05AT01

VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

College with Potential for Excellence

Residential & Autonomous – A Gurukula Institute of Life-Training

Re-accredited (3rd Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC

[Affiliated to Madurai Kamaraj University]

B.Sc. Physics/Chemistry Degree (Semester) Examinations, November 2021

Part – III: Allied Course: Third Semester: Paper – I

MATHEMATICS - I

Under CBCS and LOCF – Credit 4

Time: **3** Hours　　　　Max. Marks: **75**

SECTION – A

Answer ALL Questions (10 × 1 = 10)

1. The derivative of x^n is______

a) nx^{n-1}　　b) x　　c) non zero　　d) None

2. The value of $\cos^2 x - \sin^2 x$ is ___________

a) sin2x　　b) – cos2x　　c) cos2x　　d) None

3. The derivative of cothx is__________

a) $-\operatorname{cosech}^2 x$　　b) $\operatorname{cosech}^2 x$　　c) cosechxcothx　　d) None

4. The derivative of $\cosh^{-1} x$ is__________

a) $\frac{1}{1-x^2}$　　b) $\frac{1}{\sqrt{1+x^2}}$　　c) $\frac{1}{\sqrt{x^2-1}}$　　d) None

5. The value of $\int x^n dx$ is

a) $x^{n+1}/n+1$　　b) x^{n+1}/n　　c) $x^n/n+1$　　d) None

6. The value of $\int \frac{1}{1+x^2} dx$ is

a) $\tan^{-1} x$　　b) $\cos^{-1} x$　　c) $\sin^{-1} x$　　d) None

7. The vectors $\vec{a}$ & $\vec{b}$ are perpendicular if $\vec{a} . \vec{b} =$______

a) non zero　　b) 1　　c) 0　　d) None

8. If $\vec{f}$ is irrotational, then $\nabla \times \vec{f}$ is

a) 1 b) non zero c) zero d) None

9. The value of cosh2x = _______

a) $\cosh^2 x + \sinh^2 x$ b) $\cosh^2 x - \sinh^2 x$

c) coshx + sinhx d) None

10. The expansion of cos (A+B) = _________

a) cos A cos B – sin A sin B b) cos A cos B + sin A sin B

c) cos A sin A – cos Bsin A d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Write the expansion of sinθ.

12. Prove that $\cosh^2 x - \sinh^2 x = 1$.

13. If y = log(ax + b), find y_n.

14. Write any two properties of definite integrals.

15. Define divergence of a vector function.

16. When do you say the vector is irrotational?

17. State Stoke's theorem.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Express cos8θ in powers of sinθ.

[OR]

b) Prove that $\sin^7\theta = 1/64\,[35\sin\theta - 21\sin 3\theta + 7\sin 5\theta - \sin 7\theta]$.

19. a) Find y_n when $y = \frac{3}{(x+1)(2x-1)}$.

[OR]

b) If x = sinθ, y = cospθ, then prove that $(1 - x^2)y_2 - xy_1 + p^2y = 0$.

20. a) Prove that $\int_0^{\frac{\pi}{2}} cos^2 x\, dx = \frac{\pi}{4}$.

[OR]

b) Evaluate $\iint xydxdy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$.

21. a) Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^3$ at the (2, -1, 1) in the direction of $i+2j+2k$.

[OR]

b) Find ϕ if $\nabla\phi = (y + \sin z)\, i + x\, j + (x \cos z)\, k$.

22. a) If f = (2y + 3) i + xz j + (yz - x) k, evaluate $\int f.dr$ along the path $x = t^2$; $y = t$; $z = t^3$ from t = 0 to t = 1.

[OR]

b) Using Green's theorem to evaluate $\int f.dr$ where $f = (x^2 + y^2)i - 2xyj$ and C is the rectangle in the x – y plane bounded by y = 0, y = b, x = 0 and x = a.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. If cos (x + iy) = cos θ + i sin θ then prove that cos 2x + cos h2y = 2.

24. If y = a cos(log x) + b sin (log x) then prove that $x^2 y_2 + x y_1 + y = 0$.

25. Prove that $\int_0^{\pi/2} \log(sin\theta)\, d\theta = \frac{\pi}{2}\, log\left(\frac{1}{2}\right)$

26. Compute divergence, curl and curl of curl for the function $F = xy^3i - 2x^2yzj + 2yz^4k$ at (1, -1, 1).

27. Verify Gauss divergence theorem for $F = 4xi - 2y^2j + z^2k$ for the cylindrical region S given by $x^2 + y^2 = 2^2$; z = 0 and z = 3.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Allied Course: Third Semester: Paper – I

PROGRAMMING IN C

Under CBCS and LOCF – Credit 3

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. In C can declare__________

a) only one variable. b) Two variables.

c) Ten variables. d) any number of variables.

2. Each instruction in C program is terminated by___________

a) dot (.). b) Comma (,). c) Semi-colon (;) d) curly brace ({})

3. The assignment operator is _____________

a) = b) / c) & d) none of these

4. Which among the following is a unconditional control structure?

a) do-while. b) if-else. c) goto. d) for.

5. What is file?

a) collection of records. b) collection of argumentts.

c) group of arguments d) all.

6. Structure is a________________.

a) scalar data type. b) derived data type.

c) both a and b. d) primitive data type.

7. Which function reading information from keyboard

a) printf () b) puts() c) scanf() d) put()

8. Which is valid string function?

a) strpbrk() b) strlen() c) strxfrm() d) strcut()

9. A file opened in w+ mode can be________.

a) read/write. b) only read. c) only write. d) only close.

10. An unsigned integer variable contains values________.

a) greater or equal to zero. b) less than zero.

c) only zeros. d) (1) & (2) both.

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Outline the meant of Tokens.
12. Classify the relational operator in C.
13. Compare Entry control and Exit control loop in C.
14. How would you compare two strings?
15. Show your words for Function Call.
16. Explain the meaning of Files.
17. How would you classify the parts of Function?

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) How would you build Assigning values to variables? Give Example.

[OR]

b) How would you plan implicit type conversion in C? Give Example.

19. a) Explain what statement would you choose to find the biggest among three number in C. Give Example.

[OR]

b) How would you utilize Go to statement in C? Give Example.

20. a) How would you construct for print multiplication table using Two-Dimensional array?

[OR]

b) Select and explain the read and write function in String.

21. a) How to construct structures within structure in C?

[OR]

b) What is Union? How would you utilize the Union in C?

22. a) How would you apply pointers in an array in C?

[OR]

b) What function would you select to read and write character in file?

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. How would you classify data types in C?
24. Simplify and explain the switch statements in C with Example.
25. How would you dissect and explain the string handling function in C with Example?
26. How would you categorize the different type function in C? Give structure with Example.
27. List out and explain the random-access file in C.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: First Semester: Paper – I

ALGEBRA AND TRIGONOMETRY

Under CBCS and LOCF – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. If $x^4+px^3+qx^2+rx+s=0$ has roots as α,β,γ & δ then $\sum \alpha\beta\delta =$_______

   a) $-p$ b) $-r$ c) s d) None

2. In an equation $x^n - 1 = 0$ has only 1 as real roots if n is _________

   a) Odd b) even c) zero d) None

3. $\sum \alpha^2\beta\gamma = \sum \alpha\beta\gamma \ \text{X} \sum \alpha$ - _____________

   a) $\sum \alpha\beta^2$ b) $\left(\sum \alpha\right)^2$ c) $4\sum \alpha\beta\gamma\delta$ d) None

4. $\sum \alpha^3 =$ ______________ - 9 $\sum \alpha^2\beta$

   a) $\left(\sum \alpha\right)^2$ b) $\sum \alpha\beta^2$ c) $\left(\sum \alpha\right)^3$ d) None

5. If the G.P roots are -6, 2, -2/3 where k =2, then the value of r is ________

   a) – 2 b) 6 c) -1/3 d) None

6. If the roots of the equation is reduced by h, then x replaced by _________ in transformed equation.

   a) x – h b) x + h c) x/h d) None

7. The value of $\cosh(i\pi/2)$ is ________________

   a) 1 b) 0 c) – 1 d) None

8. The incorrect statement of the following is ____________

a) $\sinh 3x = 3\sinh x + 4\sinh^3 x$ b) $\cosh 3x = 4\cosh^3 x - 3\cosh x$

c) $\tanh 3x = \dfrac{3\tanh x - \tanh^3 x}{1 + 3\tanh^2 x}$ d) None

9. The value of $\cosh^2 x + \sinh^2 x$ = __________________

a) $\dfrac{e^{2x} + e^{-2x}}{2}$ b) $\dfrac{e^{2x} - e^{-2x}}{2}$ c) $\dfrac{e^{2x} + e^{-2x}}{2i}$ d) None

10. If z is real then Log z is ________________

a) Complex number b) real number

c) rational number d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find the roots of the equation $x^3 - 12x^2 + 39x - 28 = 0$ whose roots are in arithmetical progression.

