42537/35537/E370

Reg. No. | | | | | | | | |

V Semester B.Sc 3 / B.Sc 4 Degree Examination, March - 2022

MATHEMATICS (OPTIONAL)

Paper : I - Real Analysis

(Regular/Repeaters w.e.f 2016-2017 (New Syllabus))

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:
1. **Question Paper contains 3 Parts namely A, B and C.**
2. **Answer all questions.**

PART-A

Answer any Ten of the following. **(10×2=20)**

1. a) Define Upper and Lower Riemann integrals.

   b) State Dourboux theorem.

   c) State Bonnet form of Second mean Value theorem of integral calculus.

   d) Prove that $\left|\int_a^b Sinx^2 dx\right| \leq \frac{1}{a}$.

   e) Define absolute convergence of an improper integral and give an example.

   f) Test the Convergence of $\int_1^\infty \frac{dx}{(5+x)\sqrt{x}}$.

   g) Test the Convergence of $\int_0^{\pi/2} \frac{dx}{\sqrt{Sinx}}$.

   h) Prove that $\sqrt{n+1} = n\sqrt{n}$.

   i) Find the Value of $\int_0^\infty e^{-x^2} dx$.

   j) Prove that $\beta(x+1, y) = \beta(x, y)\frac{x}{x+y}$.

[P.T.O.

k) Evaluate $\int_0^1\int_0^3 (x^2+y^2)dxdy$.

l) Evaluate $\int_1^e\int_1^e\int_1^e \frac{dxdydz}{xyz}$.

PART-B

Answer any **Four** of the following. (4×5=20)

2. If f(x) and g(x) are bounded and integrable in [a, b] then prove that f(x).g(x) in bounded and R- integrable in [a, b].

3. Prove that every continuous function in [a, b] in R - integrable.

4. If f(x) and g(x) are +ve in [a, ∞) and $\lim_{x\to\infty}\frac{f(x)}{g(x)} = L$ (non-zero and finite). Then prove that the Integrals $\int_a^\infty f(x)dx$ and $\int_a^\infty g(x)dx$ behave alike, where a>0.

5. Test the Convergence of $\int_0^1 \frac{dx}{x^{\frac{1}{2}}(1-x)^{\frac{1}{3}}}$.

6. Prove that $\int_0^1 \frac{x^{m-1}(1-x)^{n-1}}{(x+a)^{m+n}}dx = \frac{1}{a^n(a+1)^m}\beta(m,n)$.

7. Find the volume of tetrahedron bounded by Co-Ordinater planer and the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$.

PART-C

Answer any **Four** of the following: (4×10=40)

8. a) State and Prove condition of R - integrability.

   b) Prove that f(x) = 3 x + 1 is integrable on [1, 2] and $\int_1^2 (3x+1)dx = \frac{11}{2}$.

9. a) State and Prove Fundamental theorem of integral Calculus.

b) Prove that $\frac{1}{\pi} \le \int_0^1 \frac{\sin \pi x}{1+x^2} dx \le \frac{2}{\pi}$

10. a) State and Prove Abel's test for the Convergence of an improper integral.

b) Prove that $\int_0^\infty \frac{Sinkx}{x} dx$ Converger.

11. a) Establish the relation between Beta and Gamma function.

b) Prove that $\int_0^1 \frac{y^2}{\sqrt{1-y^4}} dy \times \int_0^1 \frac{dy}{\sqrt{1-y^4}} = \frac{\pi}{4}$.

12. a) State and Prove Leibnitz's theorem for differentiation under integral sign.

b) Prove that $\int_0^{\pi/2} \frac{\log(1+\cos\alpha.\cos x)}{\cos x} dx = \frac{\pi^2}{8} - \frac{\alpha^2}{2}$.

35538/42538/E380

Reg. No. | | | | | | | | |

V Semester B.Sc.3/B.Sc. 4 Degree Examination, March - 2022

MATHEMATICS (Optional)

Paper II : Numerical Analysis

(Regular and Repeaters w.e.f. 2016-17)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:
1. **Answer all questions.**
2. **Students are allowed to use scientific calculators.**

PART-A

I. Answer any **Ten** of the following questions. **(10×2=20)**

1. a) Explain briefly Bisection method to find real root of f (x) = 0.

   b) Find the real root of $e^x - 2x = 0$ using iteration method in 3 stages.

   c) With usual notation prove that E=1 + A.

   d) Construct the forward difference table of $x^2 + 2x + 1$ for the value of x= 0, 1, 2, 3, 4..

