dots$ (4)
- b) Discuss the convergence of the series: $\frac{1}{1+\sqrt{2}} + \frac{2}{1+2\sqrt{3}} + \frac{3}{1+2\sqrt{4}} \dots$ (4)

OR

- Q5 .** a) If $\lim s_n = l$ and $\lim t_n = l'$ then prove that $\lim s_n t_n = ll'$. (4)
- b) Prove that a sequence convergent if and only it is a Cauchy sequence. (4)

UNIT-III

- Q6. a) Define Alternating Series. Write the Leibnitz test for Alternating series. (4)
- b) Discuss for absolute convergence of the series $\frac{1}{\sqrt{1}} - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} \dots\dots\dots$

OR

- Q7. a) Show that the series $\sum (-1)^n [\sqrt{n^2 + 1} - n]$ is conditionally convergent. (4)
- b) Show that the series $\sum \frac{1}{n^2 x}$ converge uniformly in $[1, \infty[$. (4)

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B.SC.(NON-MEDICAL)- 4th SEMESTER EXAMINATIONS, OCTOBER.-2017
(SUBJECT-SPECIAL FUNCTIONS AND INTEGRAL TRANSFORMS
(PAPER CODE- 09010402)

Time : 03:00 Hours

Maximum Marks – 40

Instruction :

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3. Attempt five question in all. Question No.01 is compulsory. Attempt at least one question from each unit.
4. Draw diagram whenever required.

Q1 . Answer all the following questions:

(2X4=8)

- a) Find the Laplace transform of $e^{-bt} \sinh at$.
- b) Write the formula to find the Laplace transform of Periodic function.
- c) Define the Fourier transform.
- d) Define change of scale property.

UNIT-I

Q2 . a) Find the regular singular points $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 0$. (4)

b) Show that $J_{3/2} = \sqrt{\frac{2}{\pi x}} \left(\frac{\sin x}{x} - \cos x \right)$, $J_{-3/2} = -\sqrt{\frac{2}{\pi x}} \left(\sin x + \frac{\cos x}{x} \right)$. (4)

Q3 . Establish the following recurrence relations for Bessel's functions:

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

b) $\frac{d}{dx} [x^{-n} J_n] = -x^{-n} J_{n+1}$. (4)

UNIT-II

Q4 . a) Show that $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$. (4)

b) Prove that $J_{n+3} + J_{n+5} = \frac{2}{x} (n+4) J_{n+4}$. (4)

Q5. a) Prove that $(n+1) P_{n+1}(x) = (2n+1) x P_n(x) - n P_{n-1}(x)$. (4)

b) Determine the Legendre polynomial P_0, P_1, P_2, P_3 (4)

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UNIT-III

Q6 . Find the Laplace transform of the following functions (4)

a) $\sin at \sinh at$

b) Find the Laplace transform of $\frac{\sin at - \sin bt}{t}$. (4)

Q7 . a) Evaluate $L \left\{ \int_0^1 \int_0^1 \int_0^1 \cos au \, du \, du \, du \right\}$. (4)

b) Use convolution theorem to find the Inverse Laplace transform of $\frac{s}{(s^2+9)(s^2+4)}$. (4)

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Roll No. _____

B.SC. (NON-MEDICAL) - 4th SEMESTER EXAMINATIONS, OCTOBER-2017
(SUBJECT-OSCILLATIONS AND WAVE THEORY; (PAPER CODE- 09010404)

Time : 03:00 Hours

Maximum Marks – 40

Instruction :

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3. Attempt five question in all. Question No.01 is compulsory. Attempt at least one question from each unit.
4. Draw diagram whenever required.

- Q1 . a)** At what distance from the mean position, is the kinetic energy of harmonic oscillator equal to its potential energy (2)
- b)** What is the function of water in resonance apparatus? Can we use any other liquid also? (2)
- c)** What is Simple harmonic motion. State its characteristics. (2)
- d)** Establish the relation between phase velocity and group velocity. (2)

UNIT-I

- Q2 .** What are the differences between compound pendulum and simple pendulum? Obtain an expression for the time period of a compound pendulum. (8)
- Q3 . a)** Two Identical masses are connected with two mass less springs having spring of constant k and resting on a frictionless surface. Now the system is slightly stretched. Show that the system executes simple harmonic motion and find its frequency of oscillation. (5)
- b)** A smooth tunnel is bored through the earth along one of its diameters and a ball is dropped into it. Show that the ball will execute SHM with period $T = 2\pi\sqrt{\frac{R}{g}}$ where R is the radius of earth and g is acceleration due to gravity at the surface of the earth. Assume earth to be a homogenous sphere. (3)