12. Find the relation between the coefficients in the equation $x^4 + px^3 + qx^2 + rx + s = 0$ in order that the coefficients of x^3 and x may be removable by the same transformation.

13. Find the number of real roots of the equation $x^3 + 18x - 6 = 0$.

14. State Rolle's theorem.

15. Show that $cosh^2 x - sinh^2 x = 1$.

16. If $sin(A + iB) = x + iy$, prove that $\frac{x^2}{sin^2 A} - \frac{y^2}{cos^2 A} = 1$.

17. Define logarithms of complex quantities.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Show that every equation $f(x) = 0$ of the n^{th} degree has n and only n roots.

[OR]

b) If $\alpha, \beta, \gamma, \delta$ be the roots of the biquadratic equation $x^4 + px^3 + qx^2 + rx + s = 0$, Find the values of i) $\sum \alpha^2$, (ii) $\sum \alpha^2 \beta\gamma$ in terms of the coefficients.

19. a) Remove the second term from the equation $x^3 - 21x^2 + 144x - 320 = 0$ and hence solve the equation.

[OR]

b) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$, find the value of $(\alpha^2 + 1)(\beta^2 + 1)(\gamma^2 + 1)$.

20. a) Classify completely the nature of the roots of the equation $x^5 - 6x^2 - 4x + 5 = 0$.

[OR]

b) Find the condition that the cubic equation $ax^3 + 3bx^2 + 3cx + d = 0$ has two equal roots and when the condition is satisfied, find the equal roots.

21. a) If α, β, γ be the roots of the equation $x^3 + px^2 + qx + p = 0$, show that $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma = n\pi$ radians except when $q = 1$.

[OR]

b) If $\cos(x + iy) = \cos\theta + i\sin\theta$, prove that $\cos 2x + \cosh 2y = 2$.

22. a) Find the general value of logarithm of $x + iy$.

[OR]

b) If $\log\sin(\theta + i\varphi) = \text{L} + iB$, prove that $2e^{2\text{L}} = \cosh 2\varphi - \cos 2\theta$.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. i) Prove that in an equation with real coefficients, imaginary roots occur in pairs.

ii) Solve the equation $81x^3 - 18x^2 - 36x + 8 = 0$ whose roots are in harmonic progression.

24. Show that the equation $x^4 - 3x^3 + 4x^2 - 2x + 1 = 0$ can be transformed into a reciprocal equation by diminishing the roots by unity. Hence solve the equation.

25. Utilize Horner's method to find the positive root of the equation $x^3 - 2x^2 - 3x - 4 = 0$ correct to three places of decimals.

26. i) Express $\cos 8\theta$ in terms of $\sin\theta$.

ii) Separate into real and imaginary parts of $\tan^{-1}(x + iy)$.

27. Sum to n terms of the series $\sin\alpha + c\sin(\alpha + \beta) + c^2\sin(\alpha + 2\beta)$ ....
Hence find the sum of the series to infinity when $|c| < 1$.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: First Semester: Paper – II

DIFFERENTIAL CALCULUS

Under CBCS and LOCF – Credit 4

Time: **3** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The derivative of e^x is_______________

a) $-e^x$ b) e^x c) e^{-x} d) None

2. The value of $\cosh^2 x - \sinh^2 x$ is ________________

a) cosh2x b) 0 c) 1 d) None

3. $\frac{d}{dx}(g(f(x))) = g^1(f(x))$. _________________

a) g(x) b) f(x) c) $f^1(x)$ d) None

4. The derivative of $\tanh^{-1}x$ is__________________

a) $\frac{1}{1-x^2}$ b) $\frac{1}{\sqrt{1+x^2}}$ c) $\frac{1}{\sqrt{x^2-1}}$ d) None

5. The curvature of a circle of diameter d is_____________

a) 2d b) d c) $\frac{d}{2}$ d) $\frac{2}{d}$

6. The formula for length of the subnormal is____________

a) $\frac{y_1}{y}$ b) $\frac{y}{y_1}$ c) yy_1 d) None

7. In polar coordinates, $\frac{ds}{d\theta}$ is_____________

a) $\sqrt{r^2+\left(\frac{dr}{d\theta}\right)^2}$ b) $\sqrt{\left(r\frac{d\theta}{dr}\right)^2+1}$

c) $\sqrt{r^2+\left(\frac{dr}{d\theta}\right)^2}$ d) None

8. The chord of curvature of the curve y = f(x) parallel to y axis is_____

a) 2ρ cos ψ b) 2ρ sin ψ c) 2ρ tan ψ d) None

9. Any point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is___________

a) (a cosθ , b sinθ) b) (a tanθ, b secθ)

c) (a secθ , b tanθ) d) None

10. If x = cos θ, then $4x^3-3x$ is__________

a) Sin 3θ b) Cos 3θ c) Cos 2θ d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find $\frac{d}{dx}\left\{(1+x^2)\tan^{-1}x\right\}$

12. If $y=e^{ax}$ then find y_n.

13. If the curve $r=e^{\theta\cot\alpha}$ then find polar sub normal.

14. Define radius of curvature.

15. Find $\frac{d}{dx}\{x(x^2-1)(x^2+4)\}$

16. Define evolute.

17. If $y=\log(ax+b)$ then find y_3

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Differentiate $y=x\frac{\sqrt{a^2-x^2}}{2}+\frac{a^2}{2}\sin^{-1}\frac{x}{a}$

[OR]

b) Interpret the differential coefficient of $\frac{(a-x)^2(b-x)^3}{(c-2x)^3}$

19. a) If $y^{\frac{1}{m}}-y^{\frac{-1}{m}}=2x$ show that $(1-x^2)y_2+xy_1-m^2y=0$

[OR]

b) If $y=\sin(m\sin^{-1}x)$ show that $(1-x^2)y_2-xy_1+m^2y=0$ and

$(1-x^2)y_{n+2}-(2n+1)xy_{n+1}+(m^2-n^2)y_n=0$

20. a) Interpret $\frac{ds}{d\theta}$ *and* $\frac{ds}{dr}$ for the cardioid $r=a(1+\cos\theta)$

[OR]

b) Show that in the parabola $y^2=4ax$, the sub tangent at any point is double the abscissa and the sub normal is constant.

21. a) Show that the radius of curvature at any point of the cycloid

$x=a(\theta+\sin\theta)$ and $y=a(1-\cos\theta)$ is $4a\ \cos\frac{\theta}{2}$

[OR]

b) Interpret the radius of curvature of the cardioid $r=a(1-\cos\theta)$.

22. a) Explain $\frac{du}{dt}$ where $u = x^2 + y^2 + z^2 ; x = e^t ;\ y = e^t\ \sin t$ and

$z = e^t \cos t$

[OR]

b) Compare Euler's theorem when $u = x^3 + y^3 + z^3 + 3xyz$.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. If $x(1+y)^{1/2} + y(1+x)^{1/2} = 0$ prove that $\frac{dy}{dx} = \frac{-1}{(1=x)^2}$

24. Make use of the De Mover's theorem, to find n^{th} differential coefficient of $\cos^5 \theta \sin\ ^7\theta$

25. Make use of the angle of intersection, for the curves $x^2 = 4y\ and\ y^2 = 4x$ to find the angle of intersection.

26. Construct the center of curvature of the curve $x = a(\cos t + t\ \sin t);\ y = a(\sin t - \cos t)$ and prove that its evolute is a circle.

