Course Code:05AT01

VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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 2020

Part – III : Ancillary Subject : Third Semester : Paper – I

Course Title: Ancillary Mathematics - I

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. The derivative of sinx is______
(A) –cosx (B) cosx (C) tanx (D)None
2. The expansion of coshx is______
(A) $\frac{1}{2}\left(e^x+e^{-x}\right)$ (B) $\frac{1}{2}\left(e^x-e^{-x}\right)$ (C) $\frac{e^x+e^{-x}}{2i}$ (D) None
3. The derivative of sechx is______
(A) sechxtanhx (B) – sechxtanhx (C) $\tanh^2 x$ (D) None
4. The derivative of $\operatorname{cosec}^{-1}x$ is______
(A) $\frac{1}{x\sqrt{x^2-1}}$ (B) $\frac{1}{\sqrt{1+x^2}}$ (C) $\frac{-1}{x\sqrt{x^2-1}}$ (D) None
5. If x = f(t), y = g(t) then dy/dx is
(A) dy/dt +dt/dx (B)dt/dx*dy/dt (C) dy/dt *dt/dx (D)None
6. The value of $\int \operatorname{cosec} x \cot x\,dx$ is
(A) cot x (B) cosec x (C) – cosecx (D) None
7. If f(x) is even function, then f(-x) is
(A) zero (B) – f(x) (C) f(x) (D) None
8. If $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$, then curl $\vec{r}$ is
(A) 3 (B) non zero (C) zero (D)None
9. The value of cosh(iπ/2) is _______ .
(A) 1 (B) 0 (C) – 1 (D) None
10. Inverse hyperbolic function $\sinh^{-1}x$ = ________.
(A) $\log\left(x-\sqrt{x^2+1}\right)$ (B) $\log\left(x+\sqrt{x^2+1}\right)$ (C) $\log\left(x+\sqrt{x^2-1}\right)$ (D) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Evaluate $\sin 3^{o}$ correct to three places of decimal.
12. Separate into real and imaginary parts of $\tanh(1+i)$.
13. Differentiate $\sin^{-1}(2x)$.
14. Find y' if $x=a\cos^3 t,\quad y=a\sin^3 t$.
15. Evaluate $\int_0^1\int_0^2 xy^2\,dy\,dx$.
16. Define Scalar Product.
17. State Green's Theorem.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) If cos(x + iy) = cosθ + isinθ prove that cos 2x + cosh 2y = 2.

(OR)

b) Prove that $2^5\cos^6\theta = \cos 6\theta + 6\cos 4\theta + 15\cos 2\theta + 10$.

19. a) If $x^y = y^x$ prove that $\frac{dy}{dx} = \frac{y(y - x\log y)}{x(x - y\log x)}$

(OR)

b) If y = $\left[x + \sqrt{1 + x^2}\right]^m$, Prove that $(1+x^2)\, y_2 + x\, y_1 - m^2 y = 0$.

20. a) Evaluate $I = \iint_D xy\,dy\,dx$ where D is the region bounded by the curve $x = y^2,\ x = 2 - y,\ y = 0$ and $y = 1$.

(OR)

b) Evaluate $I = \int_0^{\frac{\pi}{4}} \log(1 + \tan\theta)\,d\theta$

21. a) If $r = a\cos\omega t + b\sin\omega t$ where *a,b* are constant vectors and ω is a constant prove that $r \times \frac{dr}{dt} = \omega(a \times b)$ and $\frac{d^2 r}{dt^2} + \omega^2 r = 0$.

(OR)

b) If *r* is the position vector of any point *P(x,y,z)*, then prove that $grad\ r^n = n\ r^{n-2} r$.

22. a) Evaluate $\int_C \vec{f}.d\vec{r}$ where $\vec{f} = (x^2 + y^2)\vec{i} + (x^2 - y^2)\vec{j}$ and C is the curve $y = x^2$ joining (0,0) to (1,1).

(OR)

b) Evaluate $\iint_S \vec{f}.\vec{n}\,dS$, where $\vec{f} = \left(x + y^2\right)\vec{i} - 2x\vec{j} + 2yz\vec{k}$ and S is the surface of the plane $2x + y + 2z = 6$ in the first octant.

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. i) If u = $\log_e \tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$ prove that cosh u = sec θ.

ii) Expand cos 5θ in terms on powers of cos θ and sinθ.