   e) Evaluate Δ^4 [(1-x) (1-2x) (1-3x) (1-4x)], where h=1.

   f) Write the formula to find the first derivative using the forward difference.

   g) State simpson's $\left(\frac{1}{3}\right)^{rd}$ formula to evaluate $\int_a^b f(x)dx$.

   h) From the Taylor's series for y (x) find 'y' at x= 0.2. If y (x) satisfies $\frac{dy}{dx} = 2y + e^x$ y(0)= 0.

   i) Use Euler's modified method to compute $y_1^{(1)}$ for x= 0.05 give that $\frac{dy}{dx} = x + y$ with the initial condition $x_0 = 0,\ y_0 = 1$.

   j) Define i) Order ii) Degree of difference equation.

[P.T.O.

k) From the difference equation by eliminating a and b from the relation $y_x = a(3)^x + b(-3)^x$.

l) Solve $u_{x+2} - 25u_{x+1} + 46u_x = 0$.

PART-B

II. Answer any **Four** of the following questions. **(4×5=20)**

2) Solve by Gauss-Serial iteration method carry out 4-iterations.

$10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 14.$

3) Express the function f(x)= $2x^4 + 5x^2 + 4x + 5$ and its successive differences in a factorial notations when h= 1.

4) State and prove Newton-Gregory Forward inter potation formula.

5) Evaluate $\int_0^1 e^x dx$ approximately in steps of 0.2 using by Trapezoidal rule.

6) Explain Picard's method to solve the equation $\frac{dy}{dx} = f(x,y)$ with initial condition $y(x_0) = y_0$.

7) Solve $y_{x+2} - 3y_{x+1} - 4y_x = 5^x$.

PART-C

III. Answer any **Four** full of the following questions. **(4×10=40)**

8) a) Derive Newton-Raphson formula $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$ where i= 0, 1, 2......

b) Solve the equation $x^3+9x+1=0$ for the root lying between 2 and 3, correct to three significant figures.

9) a) If f(x) is a polynomial of degree n in x, then prove that $\Delta^n f(x)$ is constant, and $\Delta^{n+1} f(x) = 0$.

b) Find the cubic polynomial which takes the following values.

x	0	1	2	3
f(x)	1	2	1	10

10) a) State and prove Lagrange's inter polation formula for un equal intervals.

b) The Population of town is as follows.

Years	1921	1931	1941	1951	1961	1971
Population in lakhs	20	24	29	36	46	51

Estimate the increase in Population during the period 1955 to 1961.

11) a) Explain Euler's Method to solve $\frac{dy}{dx} = f(x,y)$ with initial condition $y(x_0) = y_0$.

b) Find y (0.1) and y (0.2), given that $\frac{dy}{dx} = x - 2y$, y (0)= 1, taking h= 0.1, by Runge-Kutta method.

12) a) Solve $y_{x+2} - 4y_x = x - 1$.

b) Find the solution of the difference equation $y_{x+2} - 7y_{x+1} + 12y_x = \cos x$.

42539/35539/E390

Reg. No. | | | | | | | | |

V Semester B.Sc.3/B.Sc.4 Degree Examination, March - 2022

MATHEMATICS (OPTIONAL)

Dynamics and calculus of Variations.

Paper : III

(Regular/Repeater w.e.f. 2016-17 New Syllabus)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates: 1) **Question paper has three parts namely A,B and C.**
2) **Answer all Questions.**

PART-A

I. Answer any **Ten** of the following. **(10×2=20)**

1) a) If the radial and transverse velocities are equal. Find the path.

b) Prove that the angular acceleration of the direction of a point moving in a plane is $\frac{\vartheta}{\delta}\cdot\frac{d\vartheta}{ds}-\frac{\vartheta^2}{\delta^2}\cdot\frac{d\delta}{ds}$

c) A particle is projected with velocity u making an angle α with the horizontal. Find the greatest height attained.

d) A Particle is Projected with velocity u So that its range on a horizontal plane is twice the greatest height attained. Show that the range is $\frac{4u^2}{5g}$.

e) State the laws of direct impact of two smooth spheres.

f) Define: i) Central orbit ii) Law of Force.

g) Find law of force towards the Pole for the curve $r^2 = ap$.

h) Find the extremal of the functional $\int_{x_0}^{x_1}(x+y')y'\,dx$.

i) Find the solution of Euler's equation when f is independent of x.

j) State the variation problems of calculus of Variations.

[P.T.O.

k) Define Geodesic and What is the geodesic on a Sphere.

l) Define ISO perimetric problem.