27. If $V = (x^2 + y^2 + z^2)^{-1/2}$ Prove that $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2}$ =0

05CT31

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: Third Semester: Paper – I

DIFFERENTIAL EQUATIONS

Under CBCS and LOCF – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The integrating factor of the differential equation $\frac{dy}{dx}+\frac{y}{x}=xe^x$ is ______

a) x b) $\frac{1}{x}$ c) x^2 d) x^3

2. The integrating factor of the differential equation $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$ is____________

a) $\frac{1}{x^2y^2}$ b) $\frac{1}{x^3y^2}$ c) $\frac{1}{x^2y^3}$ d) $\frac{1}{x^3y^3}$

3. The Particular integral of $(D^3+3D^2+3D+1)y=e^x$ is __________

a) $\frac{e^x}{8}$ b) $\frac{e^{-x}}{-8}$ c) $\frac{e^x}{-8}$ d) $\frac{e^{-x}}{8}$

4. The Particular integral of the differential equation $(D^2-9)y=\cos 3x$is ______

a) $\frac{\cos 3x}{18}$ b) $\frac{\cos 3x}{-18}$ c) $\frac{\cos 3x}{-9}$ d) none of them

5. The Auxiliary equation of the differential equation $\frac{d^2y}{dx^2}+4y=0$ is _______

a) $m^2-4=0$ b) $m^2=4$

c) $m^2=-2$ d) $m^2+4=0$

6. The value of $L(sinh\, at) =$

a) $\frac{s}{s^2+a^2}$ b) $\frac{a}{s^2+a^2}$ c) $\frac{s}{s^2-a^2}$ d) $\frac{a}{s^2-a^2}$

7. The value of $L\{t\ sinat\} =$

$\frac{as}{(s^2+a^2)^2}$ b) $\frac{2as}{(s^2+a^2)^2}$ c) $\frac{2as}{(s^2-a^2)^2}$ d) $\frac{as}{(s^2-a^2)^2}$

8. The value of $L^{-1}\left(\frac{7}{(s-2)^2+49}\right) =$

a) $e^{-2t}\, sinh\, 7t$ b) $e^{-2t}\, sin\, 7t$ c) $e^{2t}\, sin\, 7t$ d) $e^{2t}\, sinh\, 7t$

9. In a partial differential equation, s denotes

a) $\frac{\partial^2 z}{\partial x^2}$ b) $\frac{\partial^2 z}{\partial y^2}$ c) $\frac{\partial^2 z}{\partial x \partial y}$ d) $-\frac{\partial^2 z}{\partial x^2}$

10. In an equation $z = (x+a)^2 + (y+b)^2,\ r =$

a) 2 b) -2 c) -1 d) 0

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. The stress p in thick cylinders is given by $r\frac{dp}{dr} + 2p = 2c$ where c is a constant. Find p in terms of r.

12. Find complementary function of $(D^2 - 5D + 4)y = 0$

13. Write the condition of integrability of equation $Pdx + Qdy + Rdz = 0$

14. Find $L[\sin^2 t\ \cos^3 t]$

15. Find the complete integral of $p^2 + q^2 = npq$

16. Find $L^{-1}[\frac{s}{(s+2)^2}]$

17. Eliminate the arbitrary function from $z= f(x^2+y^2)$

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Show that the solution of the linear equation $\frac{dy}{dx} + y\cos x = \frac{1}{2}\sin 2x$ is $ye^{\sin x} = e^{\sin x}(\sin x - 1) + c$

[OR]

b) Show that the solution of the equation $\frac{dy}{dx} = \frac{x+2y-3}{2x+y-3}$ is $x + y - 2 = c^2(x-y)^3$.

19. a) Interpret the solution of $(D^2 + 5D + 6)y = e^x$

[OR]

b) Interpret the solution of $(D^2 + D + 1)y = x^2$.

20. a) Show that the general solution of the equations $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$ is $\phi(x^2 - y^2, x^2 - z^2) = 0$

[OR]

b) Demonstrate the solutions of the equations $(2D+1)x + Dy = \cos t$ $(Dx + (2D+1)y = 0\ where\ D = \frac{d}{dt}$ are

$x = Be^{\frac{t}{3}} - Ae^{-t} + \frac{1}{10}(3\cos t + 4\sin\ t)$ and

$y = Ae^{-t} + Be^{-t/3} - \frac{1}{10}(\sin t + 2\cos t)$.

21. a) Show that $L[\frac{\cos 3t - \cos 2t}{t}] = \frac{1}{2}\log(\frac{s^2+4}{s^2+9})$

[OR]

b) Show that $L^{-1}[\frac{s+2}{(s^2+4s+5)^2}] = \frac{te^{-2t}\sin t}{2}$

22. a) Form a partial differential equation by eliminating the arbitrary function f from $f(x^2+y^2+z^2, z^2-xy)$

[OR]

b) Interpret the solution of the equation $q = xp + p^2$

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Solve $\frac{dy}{dx} - y\tan x = \frac{\sin x \cos^2 x}{y^2}$.

24. Solve $(5+2x)^2 \frac{d^2y}{dx^2} - 6(5+2x)\frac{dy}{dx} + 8y = 6x$

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

26. Using Laplace transform, solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = \sin t$, given that $y = \frac{dy}{dt} = 0$ where t=0

27. Solve the equation $(y+z)p + (z+x)q = x + y$

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021
Part – III: Core Course: Third Semester: Paper – II
NUMERICAL METHODS
Under CBCS and LOCF – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. The method of obtaining the solution of the system of equations by reducing the matrix A to ____________ is known as Gauss – Jordan elimination method

   a) Upper triangular matrix b) Lower triangular matrix
   c) Diagonal matrix d) None

2. Gauss elimination method is _________________ method.

   a) Indirect b) Direct c) Iteration d) None

3. The order is a measure for the speed of ______________________

   a) Iteration b) Convergence c) Divergence d) None

4. *If* $f(x) = a_0x^n + a_1x^{n-1} + ... + a_n$, then $\Delta^n f(x) =$ ___________.

   a) $n\hbar a_0$ b) $n\hbar^n a_0$ c) $n!\hbar^n a_0$ d) None

5. $e^{hD} =$ _____________

   a) E^{-1} b) E c) Δ d) None

6. Gauss backward interpolation formula is used to interpolate the values of y for values of p lying between________________

   a) 0 and 1 b) – 1 and 0 c) – 1 and 1 d) None

7. ______________________ is independent of the order of arguments.

a) Lagrange's interpolation formula b) Divided difference formula

c) Stirling formula d) None

8. In Newton's forward interpolation formula $p =$ _______________

a) $\frac{x - x_0}{\hbar}$ b) $\frac{x - x_n}{\hbar}$ c) $\frac{x_0 - x}{\hbar}$ d) None

9. Put $n =$ ____________ in Newton's Cote's quadrature formula to get weddle's rule

a) 2 b) 4 c) 6 d) None

10. Taylor's series method is a powerful ________________ step method if we are able to find the successive derivatives easily.

a) Single b) Double c) Triple d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define an absolute error.

12. Solve the following equations by back substitution:

$$2x + 3y + 2z = 7 \qquad -3y + z = -2 \qquad 4z = 4$$

13. Find $\Delta\left(2^x\right)$

14. Find the first order differences for $f(x) = ab^{CX}$

15. Give Newton's forward interpolation formula for derivatives.

16. Give Simpson's three eighth rule formula.

17. Explain first order R-K method.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Using iteration method find the root of $x^3 - 3x + 1 = 0$ lying between 1 and 2 in seven iterations.

[OR]

b) Using Newton Raphson method find the real root of $x e^x - 2 = 0$ correct to three places of decimals.