UNIT-II

- Q4 .** Establish the equation of motion of a damped harmonic oscillator subjected to a resistive force that is proportional to the first power of its velocity. If the damping is less than critical, show that the motion of the system is oscillatory with its amplitude decaying exponentially with time. (8)
- Q5 .** Define simple harmonic motion(SHM). Show that the differential equation of motion for SHM is linear and homogenous. Hence, prove that the principle of superposition holds for SHM. (8)

UNIT-III

- Q6 .** Define ripple and gravity waves in terms of critical wavelength. Prove that the expression of the magnitude of the velocity of the waves formed on the surface of a liquid (density ρ) under the combined action of gravity and surface tension T is given by:

$$V = \sqrt{\frac{\lambda \delta}{2\pi} + \frac{2\pi T}{\rho \gamma}}$$

Where λ is the wavelength of the wave.

(8)

- Q7 .** A long uniform string of linear density μ is stretched with a Tension T, Obtain an expression for wavelength of transverse waves on a long stretched string.

(8)

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Instruction :

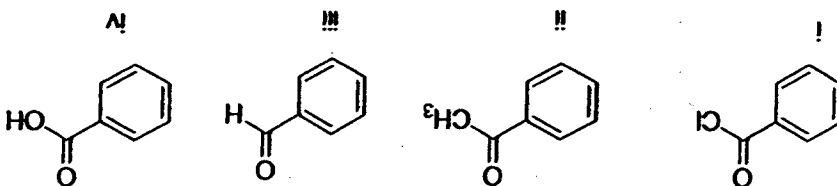
1. Write your Roll No. on the question paper.
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3. Attempt five question in all. Question No.01 is compulsory. Attempt at least one question from each unit.
4. Draw diagram whenever required.

Q1. Answer all the following:-

- a) Explain the expected absorption regions in IR spectrum of p-nitrophenol. (2)
- b) Discuss the reduction of diazonium salt. (2)
- c) Photochemical (2+2) cycloaddition reactions (2)
- d) Why α -hydrogen of acetophenone is acidic in nature? (2)

UNIT-I

- Q2. a) Arrange the following according the stretching frequency of C = O group in IR and give suitable reasons. (3)



- b) What are overtones in IR spectroscopy? (2)

- c) How will you differentiate between the alkenes and alkynes on the basis of IR spectroscopy? (3)

- a) Explain the stretching and bending vibration modes of vibration in IR spectroscopy? (3)

- b) How will you differentiate between primary amine and amides using IR spectroscopy? (2)

- c) Explain the expected absorption regions in IR spectrum of alcohol and phenol. (3)

UNIT-II

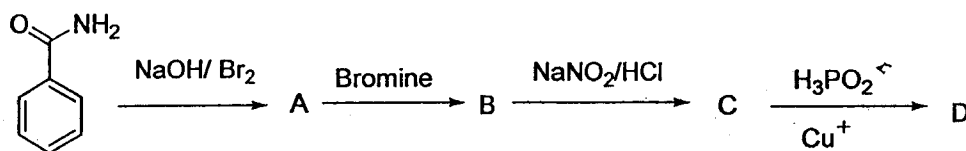
- a) Explain the Gabriel – phthalimide reaction with suitable examples. (3)

- b) Discuss the mechanism of nitration in aromatic compounds? (2)

- c) Why amines are basic in nature? Explain the role of inductive effect of alkyl group on the strength of basicity of amines. (3)

Q5. a) Complete the following reaction

(3)



b) What do you understand by the coupling reaction of diazonium salt? Explain with example.

(2)

c) Briefly discuss the Hinsberg's method of amine separation.

(3)

UNIT-III

Q6. Write short notes on the following reaction giving their mechanism:

a) Perkin reaction

(3)

b) Baeyer villager oxidation

(2)

c) Knoevenagel condensations

(3)

Q7. Write short notes on the following

a) Kolbe reaction

(3)

b) Theory of strain- less rings

(2)

c) Decarboxylation of carboxylic acid

(3)

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