PART-B

II. Answer any **Four** of the following. **(4×5=20)**

2) A Particle describes an equiangular spiral $r = e^{a\theta}$ in such a manner that its acceleration has no radial component. Prove that its angular Velocity is constant and magnitude of velocity and acceleration is each proportional to r.

3) The law of force is μu^3, a particle is projected an apse at a distance 'a' with the velocity $\frac{2}{a}\sqrt{\frac{\mu}{3}}$. Show that equation of orbit is $\gamma \cos\frac{\theta}{2} = a$.

4) When two spheres of masses m and m' moving with the velocities u and u' impact directly. Find the velocities after impact. Also show that the momentum lost by one and gained by the other is $\frac{mm'}{(m+m')}(1+e)(u-u')$.

5) A smooth Sphere of mass m impinges on another smooth sphere of mass 2m at rest, the direction of motion making an angle $45°$ with the line of centres at the momenta of impact. If $e = \frac{1}{2}$. Show that their path after impact are at rt angle.

6) Show that the general solution of Euler's equation for the integral $\int_a^b \frac{1}{y}\sqrt{1+\left(\frac{dy}{dx}\right)^2}\, dx$ is $(x-h)^2 + y^2 = k^2$.

7) State and prove Brachistochrone problem.

PART-C

III. Answer any **Four** of the following. **(4×10=40)**

8) a) Derive an expressions for tangential and normal velocities of a moving particle along the plane curve.

b) A point moves in a curve so that its tangential and normal accelerations are equal and tangent rotates with constant angular velocity. Show that intrinsic equation of the path is $S = Ae^{\varphi} + B$.

9) a) With usual notations prove that $F = h^2u^2\left[u + \frac{d^2u}{d\theta^2}\right]$.

b) If the central orbit is $a^n = r^n \cos n\theta$. Find the law of force.

10 a) A partical of mass m is projected from a fixed point into the air with the velocity u, in a direction making an angle 2 with the horizontal. Find the motion and path described.

b) A particle is projected in a direction making an angle θ with horizon. If it passes through the points (x_1, y_1) and (x_2, y_2) reffered to the horizontal and vertical axes through the point of projection then

Prove that $\tan\theta = \frac{x_2^2 y_1 - x_1^2 y_2}{x_1 x_2 (x_2 - x_1)}$.

11) a) State and prove necessary condition of Euler's equation.

b) Find the curve passing through (0,0) and $(\pi, 0)$ along which the functional $\int_0^{\pi} (y'^2 + 2y\sin x)dx$ be an extremum.

12) a) Prove that the sphere is the soild figure of revolution which, for a given surface area S, has maximum volume.

b) Find the extremal for the functional $I = \int_0^1 (y'^2 + x^2)dx$ under the end conditions y(0)=0=y(1) and Subjected to the constraint $I = \int_0^1 y dx = \frac{1}{6}$.

Reg. No. | | | | | | | | |

V Semester B.Sc. 4/3 Degree Examination, April - 2022

CHEMISTRY(Optional)

Paper : I

(Repeater/Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All questions are compulsory.*
2. *Answer all questions in the same answer book.*
3. *Draw neat diagrams and Give equations wherever necessary.*

SECTION - A

Answer any **Ten** of the following. **(10×2=20)**

1. a) Give the IUPAC name of the following.

i) $K_4 [M_0 (CN)_6]$ ii) $[Cr(H_2O)_4cl_2]cl$.

b) Define hydrate isomerism .Give an example.

c) Write von-weirmann equation.

d) What are phosphonitrilic compounds ? Give one example

e) What are condensed heterocycles ? Example.

f) How do you synthesise Barbituric acids from diethyl malonate ?

g) What are alkaloids ?

h) How do you detect presence of carbonyl group in Hygrine ?

i) What is zero point energy ?

j) State Hookes law.

k) Which type of molecule show's rotational spectrun ?

l) Write phase rule equation and name the terms involved.

SECTION - B

Answer any **Four** of the following **(4×5=20)**

2. Explain the structure of $[Fe(CN)_6]^{4-}$ on the bases of VBT.

3. Explain co-precipitation and post-precipitation

4. Discuss the structure of Conine.

[P.T.O.

5. Explain the acidity of α - hydrogenation in Ethyl Aceto Acetate (EAA)

6. Draw the phase diagram of sulphur system and discuss the application of phase rule.

7. Discuss the determination of force constant for vibrational spectrum.

SECTION - C

Answer any **Four** of the following **(4×10=40)**

8. a) What are In Organic polymer ? Discuss the classification of in organic polymer.

   b) Write the principles of green chemistry.