19. a) Apply Newton Forward interpolation formula to find Y, when X = 48 for the following data

X	40	50	60	70	80	90
Y	184	204	226	250	276	304

[OR]

b) Use Lagrange's interpolation formula to find the value of y at x = 6 from the following data.

x	3	7	9	10
y	168	120	72	63

20. a) Derive the formula for derivatives using Newton's forward difference formula.

[OR]

b) Find $y'(x)$ for the following data.

x	0	1	2	3	4
y(x)	1	1	15	40	85

21. a) Derive Trapezoidal Rule using Newton Cote's quadrature formula.

[OR]

Find $\int_0^{\frac{\pi}{2}} \sin x \, dx$ by Simpson's one third rule dividing the range into six equal parts.

22. a) Compute $y(0.1)$ by Runge-Kutta method of fourth order for the differential equation $\frac{dy}{dx} = xy + y^2, (0) = 1.$

[OR]

b) Find an approximate solution of the initial value problem $y' = 1 + y^2,\ y(0) = 0$ by Picard's method.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. Solve the system of equations using Gauss Seidal iteration method:

$6x + 15y + 2z = 72$

$x + y + 54z = 110$

$27x + 6y - z = 85$

24. Solve the difference equation $u_{n+2} + u_{n+1} = n^2 + n + 1$

25. A rod is rotating in a plane. The following table gives the angle θ(radians) through which the rod has turned for various values of time t(seconds).

t	0	0.2	0.4	0.6	0.8	1.0
θ	0	0.12	0.49	1.12	2.02	3.20

Calculate the angular velocity and the angular acceleration of the rod when $t = 0.6$ seconds.

26. Find $\int_0^{10} \frac{dx}{1+x^2}$ by using (i) Trapezoidal rule (ii) Simpson one third rule.

27. If $\frac{dy}{dx} = 1 + xy; y(0) = 2$ then find $y(0.1), y(0.2)$ and $y(0.3)$ using Euler's method. Also find the values by Modified Euler's method.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021
Part – III: Core Course: Fifth Semester: Paper – I

STATISTICS

Under CBCS and LOCF – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. If $\gamma = 0$, then the lines of regression are ___________
   a) Parallel b) equal c) perpendicular d) None
2. If the two variables deviate in the same direction, the correlation is said to be
   a) direct b) inverse c) perfect d) None
3. Any sub set A of a sample space S is called
   a) Event b) Possible event c) Sure event d) None
4. The distribution function F(x) = ___________
   a) $P(X \geq x)$ b) $P(X \leq x)$ c) $P(X = x)$ d) None
5. If X_1& X_2 are independent R.V then $\phi_{(X_1+X_2)}(t) =$ _____________
   a) $\phi_{X_1}(t)\ \phi_{X_2}(t)$ b) $\phi_{X_1}(t) + \phi_{X_2}(t)$ c) $\phi_{X_1}(t)/\phi_{X_2}(t)$ d) None
6. The M.G.F of a binomial distribution about the origin
   a) $\left(p + qe^t\right)^n$ b) $\left(q + pe^{-t}\right)^n$ c) $\left(q + pe^t\right)^n$ d) None
7. Which relation is correct
   a) $\gamma_1 = \sqrt{\beta_1}$ b) $\gamma_2 = \beta_2 - 3$ c) $\beta_2 = \dfrac{\mu_4}{\mu_2^2}$ d) all
8. If Z follows N(0,1), then p.d.f is
   a) $\phi(z) = \dfrac{1}{\sqrt{2\pi}} e^{\frac{z^2}{2}}$ b) $\phi(z) = e^{-\frac{z^2}{2}}$
   c) $\phi(z) = \dfrac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$ d) None

9. _________ confidence limits for μ is $\left(\bar{x}-\frac{s.t_{.05}}{\sqrt{n-1}}, \bar{x}+\frac{s.t_{.05}}{\sqrt{n-1}}\right)$

a) 94% b) 95% c) 96% d) None

10. In χ^2 test, the population variance is ______________

a) S^2 b) N^2 c) σ^2 d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Write the types of correlation.
12. State Spearman's rank correlation coefficient formula.
13. State addition theorem of Probability.
14. Find mode if the mean and variance of a binomial distribution is 4 and 3 respectively.
15. Define Null hypothesis.
16. How do you differentiate large and small samples?
17. Where do you apply chi-square test?

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Calculate the coefficient of correlation for the following data:

x	64	65	66	67	68	69	70
y	66	67	65	68	70	68	72

[OR]

b) Given: N = 50, Mean of Y = 44, Variance of X = 9/16 of the variance of Y. Regression equation of X on Y is 3Y – 5X = -180.

Find: i) the mean of X and ii) coefficient of correlation between X and Y.

19. a) From a pack of well shuffled playing cards, two cards are drawn at random. What is the probability that it is (i) a diamond and a heart (ii) a king and a queen?

[OR]

b) Let X be a random variable with the probability distribution

x:	-3	6	9
p(x):	1/6	1/2	1/3

Find: i) E(X) ii) $E(X^2)$ iii) $E[(2X+1)^2]$

20. a) Derive the recurrence relation for the moments of the binomial distribution.

[OR]

b) Obtain the Moment generating function about the origin of the Normal distribution.

21. a) Write down the applications of t – distribution.

[OR]

b) A normal population has a mean of 6.8 and S.D. of 1.5. In a sample of 400 members mean is 6.75. Is the difference significant?

22. a) Test the hypothesis that σ = 10, given that s = 15 for a random sample of size 50 from a normal population.

[OR]

b) write a short note on the Chi-square test of goodness of fit of a random sample to a hypothetical distribution.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Ten competitors in a beauty contest are ranked by three judges in the following order:

I judge:	1	5	4	8	9	6	10	7	3	2
II judge:	4	8	7	6	5	9	10	3	2	1
III judge:	6	7	8	1	5	10	9	2	3	4

Use the rank correlation coefficient to determine which pair of judges has the nearest approach to common tastes in beauty.

24. a) Find the constant k such that the function

$f(x) = kx^2$, if $0 < x < 3$

$= 0$, elsewhere.

is the probability function. Compute $P(1 < X < 2)$

b) If A and B are independent events then prove that $\bar{A}$ and $\bar{B}$ are also independent events

25. Fit a Poisson distribution to the following data.

X:	0	1	2	3	4	Total
f:	79	18	2	1	0	100

26. Two random sample have the following results

Sample	Size	Sample mean	Sum of equals of deviation of mean
1	10	15	90
2	12	14	108

Test whether the samples come from the same normal population at 5% level of Significance for F- test [$F_{0.05}(9, 11) = 2.90$ $F_{0.05}(11, 9) = 3.10$]

27. The following figures show the distribution of digits in numbers chosen at random from a telephone directory:

Digits:	0	1	2	3	4	5	6	7	8	9	Total
Frequency:	1026	1107	997	966	1075	933	1107	972	964	853	10000

Test whether the digits may be taken to occur equally frequently in the directory.