24. Find y', if $y = x^x + x^{\frac{1}{x}}$.

25. Evaluate $I = \iiint_D xyz\,dx\,dy\,dz$ where D is the region bounded by the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$.

26. Prove that $div(r^n r) = (n+3) r^n$. Deduce that $r^n r$ is solenodial iff *n = -3*.

27. Verify Gauss divergence theorem for the vector function $\vec{f} = (x^3 - yz)\vec{i} - 2x^2 y\,\vec{j} + 2\,\vec{k}$ over the cube bounded by $x = 0, y = 0, z = 0, x = a, y = a\ and\ z = a.$

05AT31

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

PROGRAMMING IN C

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. Identifiers are_________ CO1K1
A. user-defined names. B. reserved keywords. C. C statements. D. tokens.

2. The role of a compiler is to translate source program statements to_________. CO1K1
A. object codes. B. octal codes. C. decimal codes. D. binary codes.

3. A character array always ends with________. CO2K1
A. null (\0) character. B. question mark (?). C. full stop(.). D. exclamation mark(!).

4. Which among the following is a unconditional control structure? CO2K1
A. do-while. B. if-else. C. goto. D. for.

5. If a storage class is not mentioned in the declaration then default storage class is_________.
A. automatic. B. static. C. external. D. register. CO3K1

6. The scanf() statement is an_______. CO3K1
A. input. B. output. C. pointer. D. file.

7. The __________________ loop executes at least once. CO4K1
A. for B. while C. do-while D. while & do-while

8. Which is valid string function ? CO4K1
A. strpbrk() B. strlen() C. strxfrm() D. strcut()

9. The operator & is used for CO5K1
A. Bitwise AND B. Bitwise OR C. Logical AND D. Logical OR

10. The bitwise AND operator is used for CO5K1
A. Masking B. Comparison C. Division D. Shifting bit

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. What is mean by C tokens? CO1K2
12. Define data type. CO1K2
13. Give notes on conditional statements. CO2K2
14. Give short notes an argument return a integer value. CO2K2
15. Give an example for concatenation of two strings. CO3K2
16. What is meant by swapping? CO4K2
17. How to read and write string values. CO5K2

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Explain about various types of constant in C. CO1K3

(OR)

	b) Explain Logical operators.	CO1K3
19.	a) Write short note on Go To statement.	CO2K3
	(OR)	
	b) Write in detail about simple if statement.	CO2K3
20.	a) Explain one dimensional array.	CO3K3
	(OR)	
	b) Write short notes on strcpy( ) function.	CO3K3
21.	a) Write an example for character array with return arguments.	CO4K3
	(OR)	
	b) Write short notes on multi-dimensional array.	CO4K3
22.	a) Write a program for sum of any two matrices of any order.	CO5K3
	(OR)	
	b) Write a C program to find the roots of the quadratic equations.	CO5K3

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23.	Discuss in detail of about various types of C operators.	CO1K4
24.	Explain Switch statement with suitable example.	CO2K4
25.	Write a program for sorting n numbers in the ascending order.	CO3K4
26.	Write a program for multiplication of any two matrices of same order.	CO4K4
27.	Explain Pointers and Structures.	CO5K4

*** ALL THE BEST***

Course Code: 05CT11

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

Course Title: Algebra and Trigonometry

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

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 a transformation of equation, the reciprocal equation is derived by substituting x by ___.
   (a) –x (b) 1/x (c) x^2 (d) None
3. Inverse hyperbolic function $\cosh^{-1}x$ = ________.
   (a) $\log\left(x-\sqrt{x^2+1}\right)$ (b) $\log\left(x+\sqrt{x^2+1}\right)$ (c) $\log\left(x+\sqrt{x^2-1}\right)$ (d) None
4. The value of $1+\tan^2\theta$ = _______.
   (a) $\cot^2\theta$ (b) - $\sec^2\theta$ (c) $\sec^2\theta$ (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. An equation f(x) = 0 cannot have more ____ roots than there are changes of sign in f(x).
   (a) two (b) – ve (c) + ve (d) None
7. The value of cosh2x = ______ .
   (a) $\cosh^2x + \sinh^2x$ (b) $\cosh^2x - \sinh^2x$ (c) coshx + sinhx (d) None
8. The imaginary part of sin(x+iy) is _______ .
   (a) cosx+ sinhy (b)cosxsinhy (c) cosx - sinhy (d) None
9. The value of Log i is _______.
   (a) i(π/2 - 2nπ) (b) (π/2 +2nπ) (c) i(π/2 +2nπ) (d) None
10. The value of $\log\left(\frac{2+3i}{2-3i}\right)$ is ________.
    (a) real number (b) complex number (c) rational number (d) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Form a quadratic equation which has one of the root as $3 - \sqrt{-2}$.
12. Find the quotient and remainder when $3x^3 + 8x^2 + 8x +12$ is divided by x – 4.
13. Define Rolle's theorem
14. If x + iy = tan(A + iB) prove that $x^2 + y^2 + 2x \cot A = 1$.
15. Find Log (1-i)
16. If $\cos^2\theta + \sin^2\theta = 1$ show that $\cosh^2 x - \sinh^2 x = 1$.
17. If ∝, β, γ and δ are root of the equation $x^4 + px^3 + qx^2 + rx + s = 0$. Find $\sum \propto^2$.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Find the sum of the cubes of the roots of the equation $x^5 = x^2 + x + 1$.