9. a) Discuss the M.O picture of pyridine.

   b) How do you synthesise.

      i) Dicarboxylic acid ii) ketone from Ethyl Aceto Acetate(EAA)

10. a) The rotational spectrum of HCL shows a series of lines separated by 20.8cm. find the moment of inertia and the bond distance.

    (Given : NA = 6.023×10^{23} , C = 3×10^{8} mts/sec , h = 6.626×10^{-34} joules)

    b) Draw the phase diagram and discuss the phase-rule of Bismuth- cadmium system.

11. a) What is geometrical isomerism ? Explain with four Co-ordinate complex.

    b) Write the Hoffmann's exhaustive methylation of pyridine .

12. a) Explain the energy levels of diatomic molecules (rigid rotator).

    b) Discuss the comparative basic character of pyrrole, pyridine and piperidine.

online

42526/35526/E260

Reg. No. | | | | | | | | |

V Semester B.Sc. 4/3 Degree Examination, April - 2022

CHEMISTRY (Optional)

Paper : II

(Repeater / Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *ALL Questions are Compulsory.*
2. *Answer ALL Questions in the Same Answer Book.*
3. *Draw neat Diagram and Give Equations wherever necessary*

SECTION - A

Answer any **TEN** of the following. **(10×2=20)**

1. a) What are ferrous and nonferrous alloys? Give examples.
   b) What is Cement? Mention its Raw Materials.
   c) Give two advantages of Gaseous fuels.
   d) Write any two applications of natural abrasives.
   e) How PCC is Prepared?
   f) What is base peak in mass spectroscopy?
   g) What are azo dyes? Give an example.
   h) Mention two applications of $LiA1H_4$.
   i) Write BET equation and mention the terms involved in it.
   j) Give one example when K_p becomes equal to K_c.
   k) Explain homogeneous catalysis with example.
   l) What is Chain-inhibition? Give example.

SECTION - B

Answer any **FOUR** of the following. **(4×5=20)**

2. How is brass manufactured by fusion method. Give two uses of brass?
3. Explain the manufacture of Port Land Cement by dry process.

[P.T.O.

4. Write the mechanism of formation of Amide by using DCC.

5. Give the principle of mass spectroscopy & explain Mc-Lafferty rearrangement.

6. Describe the determination of surface area using BET equation.

7. Explain the steps involved in the mechanism of chain reaction with suitable example.

SECTION - C

Answer any **FOUR** of the following. **(4×10=40)**

8. a) Explain manufacture of glass using tank furnace.

   b) Explain manufacture of bio-gas. Give its composition & two uses.

9. a) Give the synthesis and uses of

      i) Malachite Green.

      ii) Eosin.

   b) Explain the mechanism of OsO_4 hydroxylation of alkenes.

10. a) Explain intermediate compound formation theory of Catalysis.

    b) Derive relationship between K_p, K_c and K_x.

11. a) Write a note on Varnishes and Paints.

    b) Derive Van't Hoff's reaction isotherm.

12. a) Write the synthesis of DDQ and How it is used in the Benzylic oxidation of tetralin?

    b) Explain manufacture and application of Carborandum.

42542/E420

Reg. No. | | | | | | | | |

V Semester B.Sc. 4 Degree Examination, March - 2022

PHYSICS

Paper : I

(Repeater / Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *Calculator are allowed to solve the problems.*
2. *Write Intermediate Steps.*

PART - I

Answer any **TEN** questions. **(10×2=20)**

1. a) What is Configuration Space?

   b) State the Principle of Virtual Work.

   c) What is Holonomic Constraints? Give one example.

   d) What is Bounded Motion?

   e) State Kepler's first law of Planetory Motion.

   f) What is Length Contraction?

   g) Define Zener Breakdown and Avalanch Breakdown.

   h) State Maximum Power Transfer Theorem.

   i) What is negative feedback?

   j) How much electric energy could theoretically be obtained by annihilation of 1×10^{-3} Kg of matter.

   k) The applied input Ac-power to a bridge rectifier is 150 Watts. Find the DC - output power if the rectification efficiency is 80%.

   l) The amplification factor of FET is 3.5. Calculate the mutual conductance, if the drain resistance is 2.5 $K\Omega$.