05CT52

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: Fifth Semester: Paper – II

MODERN ALGEBRA

Under CBCS and LOCF – Credit 4

Time: **3** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Let S={1,2,3,4}.define a relation ρ on S as a ρ b⇔a<b.Then ρ is______

a){(1,2)(1,3),(1,4)} b){(1,2),(1,3),(1,4),(2,3),(2,4)}

c){(1,2),(1,3),(1,4),(2,3),(2,4),(3,4)} d){(1,1),(2,2),(3,3),(4,4)}

2. Let A be a finite set of size n. The number of element in the power set of A is____________

a) n^2 b) 2^n c) $2n$ d) $2n^2$

3. .if f:R $\rightarrow R$ *is given by* $f(x) = 2x - 1$ *and* $g: R \rightarrow R$ *is given by* $g(x) = 3x + 1$ *then the composition* $(fog)(x)$*is* ..

a) 6x+1 b) 6x-2 c) 5x d) $6x^2 - x - 1$

4. An element a is called idempotent if____________

a) $a^2 = e$ b) $a^2 = a$ c) a=a^{-1} d) a=2

5. Let G be a finite group. Let H and K be subgroup of G such that H is a subgroup of K. Then______________

a) [G : H][H : K] = [G: K] b) [G : K][K : H] = [G: H]

c) [G : K][H : K] = [G: H] d) none of the above

6. In the group $(Q, +)$the inverse of 0 is_______________

a) -1 b) 0 c) 1 d) none

7. The order of -1 in (Z,+) is_____________

a) 2 b) 1 c) 0 d) infinite

8. Index of the subgroup 5Z in (Z,+)is

a) 3 b).5 c)7 d) infinite

9. the set of generators of group $(Z_{12} \oplus)$ *is* ....

a)1,2,3,4 b) 1,3,6,9 c) 1,5,7,11 d) 2,3,5,7,11

10. An example of an infinite commutative ring without identity is

a) (Z,+,.) b) (Zn,⊕,⊗) c) (2Z,+,.) d) M2(R)

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Find fog and gof for the following f,g:R→R is given by f(x)=2x-1, g(x)=3x+1

12. Show that in a group G, $x^2 = x \ iff \ x = e$

13. Find the order of 2 and 3 in $(Z_8, \oplus)$.

14. Find the index of $\{0, 4\}$ in $(Z_8, \oplus)$.

15. Define: Isomorphism.

16. Write the definition for Ring.

17. If R is a ring S.t a^2=a for all $a \varepsilon R$, Prove that

i) a + a = 0

ii) a + b $\Rightarrow a = b$.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) If P and σ are equivalence relations defined on a set S, prove that $\rho n \sigma$ is an equivalence relation.

[OR]

b) Show that $f : R \rightarrow R$ defined by f(x) = 2x - 3 is a bijection and final its inverse. compute $f^{-1} 0 f \ and \ fof^{-1}$

19. a) Prove that A_η An is a group containing $\frac{n!}{2}$ permutations.

[OR]

b) Prove that a subgroup of a cyclic group is cyclic.

20. a) State and prove Lagrange's Theorem.

[OR]

b) Prove that a Subgroup of index two is normal.

21. a) Define Kernel of a homomorphism. Prove that the kernel is a normal Subgroup of G.

[OR]

b) State and Prove Fundamental theorem of Homomorphism.

22. a) Prove that Z_n is an integral domain iff n is prime.

[OR]

b) If F is any field then Prove that the only ideals of Fare $\{0\}$ and F.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. Show that $f : R \rightarrow (0,1)$ defined by $f(x) = \frac{1}{2}\left[1 + \frac{x}{1+1x1}\right]$ is a bijection.

24. Prove that the union of two subgroups of a group G is a subgroup iff one is contained in the other.

25. State and prove Fermat's theorem.

26. Prove that an isomorphism is an equivalence relation among groups.

27. R is a commutative ring with identity then prove that an ideal M of r is maximal iff R/M is field.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: Fifth Semester: Paper – III

REAL ANALYSIS

Under CBCS and LOCF – Credit 5

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **($10 \times 1 = 10$)**

1. The diameter of any non-empty subset with at least 2 elements in a discrete metric space is____________

a) 0 b) ∞ c) $-\infty$ d)1

2. In **R** with usual metric the correct statement is ________

a) [0,1) is an open set b) (0,1) is an open set

c) **Q** is open d) **Z** is open

3. In any metric space the incorrect statements is __________

a) Arbitrary intersection of closed sets is a closed set

b) the union of a finite number of closed sets is closed

c) The intersection of any family of open sets is open

d) the union of any family of open sets is open.

4. The incorrect statement is ____________

a) In **R** with usual metric any closed interval is a closedset

b) **Q** is not closed in **R**

c) Every closed ball in **R** is closed

d) The set of irrational numbers is closed in **R**

5. In **R** with usual metric an example of a set A with Int $\overline{A} = \Phi$ is __________

a) **Q**
b) **R – Q**
c) $\{0,1,\frac{1}{2},\frac{1}{3},\ldots,\frac{1}{n},\ldots\}$
d) [0,1]

6. Which of the following is a compact subset of R with usual metric?

a) **N**
b) **R**
c) [0,5]
d) $\{1,\frac{1}{2},\ldots\frac{1}{n},\ldots\}$

7. Which of the following is not a connected subset of **R**?

a) [1,2]
b) $(0,\infty)$
c) (3,4)
d) (1,2) U (2,3)

8. Which of the following pairs of the metric spaces (all with usual metric) are homeomorphic?

a) (0,1) and (0,2)
b) (0,4) and [0,4]
c) $[0,\infty)$ and $(1,\infty)$
d) [0,1] and **R**

9. Let (M,d) be any metric space. Let f : M $\to$**R**and g : M $\to$**R** be any two continuous functions. Then the incorrect statement is ___________

a) f + g is continuous
b) fg is continuous
c) cf is continuous, where c is constant
d) f/g is continuous

10. Which of the following statements is not true? The continuous image of

a) a connected metric space is connected
b) a compact metric space is compact
c) a complete metric space is complete
d) a complete and totally bounded metric space is complete and totally bounded

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. State Holder's inequality.

12. Determine whether d(x, y) defined on R by d(x, y) = $(x-y)^2$ is a metric or not.

13. Define interior point with example.

14. When will you say a metric space is separable? Give an example.

15. Define uniform continuous.

16. What do you mean by connected set? Give an example for a connected set.

17. Show that R with usual metric is not compact.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Prove that Q is countable.

[OR]

b) Prove that in any metric space (M, d) each open ball is an open set.

19. a) Let M be a metric space and M_1 be a subspace of M. Let $F_1 \subseteq M_1$. Prove that F_1 is closed in M_1, if there exists a set F which is closed in M such that $F_1 = F \cap M_1$.

[OR]

b) Let (M, d) be a metric space. Let A, B $\subseteq$ M. Prove that Int(A ∩ B) = Int A ∩ Int B.

20. a) Prove that for a convergent sequence (x_n) the limit is unique.

[OR]

b) Let (M_1, d_1) and (M_2, d_2) be two metric spaces. Prove that a function $f : M_1 \to M_2$ is continuous if $f^{-1}(F)$ is closed in M_1 whenever F is closed in M_2.

21. a) Prove that a metric space M is connected iff there does not exist a continuous function f from M onto the discrete metric space $\{0,1\}$.

[OR]

b) State and prove the intermediate value theorem.

22. a) Prove that any compact subset A of a metric space M is bounded.

[OR]

b) Let f be a continuous mapping from a compact metric space M_1 to any metric space M_2. Then prove that $f(M_1)$ is compact.

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. State and prove Minkowski's Inequality.

24. Let M be a metric space and A $\subseteq$ M. Then prove that $\overline{A} = A \cup D(A)$.

25. State and prove Cantor's Intersection theorem.

26. Prove that a subspace of R is connected iff it is an interval.

27. State and prove Heine Borel theorem.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Core Course: Fifth Semester: Paper – IV

STATICS

Under CBCS and LOCF – Credit 4

Time: **3** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Two forces P and Q act at a point at an angle α. Then minimum value of the resultant is_____________

   a) P-Q b) P + Q c) P/Q d) None

2. The resultant of two forces represented completely by $\overline{OA}$ *and* $\overline{OB}$ is represented by _____________, where C is the middle point of AB.

   a) $\overline{OC}$ b) $2\overline{OC}$ c) $\overline{AB}$ d) None

3. The resultant of two unlike and unequal parallel forces act near the _____________ force.

   a) Smaller b) greater c) equal d) None

4. Two parallel forces are said to be _________ when they act in the same direction.

   a) Like b) unlike c) neither like nor unlike d) None

5. The _______________ of the body acts vertically downwards through its center of gravity.

   a) Mass b) weight c) shape d) None

6. When a rod is resting with one end in contact with a smooth plane, the angle between the reaction R and the plane at the point of contact will be ___________.

   a) 0 b) 45^0 c) 90^0 d) None

7. When two bodies are in contact the direction of the friction at the point of contact is ___________ to the direction would commence to move.

a) Same b) opposite c) parallel d) None

8. In a parallelogram the ___________ bisects each other.

a) Sides b) angles c) diagonals d) None

9. In catenary, if two points A and B from where the string is suspended are in the horizontal line, then the distance CD the depth of the lowest point below AB is called the ___________.

a) Sag b) span c) directrix d) None

10. Let OC represents a given force F and OX, OY be two lines making angles α and β with OC. Then component of force along OY is ______.

a) $\frac{F\sin\alpha}{\sin(\alpha+\beta)}$ b) $\frac{F\sin\beta}{\sin(\alpha+\beta)}$ c) $\frac{F\sin\beta}{\cos(\alpha+\beta)}$ d) None

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. State perpendicular triangle of forces.