(OR)

b) If $\propto$ be a real root of the cubic equation $x^3 + px^2 + qx + r = 0$ of which the coefficients are real, show that the other two roots of the equation are real if $p^2 \geq 4q + 2p\propto + 3\propto^2$.

19. a) Show that the equation $x^4 - 3x^3 + 4x^2 - 2x + 1 = 0$ can be transformed into receiprocal equation by diminishing the roots by unity.

(OR)

b) Sove the equation $x^4 + 20x^3 + 143x^2 + 430x + 462 = 0$ by removing its second term .

20. a) Find the multiple roots of the equation $x^4 - 9x^2 + 4x + 12 = 0$

(OR)

b) Find the nature of the roots of the equation $4x^3 - 21x^2 + 18x + 20 = 0$.

21. a) Prove that $\cosh^7 x = (1/2^6)[\cosh 7x + 7 \cosh 5x + 21 \cosh 3x + 35 \cosh x]$.

(OR)

b)Show that $\lim_{x\to 0} \frac{3\sin x - \sin 3x}{x - \sin x} = 24$.

22. a) Find the grneral value of $\text{Log}_{(-3)}^{(-2)}$.

(OR)

b) If $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$, find the sum to infinity of the series $1 + \frac{1}{2}\cos 2\theta - \frac{1}{2\,.\,4}\cos 4\theta + \frac{1\,.\,3}{2\,.\,4\,.\,6}\cos 6\theta - \ldots$

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. show that the roots of the equation $x^3 + px^2 + qx + r = 0$ are in arithmetical progression if $2p^3 - 9pq + 27r = 0$. Show that the above condition is satisfied by the equation $x^3 - 6x^2 + 13x - 10 = 0$. Hence or otherwise solve the equation.
24. Solve the equation $6x^6 - 25x^5 + 31x^4 - 31x^2 + 25x - 6 = 0$.
25. By using Horner's method find the positive root of the equation $x^3 - 2x^2 - 3x - 4 = 0$ correct to three places of decimals.
26. Show that $\cos 8\theta = 128 \cos^8\theta - 256 \cos^6\theta + 160 \cos^4\theta - 32 \cos^2\theta + 1$.
27. Find the sum to infinity of the series $\sin\propto + c\sin(\propto + \beta) + \frac{c^2}{2}\sin(\propto + 2\beta) + \ldots$ when $|c| \leq 1$.

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

DIFFERENTIAL CALCULUS

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. If c is a constant, then $\frac{dc}{dx}$ = ______ **(CO1K1)**

(A) non zero (B) 1 (C) 0 (D) None

2. The derivative of sinx is______ **(CO1K1)**

(A) –cosx (B) cosx (C) tanx (D) None

3. The derivative of cosx is______ **(CO2K1)**

(A) - sinx (B) sinx (C) tanx (D) None

4. The derivative of x^n is______ **(CO2K1)**

(A) nx^{n-1} (B) x (C) n! (D) None

5. The derivative of e^x is______ **(CO3K1)**

(A) - e^x (B) e^x (C) e^{-x} (D) None

6. If f(x,y) is a homogeneous function of degree n, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ is………. **(CO3K1)**

(A) f (B) n f (C) f / n (D) None

7. Any point on the 4 cusped hypocycloid $x^{2/3}+y^{2/3}=a^{2/3}$ is…… **(CO4K1)**

(A) (a cosθ , a sin θ) (B) (a $\cos^2\theta$, a $\sin^2\theta$) (C) (a $\cos^3\theta$, a $\sin^3\theta$) (D) None