PART - II

Answer any **FOUR** questions. **(4×5=20)**

2. Explain the application of Lagrange's equation in case of motion of a single particle in Polar coordinates.

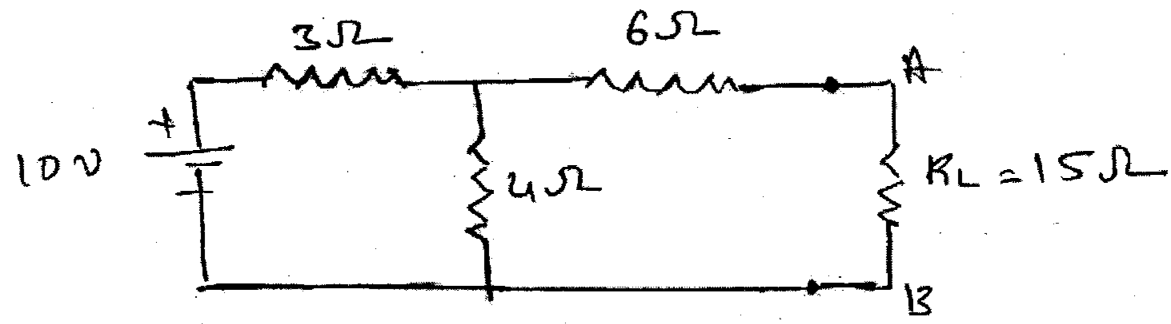
[P.T.O.

3. Derive Second Law of Planetory Motion.

4. Derive Einstein's Mass-energy relation.

5. Compute the mass and speed of an electron having kinetic energy 1.5 Meu. Given - rest mass of an electron, $m_0 = 9.1 \times 10^{-31}$ Kg m. Velocity of light in vacuum, $C = 3 \times 10^8$ m/sec.

6. Draw Norton's equivalent circuit of the given circuit. Find the current in the load resistance.



7. Hartly Oscillator has a capacitor of 150 PF and inductance of each part of the inductance coil is 2.5mH. Calculate the operating frequency of the oscillator neglecting the mutual inductance between the two coil.

PART - III

Answer any **FOUR** questions. **(4×10=40)**

8. Derive Lagrange's equation from D'Alembert's Principle.

9. Derive an expression for the total energy of a particle moving under central force.

10. Derive the relation for variation of mass with velocity.

11. State and Prove Thevenins's Theorem.

12. Explain the working of Hartley Oscillator, with a neat circuit diagram. Write expression for its frequency of oscillation.

42543/E430

Reg. No. | | | | | | | | |

V Semester B.Sc. 4 Degree Examination, March - 2022

PHYSICS

Paper : II

(Repeater / Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

Calculators are allowed to solve the problems.

PART - I

Answer any **TEN** of the following. **(10×2=20)**

1. a) Give the expression for Compton Shift.
   b) Mention any two properties of Lasers.
   c) What are Eigen function and Eigen values.
   d) Mention the quantum numbers used in vector model of atom.
   e) Give the expression for Lande's 'g' factor.
   f) Write the selection rule for rotational transistion.
   g) Define Co-herent and incoherent Scattering.
   h) Write the differential Equation for Hermite Polynomial.
   i) Mention two applications of Raman Effect.
   j) If the uncertainity in position of electron is $2A^{\circ}$. Calculate the uncertainity in momentum.
   k) Calculate interatomic distance between atoms of molecule given MI of molecule is 6.4×10^{-48} Kgm^2 and reduced mass is 1.6×10^{-27} Kg.
   l) Prove that $J_0^1 = -J_\perp$ using Bessel's Equation.

PART - II

Answer any **FOUR** of the following. **(4×5=20)**

2. State the de-Broglie hypothesis and derive the expression for de-Broglie Wave length.

[P.T.O.

3. Derive the expression for time independent Schrodinger Wave Equation.
4. Write a note on Quantum number associated with the vector model of atom.
5. Deduce the Zero point energy if the length of box is 10^{-10} m and there are 10 electrons in it, Find the total energy of the system.
6. Calculate the Zeeman shift observed in Normal Zeeman effect when spectral line of wavelength 5400 A^{o} is subjected to magnetic field of 1 Tesla, given $e = 1.6\times10^{-19}C$ and $m = 9.1\times10^{-31}kg$
7. Show that $J_{1/2}(x) = \sqrt{\left(\frac{2}{\pi x}\right)}\sin x$.

PART - III

Answer any **FOUR** of the following. **(4×10=40)**

8. Explain Division and Germer experiment to prove the de-Broglie hypothesis.
9. With neat diagram Explain the construction and working of Laser Diode.
10. What is Zeeman Effect? Mention the difference between Normal and anomalous zeeman effect. Explain the experimental setup used to observe the normal Zeeman Effect.
11. Give the theory of origin of pure rotational spectrum of diatomic molecule.
12. Derive Rodrigue's formula for Legendre's Polynomial.