12. State the extended form of parallelogram law of forces.

13. Give the conditions of equilibrium of three coplanar parallel forces.

14. Define limiting friction.

15. Define the Cartesian equation to the catenary.

16. What do you mean by a couple?

17. Define angle of friction.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) State and prove Lami's theorem.

[OR]

b) Five forces acting at a point are represented in magnitude and direction by the lines joining the vertices of any pentagon to the midpoints of their opposite sides. Show that they are in equilibrium.

19. a) At what height from the base of a pillar must the end of a rope of a given length be fixed so that a man standing on the ground and pulling at its other end with a given force may have the greatest tendency to make the pillar overturn?

[OR]

b) ABC is an equilateral triangle of side a: D.E.F divide the sides BC, CA, AB respectively in the ratio 2 : 1 . Three forces each equal to P act at D, E, F perpendicularly to the sides and outward from the triangle. Prove that they are equivalent to a couple of moment (½)Pa.

20. a) A beam of weight W hinged at one end is supported at the other end by a string so that the beam and the string are in a vertical plane and make the same angle θ with the horizon. Show that the reaction at the hinge is $\frac{W}{4}\sqrt{8+\ cosec^2\theta}$

[OR]

b) Forces 3,2,4,5 kg wt. act respectively along the sides AB, BC, CD and DA of a square. Find the magnitude of their resultant and the points where its line of action meets AB and AD.

21. a) A uniform sphere is held in equilibrium on a rough inclined plane of angle α by a force of magnitude $\frac{W}{2}\sin\alpha$ applied tangentially to its circumference, where W is the weight of the sphere. Prove that the force must act parallel to the plane and that the coefficient of friction must be not less than $\frac{1}{2}\tan\alpha$.

[OR]

b) Prove that angle of repose of a rough inclined plane is equal to the angle of friction.

22. a) Prove that tension at any point is proportional to the height of the point above the origin.

[OR]

b) The span of a suspension bridge is 100 mts and the sag at the middle of the chain is 10 mts. If the total load on each chain is 750 quintals, find the tension at the lowest point.

SECTION – D

Answer any THREE Questions **($3 \times 10 = 30$)**

23. E is the middle point of the side CD of a square ABCD. Forces 16, 20, $4\sqrt{5}$,$12\sqrt{2}$kg. wt. Act along AB, AD, EA, CA in the directions indicated by the order of the letters. Show that they are in equilibrium.

24. State and prove Varigon’s theorem.

25. A uniform rod, of length a, hangs against a smooth vertical wall being supported by means of a string of length l, tied to one end of the rod, the other end of the string being attached to a point in the wall; show that the rod can rest inclined to the wall at an angle θ is given by $\cos^2\theta = \frac{l^2 - a^2}{3a^2}$.. What are the limits of the ratio of a : l in order that equilibrium may be possible?

26. A uniform cylinder of height h is placed with its plane circular base of radius r on a rough inclined plane and the inclination of the plane to the horizon is gradually increased. Show that the cylinder will

i) slide before it topples over if μ, the coefficient of friction is less than $\frac{2r}{h}$

ii) topple if μ is greater than $\frac{2r}{h}$. What happens if $\mu = \frac{2r}{h}$?

27. A uniform chain of length l is to be suspended from two points in the same horizontal line so that either terminal tension is n times that at the lowest point. Show that the span must be

$$\frac{1}{\sqrt{n^2 - 1}}\log\left(n + \sqrt{n^2 - 1}\right).$$

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – III: Elective Course: Fifth Semester: Paper – I

LINEAR PROGRAMMING

Under CBCS and LOCF – Credit 5

Time: **3** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. Which of the following is not correct about LPP?

a) All constraints must be linear relationships.

b) Objective function must be linear

c) All the constraints and decision variable must be of either $' \leq '$ or $' \geq '$ tybe

d) All decision variable must be non-negative.

2. Which of the following is not correct?

a) Feasible solution of an LPP is independent of the objective function.

b) The feasible region of an LPP must be a convex set.

c) The feasible region for a constraint is restricted if its$\geq$ or $\leq$sign is replaced by a $=$ sign.

d) It is not possible to obtain feasible solution of an LPP by graphical method.

3. A necessary and sufficient condition for a basic feasible solution to a minimization LPP to be an optimum is that (for all j):

a) $z_j - c_j \geq 0$ b) $z_j - c_j \leq 0$

c) $z_j - c_j = 0$ d) $z_j - c_j > 0$ or$z_j - c_j < 0$

4. Which of the following is not correct?

a) An LPP may have no optimum solution, a unique and optimum solution, multiple optimum solution or an unbounded solution

b) In the optimum solution to an LPP if a basic variable is zero, then multiple optimum solutions are indicated

c) Multiple optimum solutions to an LPP would all have the same objective function values and would consume the same amount of the resources

d) The inverse of a square matrix can be obtained by using *Simplex method*

5. The right hand side constant of a constraint in a primal problem appears in the corresponding dual is

a) a coefficient in the objective function

b) a right hand side constant of a constraint in a dual problem

c) an input-output coefficient d) none of the above

6. The number of primal constraints is equal to the number of ________

a) dual variables b) dual constraints c) both a and b d) none of them

7. While solving the T.P the occurrence of degeneracy means that

a) Total supply equals total demand

b) The solution so obtained is not feasible

c) The few allocations become negative

d) None of the above

8. In a T.P, existence of a feasible solution if and only if _________

a) total supply = total demand

b) total supply< total demand

c) total supply> total demand

c) total supply not equal to total demand

9. In an assignment problem, origin is called

a) resources b) activity

c) destination d) basis

10. In making assignments, which of the following should be preferred

a) Only that row which have single zero

b) Only that column which have single zero

c) Only a row/column that have single zero

d) Only column having more than zero

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Define feasible solution to a general LPP.

12. Find the standard form of the following LPP

Minimize $z = 2x_1 + x_2 + 4x_3$ subject to the constraints:

$-2x_1 + 4x_2 \leq 4,\ x_1 + 2x_2 + x_3 \geq 5,\ 2x_1 + 3x_3 \leq 2,\ x_1, x_2 \geq 0$ and x_3 unrestricted in sign.

13. Which property of solutions of LPP is stated in fundamental theorem of linear programming?

14. What are the two fundamental conditions on which the simplex method is based?

15. Define Primal-Dual pair in matrix form when the LPP is of maximization type.

16. What is the necessary and sufficient condition for the existence of a feasible solution to the general transportation problem?

17. Define the term optimum strategy in a game.

SECTION – C

Answer ALL Questions **(5 × 5 = 25)**

18. a) Explain the procedure for mathematical formulation of a linear programming problem.

[OR]

b) Show that the set of all feasible solutions to an LPP is a convex set.

19. a) Explain the major steps involved in obtaining the optimal solution to a general LPP.

[OR]

b) Show that any convex combination of k different optimum solutions to an LPP is again an optimum solution to the problem.

20. a) Rephrase the following LPP in its standard form and obtain the dual problem:

Minimize $z = 4x_1 + 6x_2 + 18x_3$ subject to the constraints:

$x_1 + 3x_2 \geq 3$, $x_2 + 2x_3 \geq 5$, $x_1, x_2, x_3 \geq 0$.