8. The value of D ($\sqrt{x}$) is …….. **(CO4K1)**

(A) $\frac{1}{\sqrt{x}}$ (B) $\frac{1}{2\sqrt{x}}$ (C) $\frac{2}{\sqrt{x}}$ (D) None

9. Under usual notations, which one is correct? **(CO5K1)**

(A) φ = ψ + θ (B) θ = ψ + φ (C) ψ = φ + θ (D) None

10. The result $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=nu$ is ………… **(CO5K1)**

(A) Leibnitz's theorem (B) Euler's theorem (C) Laplace theorem (D) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Find the Differential coefficient of $y=(x^2+1)(x+2)$ **(CO1K2)**

12. Solve $\frac{d}{dx}(e^x \sin x)$ **(CO1K2)**

13. Solve $\frac{d}{dx}(\tan(e^x))$ **(CO2K2)**

14. If $x=at^2$, $y=2at$. Find $\frac{dy}{dx}$. **(CO2K2)**

15. Define evolute. **(CO4K2)**

16. Define involute. **(CO5K2)**

17. Define Eulers theorem. **(CO5K2)**

Section –C

Answer any three questions **(5x5=25 marks)**

18. a) Solve $\frac{d}{dx}\left(\frac{\sqrt{x}}{2x+3}\right)$ **(CO1K3)**

or

b). Find the differentiate $\tan^{-1}\left(\frac{cosx}{1+sinx}\right)$ **(CO1K3)**

19. a) Find y_n where y= $\frac{3}{(x+1)(2x-1)}$ **(CO2K3)**

or

b). Find the differential coefficients of $\left(\frac{x^3}{3x-2}\right)$ **(CO2K3)**

20. a) Find the length of the subtangent and subnormal at the point ‘t’ on the curve x=a(cost+tsint) y=a(sint-tcost). **(CO3K3)**

or

b). Find the angle which radius vector cuts the curve $\frac{l}{r} = 1 + ecos\theta$. **(CO3K3)**

21. a) Find the envelope of the family of the circles $(x-a)^2 + y^2 = 2a$ where ‘a’ is parameter. **(CO4K3)**

or

b) Find the radius of curvature for the curve $\sqrt{x} + \sqrt{y} = 1$ at (1/4,1/4). **(CO4K3)**

22. a) Show that the radius of curvature of the cardioid $r = a(1 - \cos\theta)$ is $\frac{2}{3}\sqrt{ar}$. **(CO5K3)**

or

b) Find the n^{th} differential coefficient of cosx cos2x cos3x. **(CO5K3)**

Section –D

Answer any Three questions **(3x10=30 marks)**

23. Find the differential coefficient of $\frac{(a-x)^2 (b-x)^3}{(c-2x)^3}$ **(CO1K3)**

24. Find the Differentiate y=x$\frac{\sqrt{(a^2-x^2)}}{2}$ +$\frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right)$ **(CO2K3)**

25. Prove that if y=sin (m $\sin^{-1}x$) then $(1-x^2)y_2-xy_1+m^2y=0$ **(CO2K3)**

26. Find the evolute of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. **(CO2K3)**

27. If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$. Prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$ **(CO2K3)**