[OR]

b) Summarize the information that can be observed from the definition of general Primal-Dual pair.

21. a) Show that the number of basic variables of the general transportation problem at any stage of feasible solution must be m+n-1.

[OR]

b) Explain the North-West corner method to obtain an initial basic feasible solution of a transportation problem.

22. a) Summarize the procedure of locating the saddle point of a payoff matrix in a game.

[OR]

b) Show that the value of the game whose payoff matrix is

$$\begin{array}{cc} & P2 \\ P1 & \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{array} \; is\, 17/5.$$

SECTION – D

Answer any THREE Questions **(3 × 10 = 30)**

23. Solve the following LPP graphically:

Maximize $z = 2x_1 + 4x_2$ subject to the constraints:

$x_1 + 2x_2 \le 5$, $x_1 + x_2 \le 4$, $x_1, x_2 \ge 0$.

24. Solve the following LPP using Two-Phase method:

Maximize $z = 5x_1 - 4x_2 + 3x_3$ subject to the constraints:

$2x_1 + x_2 - 6x_3 = 20$, $6x_1 + 5x_2 + 10x_3 \le 76$, $8x_1 - 3x_2 + 6x_3 \le 50$,

$x_1, x_2, x_3 \ge 0$.

25. Solve the following LPP using duality:

Maximize $z = 2x_1 + x_2$ subject to the constraints:

$x_1 + 2x_2 \le 10$, $x_1 + x_2 \le 6$, $x_1 - x_2 \le 2$, $x_1 - 2x_2 \le 1$, $x_1, x_2 \ge 0$.

26. Solve the following transportation problem:

	D1	D2	D3	D4	Supply
S1	3	7	6	4	5
S2	2	4	3	2	2
S3	4	3	8	5	3
Demand	3	3	2	2	

27. Solve the following assignment problem:

	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

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B.A. / B.Sc. Degree (Semester) Examinations, November 2021

Part – IV: Non-Major Elective Course: First Semester: Paper – I

FUNDAMENTALS OF MATHEMATICS

Under CBCS and LOCF – Credit 2

Time: **2** Hours | Max. Marks: **75**

SECTION – A

Answer ALL Questions (10 × 1 = 10)

1. $\frac{5^4}{5^2}$ is equal to ____________

a) 5^4 b) 4^5 c) 5^2 d) 125^2

2. In the ratio 3:2 = a:8 the value of a is __________

a) 10 b) 8 c) 14 d) 12

3. Find the identity Matrix

a) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} 0 & 1 \\ 2 & 3 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 2 \\ 0 & 0 \end{pmatrix}$ d) None

4. Find the Scalar matrix

a) $\begin{pmatrix} 5 & 0 \\ 0 & 5 \end{pmatrix}$ b) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ c) $\begin{pmatrix} 0 & 1 \\ 0 & 5 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 0 \\ 0 & 5 \end{pmatrix}$

5. The slope of the straight line ax +by+c=0 is

a) $^{c}/_{a}$ b) $^{c}/_{b}$ c) $^{b}/_{a}$ d) $^{-a}/_{b}$

6. Find the duplicate of the ratio a:b is ___________

a) 8:27 b) 4:9 c) 5:1 d) 25:10

7. The Fifth term in the GP 3,6, 12……… is

a) 28 b) 25 c) 82 d) 48

8. The distance between (0,0) and (6,8) points by ______________

a) 5 b) 10 c) 20 d) 30

9. The ratio between any terms to the previous terms of GP is _____________

a) common difference b) Ratio

c) common ratio d) Term

10. The decimal value of the 4:20 is

a) 0.1 b) 0.2 c) 0.3 d) 0.4

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. Evaluate$(5a^2)^3$

12. Find the compound ratio for 3:2 and 4:5

13. Calculate the distance between the points (3,7) and (4,8)

14. Find the slope of the line joining the two points (-3,2) and (6,7)

15. If A = $\begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix}$ and B = $\begin{pmatrix} 1 & 3 \\ 4 & 1 \end{pmatrix}$ to find A+B

16. Define Geometric Progression

17. Find the mean proportional to 20 and 180

SECTION – C

Answer ALL Questions **(3 × 9 = 27)**

18. a) If $x=2^{2/3}+2^{1/3}$, then prove that $x^3-6x=6$

[OR]

b) Simplify: $\frac{2^5.8^2.4^3}{2.(64)^2}$

19. a) Find the mean proportion of 9 and 40 and the third proportion between 4 and 6.

[OR]

b) Check whether the points A (8,0) B (4,0) C (5,1) D (9,1) form a parallelogram

20. a) Find the roots of $2x^2+9x+10=0$

[OR]

b) If A= $\begin{pmatrix} 2 & 4 \\ 1 & 2 \end{pmatrix}$, B= $\begin{pmatrix} 1 & 1 \\ -3 & 2 \end{pmatrix}$ and C= $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Find: i) 2A+3B-2C ii) A^2 iii) B^2

SECTION – D

Answer any TWO Questions **(2 × 14 = 28)**

21. Monthly income of A and B are in the ratio of 5:6 and their expenses in the ratio 4:5. If each save ₹ 200 per month. Find their incomes.

22. i) Prove that $\left(\frac{x^a}{x^b}\right)^{a+b}$ x $\left(\frac{x^b}{x^c}\right)^{b+c}$ x $\left(\frac{x^c}{x^a}\right)^{c+a}$ = 1

ii) If a^x=b, b^y=c, c^z=a prove that xyz= 1

23. Show that the points (8, -10) (7, -3) and (0, -4) are vertices of right angle Triangle

24. If A= $\begin{pmatrix} 1 & 2 & 3 \\ 0 & 2 & 1 \\ 3 & 2 & 0 \end{pmatrix}$ Find A^{-1}

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021

Part – IV: Skill Based Course: Third Semester: Paper – I

MATHEMATICAL LOGIC

Under CBCS and LOCF – Credit 2

Time: **2** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions: **(10 × 1 = 10)**

1. Which of the following is an idempotent Law?

a) pvp ⇒ b) p→q c) p : q d) None

2. Which one of the following is biconditional law?

a) ¬ b) ∧ c) ⇔ d) None

3. p ∨(p ∧q) ⇔

a) q b) p c) 7q d) 7p

4. p→ q ⇔ _________

a) 0 b) 1 c) p d) None of these

5. ¬ (p ∨q) =

a) ¬ p ∧¬q b) ¬ p ∨¬q c) ¬ p d) None

6. p ∧0 = ___________

a) 1 b) ¬ p ∧¬q c) 0 d) ¬q

7. ¬ (p ∧q) = _____________

a) ¬ p∧q b) ¬ p ∨¬q c) 0 d) 1

8. p ∨(p∨q) = _____________

a) 0 b) 1 c) p d) None

9. $p \wedge \neg q$ = _______________

a) p b) $\neg p$ c) 1 d) 0

10. $p \vee 0$ = _________

a) 1 b) p c) 0 d) $\neg$ p

SECTION – B

Answer any FIVE Questions: **(5 × 2 = 10)**

11. Write the truth table for conditional operator.
12. Write the truth table for biconditional operator.
13. Write the Associate Law
14. Write the Abortion Law
15. Write the Commutative Law
16. Define a Tautology
17. Write the Distributive Law

SECTION – C

Answer ALL Questions: **(3 × 9 = 27)**

18. a) Verify whether:

i) $(p \vee q) \rightarrow q$ is a tautology ii) $(p \vee \neg q)$ is a tautology

[OR]

b) Prove that $(p \rightarrow q) \Rightarrow (\neg p \rightarrow \neg q)$

19. a) i) Construct the truth table i) $p \Rightarrow (q \rightarrow r)$ ii) $p \rightarrow (q \wedge r)$

[OR]

b) Prove by truth table method $(p \vee q) \Rightarrow \neg(\neg p \wedge \neg q)$

20. a) Prove by Replacement Process $(p \rightarrow q) \wedge (R \rightarrow q) \Leftrightarrow (p \vee q) \rightarrow Q$