*** ALL THE BEST ***

Course Code:05CT31

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

Course Title: DIFFERENTIAL EQUATIONS

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. The degree of the differential equation $[1+(\frac{dy}{dx})^2]^3 = k\frac{d^2y}{dx^2}$ is ________
   a) 4 b) 6 c) 1 d) 2.
2. The integrating factor of Bernoulli's equation $(x+1)\frac{dy}{dx}+1 = 2e^{-y}$ is ________
   a) x b) $x+2$ c) $x-1$ d) $x+1$
3. $(D^2+1)y = \cos x$ has ________
   a) Particular integral alone as general solution.
   b) Complementary function alone as a general solution.
   c) No solution
   d) Complementary function+ Particular integral as general solution.
4. The complementary function of the differential equation $(D^2+10D+25)y = 0$ is ________
   a) $y = (A+Bx)e^{5x}$ b) $y = (A-Bx)e^{5x}$ c) $y = (A-Bx)e^{-5x}$ d) $y = (A+Bx)e^{-5x}$
5. One of the solution of the differential equation $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$ is ________
   a) $x^3-y^3 = 0$ b) $x^4-y^4 = 0$ c) $x^2-y^2 = 0$ d) $x-y = 0$
6. The value of $\Gamma(n) =$
   a) $n!$ b) $(n-1)!$ c) $(n+1)!$ d) $(n+2)!$
7. The value of $L\{f(at)\} =$
   a) $aF\left(\frac{s}{a}\right)$ b) $aF(sa)$ c) $\frac{1}{a}F\left(\frac{s}{a}\right)$ d) $\frac{1}{a}F(sa)$
8. The value of $L^{-1}\left(\frac{1}{s+a}\right) =$
   a) e^{at} b) e^{-at} c) $-e^{at}$ d) $-e^{-at}$
9. The value of $L^{-1}\left(\frac{1}{sa+b}\right) =$
   a) $\frac{1}{a}e^{-b(t+a)}$ b) $\frac{1}{a}e^{-bta}$ c) $\frac{1}{a}e^{-\frac{bt}{a}}$ d) $\frac{1}{a}e^{-b(t-a)}$
10. The solution obtained by giving particular values to the arbitrary constants in a complete integral is called ______
    a) Complete integral b) Singular integral c) Particular integral d) General integral

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Define general solution.

12. Solve $\frac{dy}{dx} = \frac{y+2}{x-1}$

13. Solve $\left(D^2 + 5D + 4\right)y = 0$

14. Find the particular integral $\left(D^2 + D + 1\right)y = x^2$.

15. Define simultaneous equation of the first order and first degree.

16. Define Laplace transform.

17. Define Complete Integral.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Solve the linear differential equation $\frac{dy}{dx} + y\cos x = \frac{1}{2}\sin 2x$

(OR)

b) Solve $(1-x^2)\frac{dy}{dx} + 2xy = x\sqrt{1-x^2}$

19. a) Solve $\left(D^2 + 16\right)y = 2e^{-3x} + \cos 4x$

(OR)

b) Solve $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$

20. a) Solve the equation $\frac{dx}{y - xz} = \frac{dy}{yz + x} = \frac{dz}{x^2 + y^2}$

(OR)

b) Solve the equation $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$

21. a) Find $L^{-1}\left(\frac{s-3}{s^2 + 4s + 13}\right)$

(OR)

b) Find $L\left(te^{-t}\sin t\right)$.

22. a) Solve $p^2 + q^2 = npq$.

(OR)

b) Solve $p(1+q^2) = q(z-1)$.

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

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

24. Solve $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \frac{\log x \sin(\log x) + 1}{x}$

25. Solve the equation $(x-1)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = (x-1)^2$.

26. Find $L^{-1}\left(\frac{1}{s(s+1)(s+2)}\right)$

27. Solve (i) $p + q = x + y$ (ii) $z = px + qy + \sqrt{\left(1 + p^2 + q^2\right)}$

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – III: Core Subject: Third Semester

NUMERICAL METHODS

Under CBCS and OBE – Credit 5

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. Choose the transcendental equation from the following ________________.
   a) $x^3 - 1 = 0$ b) $x^2 + x + 1 = 0$ c) $x = 1$ d) $e^x - 1 = 0$
2. Regula – Falsi method is also known as a _________________.
   a) Method of tangents b) Method of chords c) Method of false position d) None
3. With standard notation the correct statement is ___________________
   a) $\Delta = E - 1$ b) $\nabla = 1 + E^{-1}$ c) $D = h \log E$ d) None
4. With usual notation $x^{(n)}$ is a polynomial of degree ______________.
   a) n b) $n-1$ c) $n+1$ d) None
5. Newton's backward interpolation formula is used to interpolate the values of y for ________.
   a) $0 < p < 1$ b) $-1 < p < 0$ c) $-\frac{1}{2} < p < \frac{1}{2}$ d) None
6. Newton's forward interpolation formula is used to interpolate the value of y _____________.
   a) Near the beginning b) Near the end c) Near the middle d) None
7. First divided difference $[x_1, x_2] =$ _______________.
   a) $\frac{y_1 - y_0}{x_1 - x_0}$ b) $\frac{y_2 - y_1}{x_2 - x_1}$ c) $\frac{x_2 - x_1}{y_2 - y_1}$ d) None
8. The process of estimating the value of x for some value of y which is not in the table is called _____.
   a) Interpolation b) Inverse interpolation c) Divided difference d) None
9. $y_n = y_0 + \int_{x_0}^{x} f\left(x, y_{n-1}\right) dx,$ where $n = 1, 2, ----$
   a) Picards formula b) Eulers formula c) Taylor's formula d) None
10. $y_{n+1} = y_n + \hbar\, f\left(x_n, y_n\right);\ n = 0, 1, 2, -----$ where $n = 1, 2, ----$
    a) Picards formula b) Eulers formula c) Taylor's formula d) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Write Newton Raphson formula to obtain cube root of N.
12. Solve the following equations by Gauss elimination method: $x + y = 2$; $2x + 3y = 5$
13. Prove that Δ is linear.
14. Define central difference operator.
15. Solve: $(E^2 + 5E + 6)\, y_n = 0$.

16. Find the order, degree of the difference equation: $E^2 y_n + 3 E y_{n-1} + y_n = n^2$
17. Write the formula for finding derivatives using Newton's forward difference.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. (a) Use Aitken's Δ^2 method find the real root lying between 1 and 2 of the equation x^3 -3x+1=0.

[OR]

(b)Solve the system of equations by Gauss Jordan method.

$x + y + z = 9;\ 2x - 3y + 4z = 13;\ 3x + 4y + 5z = 40$

19. (a) Find $\Delta^n \sin x$ taking h=1.

[OR]

(b) Find $\Delta\,(5x^4 + 6x^3 + x^2 - x + 7)$.

20. (a) Find the Fibonacci difference equation and solve

[OR]

(b)If y (75) = 246, y (80) = 202, y (85) = 118, y (90) = 40 find y (79).

21. (a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 51 from the following data

x	50	60	70	80	90
y	19.96	36.65	58.81	77.21	94.61

[OR]

(b) Evaluate $I = \int_0^1 \frac{1}{1+x^2} dx$ using Trapezoidal rule with h=0.2. Hence determine the value of π.

22. (a) Evaluate $I = \int_0^{\frac{\pi}{2}} \sin x\, dx$ using Simpsons $\frac{1}{3}$ rule dividing the range into six equal parts.

[OR]

(b) Using Taylor's method solve $\frac{dy}{dx} = 1 + xy$ with $y_0 = 2$. Find (i) y(0.1) (ii) y(0.2) (iii) y(0.3)

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. Find the inverse of the matrix $A = \begin{pmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$

24. Solve the difference equation: $y_{n+2} + y_{n+1} + y_n = n^2 + n + 1$

25. Find the maximum and minimum value of y from the following table

x	0	1	2	3	4	5
y	0	$\frac{1}{4}$	0	$\frac{9}{4}$	16	$\frac{225}{4}$

26. Evaluate $I = \int_0^6 \frac{1}{1+x} dx$ using (i) Trapezoidal rule (ii) Simpson's rule (both)

(iii) Weddle's rule. Also check up the direct integration.

27. Compute y(0.1) and y(0.2) by Runge-Kutta method of fourth order for the differential equation $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$

***** BEST WISHES *****

Course Code: 05CT51

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – III : Core Subject : Fifth Semester : Paper – I

Course Title: STATISTICS

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. The relation between the covariance and the coefficient of correlation is

   (A) $\gamma_{xy} = \dfrac{\operatorname{cov}(x,y)}{\sigma_x + \sigma_y}$ (B) $\gamma_{xy} = \dfrac{\operatorname{cov}(x,y)}{\sigma_x \pm \sigma_y}$ (C) $\gamma_{xy} = \dfrac{\operatorname{cov}(x,y)}{\sigma_x \sigma_y}$ (D)None

2. The line of regression passes through the point_________.

   (A) Mid-point (B) Mean points (C) Origin (D)None

3. If u = x + y then $\bar{u} =$ _____.

   (A) $\bar{x}\bar{y}$ (B) $\bar{x} - \bar{y}$ (C) $\bar{x} + \bar{y}$ (D) None

4. ______ $= \dfrac{P(A \cap B)}{P(B)}$

   (A) $P(A \cup B)$ (B) $P(B\,|\,A)$ (C) $P(A\,|\,B)$ (D)None

5. If X & Y are independent R.V, then E (XY) = _____

   (A) E(X) +E(Y) (B) E(X)/ E(Y) (C) E(X) E(Y) (D)None

6. The value of $\Phi(0)$ is

   (A) 1 (B) <1 (C) >1 (D) None

7. The Characteristic function of binomial distribution is

   (A) $\left(q + pe^{it}\right)^n$ (B) $\left(p + qe^{it}\right)^n$ (C) $\left(q + pe^{it}\right)^{-n}$ (D) None