[OR]

b) Check for Tautology $(p \vee q) \vee r$

SECTION – D

Answer any TWO Questions: **(2 × 14 = 28)**

21. Construct the truth table for $(p \wedge q) \vee (q \wedge r) \vee (r \wedge p)$
22. Construct the truth table for $(p \vee q) \vee (r \vee s)$
23. Prove that $(P \rightarrow Q) \wedge (Q \rightarrow R) \Rightarrow (P \vee R) \rightarrow Q$
24. Construct the truth table for $P \rightarrow (Q \rightarrow R)$

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B.Sc. Mathematics Degree (Semester) Examinations, November 2021
Part – IV: Skill Based Course: Fifth Semester: Paper – I

QUANTITATIVE APTITUDE

Under CBCS and LOCF – Credit 2

Time: **2** Hours Max. Marks: **75**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. A does a work in 10 days and B does the same work in 15 days. In how many days they together will do the same work?
   a) 5 days b) 6 days c) 8 days d) 9 days
2. A and B can do a work in 12 days, B and C in 15 days, C and A in 20 days. If A, B and C work together, then in how many days they will complete the work?
   a) 5 days b) 7 days c) 10 days d) 15 days
3. A car moves at the speed of 80 kmph. What is the speed of the car in meters per second?
   a) 8 m/s b) 20 m/s c) 22 2/9 m/s d) 25 m/s
4. If two trains of length a meters and b meters are moving in opposite directions at u m/s and v m/s respectively, then time taken by the trains to cross each other is ______________.
   a) (a+b)/(u-v) b) (a+b)/(u+v) c) (a-b)/(u-v) d) (a-b)/(u+v)
5. A train moves with a speed of 108 kmph. Its speed in m/s is __________.
   a) 10.8 b) 18 c) 30 d) 38.8

6. The simple interest at x % for x years will be Rs. x on a sum of ____.

a) ₹ x b) ₹ 100 / x c) ₹ 100 x d) ₹ 100 / x^2

7. What is the formula to find Amount when interest is compounded Quarterly?

a) $P\left[1+\frac{\left(R/2\right)}{100}\right]^{2n}$ b) $P\left[1+\frac{\left(R/4\right)}{100}\right]^{4}$ c) $P\left[1+\frac{\left(R/4\right)}{100}\right]^{n}$ d) $P\left[1+\frac{\left(R/4\right)}{100}\right]^{4n}$

8. The present worth of Rs. x due in n years, when the rate of interest R% is ___________.

a) $x\left(1+\frac{R}{100}\right)^{n}$ b) $\frac{\left(1+\frac{R}{100}\right)^{n}}{x}$ c) $\frac{x}{\left(1+\frac{R}{100}\right)^{n}}$ d) $\frac{1}{x\left(1+\frac{R}{100}\right)^{n}}$

9. $\text{Log}_a(xy)$ is _______________.

a) $\text{Log}_a(x+y)$ b) $\text{Log}_a x + \text{Log}_a y$ c) $\text{Log}_a x / \text{Log}_a y$ d) $\text{Log}_a(x-y)$

10. The value of $\log_2 16$ is ______________.

a) 1/8 b) 4 c) 8 d) 16

SECTION – B

Answer any FIVE Questions **(5 × 2 = 10)**

11. A and B working together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work?

12. A cyclist covers a distance of 750 meters in 2 min 30 sec. What is the speed in kmph of the cyclist?

13. A train 100 meter long is running at the speed of 30 kmph. Find the time taken by it to pass a man standing near the railway line?

14. A train 280 meter long running with a speed of 63 kmph. How much time the train will take to pass a tree?

15. At what rate percent per annum will a sum of money double in 16 years?

16. A sum of ₹ 12,500 amounts to ₹ 15,500 in 4 years at the rate of simple interest. What is the rate of interest?

17. Find the amount on ₹ 7,500 at 4% per annum for 2 years, compounded annually?

SECTION – C

Answer ALL Questions **(3 × 9 = 27)**

18. a) A and B can do a piece of work in 18 days; B and C can do it in 24 days; A and C can do it in 36 days. In how many days will A, B and C finishes it, working together & separately?

[OR]

b) A man travelled from the village to the post office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 min, find the distance of the post office from the village?

19. a) A train is moving at a speed of 132 kmph. If the length of the train is 110 meters, how long will it take to cross a railway platform 165 meters long?

[OR]

b) A man is standing on a railway bridge which is 180 meters long. He finds that a train crosses the bridge in 20 seconds but himself in 8 seconds. Find the length of the train and its speed?

20. a) A sum of ₹ 800 amounts to ₹ 920 in 3 years at simple interest. If the interest rate is increased by 3% it would amount to how much?

[OR]

b) If ₹ 500 amount to ₹ 583.20 in two years compounded annually, find the rate of interest per annum?

SECTION – D

Answer any TWO Questions **(2 × 14 = 28)**

21. 2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days. In how many days can 2 men and 1 boy do the work?

22. Two trains 137 meters and 163 meters in length are running towards each other on parallel lines, one at the rate of 42 kmph and the other at 48 kmph. In what time will they be clear of each other from the moment they meet?

23. A certain sum of money amounts to ₹ 1008 in 2 years and to ₹ 1164 in 3 ½ years. Find the sum and rate of interest?

24. Find the compound interest on ₹ 16,000 at 20% per annum for 9 months, compounded quarterly?

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HAND HEART HEAD

CERTIFICATE COURSE EXAMINATIONS, November 2021

QUANTITATIVE APTITUDE

Time: **2** Hours Maximum Marks: **50**

SECTION – A

Answer ALL Questions **(10 × 1 = 10)**

1. A does a work in **10** days and B does the same work in **15** days. In how many days they together will do the same work?
2. What is the average speed a car when it moves **x** kmph & **y** kmph on the same location?
3. An athlete runs **200** meters race in **24** seconds. What is his speed?
4. Suppose two trains are moving in opposite directions at **u** m/s and **v** m/s, then what is the relative speed of the trains?
5. If a speed is **14** m /s, what is the speed in terms of kmph?
6. If P as principal, R as rate of interest, N as years and S.I as simple interest, what is the formula to find the principal?
7. What is the formula to find Amount when interest is compounded Half-yearly?
8. What is the Amount, when the rate are different for different years, say R_1%, R_2%, R_3% for 1^{st}, 2^{nd} and 3^{rd} year respectively?
9. Express the value of $\text{Log}_a(x/y)$?
10. What is the value of $\log_5\left(\frac{1}{125}\right)$?

SECTION – B

Answer ALL Questions **(4 × 5 = 20)**

11. a) A man travelled from the village to the post office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 min, find the distance of the post office from the village?

[OR]

b) A train is moving at a speed of 132 kmph. If the length of the train is 110 meters, how long will it take to cross a railway platform 165 meters long?

12. a) Find the simple interest on ₹ 3,000 at 6 ¼% per annum for the period from 4^{th} Feb, 2005 to 18^{th} Apr, 2005?

[OR]

b) In what time will ₹ 1000 become ₹ 1331 at 10% per annum compounded annually?

13. a) Evaluate: $\log_5 3 \; X \; \log_{27} 25$

[OR]

b) A sum of money amount to ₹ 6690 after 3 years and ₹ 10,035 after 6 years on compound interest. Find the sum?

(PTO)

14. a) Simplify: $\log\frac{75}{16} - 2\log\frac{5}{9} + \log\frac{32}{243}$

[OR]

b) What was the day of the week on 16^{th} July 1776?

SECTION – C

Answer any TWO Questions **(2 × 10 = 20)**

15. 2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days. In how many days can 2 men and 1 boy do the work?

16. Two trains 100 meters and 120 meters long are running in the same direction with speeds of 72 kmph and 54 kmph. In how much time will the first train cross the second?

17. Kumar borrowed some money at the rate of 6% per annum for the first two years, at the rate of 9% per annum for next three years and at the rate of 14% per annum for the period beyond five years. If he pays total interest of ₹ 11,400 at the end of nine years, how much money did he borrow?