8. If X is $N(\mu, \sigma^2)$ then the M.G.F about the origin is

   (A) $e^{\mu t - \frac{t^2\sigma^2}{2}}$ (B) $e^{\mu t + \frac{t^2\sigma^2}{2}}$ (C) $e^{\frac{t^2\sigma^2}{2}}$ (D) None

9. If X_1 and X_2 are two independent samples of size n_1& n_2 respectively, from a normal population, then t_ distribution with the degrees of freedom is

   (A) n_1+n_2-2 (B) n_1+n_2+2 (C) n_1+n_2 (D)None

10. The application based on ____ distribution is population variance.

    (A) T (B) χ^2 (C) F (D)None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. If one of the regression coefficients is greater than unity the other is less than unity.
12. Define regression line *x* on *y*.
13. Define conditional probability.
14. If *X* is a continuous random variable, then write a formula for $E[x]$, $E[x^2]$ and variance.
15. Define binomial distribution.
16. Define Fiducial limits.
17. Define χ^2 - test for population variance.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) From the following data of marks obtained by 10 students in physics and chemistry calculated the rank correlation coefficient

Physics(P)	35	56	50	65	44	38	44	50	15	26
Chemistry(C)	50	35	70	25	35	58	75	60	55	35

(OR)

b) A programmer while writing a program for correlation coefficient between two variables x and y from 30 pairs of observation obtained the following results $\sum x = 300, \sum x^2 = 3718, \sum y = 210,$ $\sum y^2 = 2000, \sum xy = 2100.$ At the time checking it was found that he had copied down two Pairs (18,20) and (20,15) instead of the correct values (10,15) and (20,15). Obtain the correct value of the correlation coefficient.

19. a) State and Prove Boole's inequality.

(OR)

b) A bag contains 5 red and 3 black balls and a second bag 4 red and 5 black balls. One of the bag is selected at random and draw of 2 balls is made from it. What is the probability that one of them is red and other is black.

20. a) Six dice are thrown 729 times. How many times do your expect at least 3 dice to shown a five or six.

(OR)

b) Assuming that one is a case of twins calculate the probability of 2 or more births of twins on a day when 30 births occur using (i) Binomial Distribution (ii) Poisson distribution.

21. a) A random sample of 10 boys has the following I.Q. (Intelligent Quotients) 70, 120, 110, 101, 88, 83, 95, 98, 107, and 100. Do these data support the assumption of a population mean I.Q. of 100? (t-test of 9 = 2.26).

(OR)

b) In one sample of 8 observations the sum of the squares of deviation of the sample values from the sample mean was 84.4 and in another sample of 10 observation it was 102.6. Test whether the difference in variances is significant at 5% level using F-Test. (F-test (7,9)=3.29).

22. a) Prove that $\chi^2 = \sum_{i=1}^{k} \frac{(o_i - e_i)^2}{e_i} = \sum_{i=1}^{k} \frac{o_i{}^2}{e_i} - n$ where there are k set of theoretical and observed values with the total freq n.

(OR)

b) The S.D of the distribution of times taken by 15 workers for performing a job is 6.4 sec. Can it be taken as a sample from a population whose s.d is 5 sec?. (value of 14 = 23.685)

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. If $x = 4y + 5$ *and* $y = kx + 4$ are the regression lines of *x* on *y* and *y* on *x* respectively.

(i) Show that $0 \le k \le 1/4$

(ii) If *k=1/8* find the means of two variables *x* and *y* and the correlation coefficient between them.

24. Obtain the (i) Mean (ii) Median (iii) Mode for the following distribution

$$f(x) = \begin{cases} 6(x - x^2) & if\ 0 < x < 1 \\ 0 & otherwise. \end{cases}$$

25. The marks of 1000 students in a university are found to be normally distributed with mean 70 and SD 5. Estimate the number of students whose marks will be (i) between 60 & 75 (ii) more than 75 (iii) less than 68.

26. A group of 10 rats fed on a diet A and another group of 8 rats fed on a different diet B recorded the following increases in weights in gms .

Diet A	5	6	8	1	12	4	3	9	6	10
Diet B	2	3	6	8	1	10	2	8	----	---

Test whether diet A is superior to diet B.

27. The theory predicts that the proportion of an object available in the four groups A, B, C, D should be 9:3:3:1. In an experiment among 1600 items of this object the numbers in the four groups were 882, 313, 287 and 118. Use χ^2 test to verify whether the experimental result supports the theory. (the value of 3 = 7.851)

05CT52

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – III : Core Subject : Fifth Semester : Paper – I

MODERN ALGEBRA

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. The range of the function f:R→ $R \text{ given by } f(x) = x^2 \text{ is } \ldots$ CO1K1
   (A) R (B) R^+ (C) $R^+ \cup \{0\}$ (D)R*
2. Any binary operation defined on a singleton set is……. CO1K1
   (A) commutative and associative (B) commutative but not associative
   (C) associative but not commutative (D) neither commutative nor associative
3. The function f:R→ $R \text{ defined by } f(x) = 3x \text{ is } \ldots.$ CO2K1
   (A) Bijection (B) 1-1 but not onto (C)Not 1-1 but onto (D)Neither 1-1 nor onto
4. The function f:Z→ $Z \text{ defined by } f(x) = 3x \text{ is } \ldots$ CO2K1
   (A)Bijection (B) Injective but not surjective (C) Surjective but not injective
   (D) Neither injective nor surjective
5. The function f:R→ $R^+ \text{ given by } f(x) = e^x \text{ is } \ldots..$ CO3K1
   (A)bijection (B)1-1 but not onto (C)onto but not injective (D) Neither 1-1 nor onto
6. In the group (C*, .) order of i is…… CO3K1
   (A) 1 (B) 2 (C) 3 (D) 4
7. The order of an element a in a group G with the identity elements e is……. CO4K1
   (A) an integer n such that a^n=e (B) a positive integer n such that a^n=e
   (C) the least positive integer n such that a^n=e (D) the least positive integer n such that a^n=a
8. Let G be a group of prime order. Then….. CO4K1
   (A) G has no subgroups (B) G has no proper subgroups
   (C) G has more then2 subgroups (D) G is nonabelian
9. The kernel of homomorphism f:(Z,+)→ $(Z,+)$ given f(x)$= 2x$ is…. CO5K1
   (A) Z (B) $\{\frac{1}{2}\}$ (C) {1} (D) {0}
10. The cyclic subgroup of Z_{24} generated by 18 has order ________ CO5K1
    (A) 4 (B) 6 (C) 9 (D) None of these

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Define injective CO1K2
12. Define Surjective CO1K2
13. Define permutation CO2K2
14. Define function CO3K2
15. Define monomorphism. CO3K2
16. Define epimorphism. CO4K2
17. Define homomorphism. CO5K2

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Show that the union of two equivalence relation need not be an equivalence relation. **CO1 K3**

(OR)

b) If ρ and σ are equivalence relations defined on a set Prove that $\rho \cap \sigma$ is an equivalence relation. **CO1 K3**

19. a) Show that f: R-{3} $\rightarrow$R-{1} given by f(x) = $\frac{x-2}{x-3}$ is a bisection and find it is inverse. **CO2 K3**

(OR)

b) If f: A$\rightarrow$B and g: B$\rightarrow$C are bisection prove that $(gof)^{-1}=f^{-1}og^{-1}$. **CO2 K3**

20. a) If f(x)=2x-1 and g(x)=3x+1 , find (i) fof (ii)fog (iii) gof (iv)gog. **CO3 K3**

(OR)

b) State and prove cayley's theorem. **CO3 K3**

21. a) Prove that isomorphism is equivalent relation. **CO4 K3**

(OR)

b) Show that any group f : G $\rightarrow$G given by $f(x)=x^{-1}$ is an isomorphism. **CO4 K3**

22. a) Prove that intersection of two normal subgroups of group G is a normal Subgroup of G. **CO5 K3**

(OR)

b) If f : C $\rightarrow$C defined by $f(z) = \bar{z}$ is an isomorphism. **CO5 K3**

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. Let G a group in which $(ab)^m=a^mb^m$ for three consecutive integers and for all a,b ε G then prove that G is abelian . **CO1 K4**
24. Prove that any permutation can be expressed as a product of disjoint cycles. **CO2 K4**
25. Prove that Z_n is integral domain iff n is prime. **CO3 K4**
26. State and prove fundamental theorem of homomorphism. **CO4 K4**
27. Prove that R be a commutative ring with identity. An ideal M of R is a Maximal iff R/M is a field. **CO5 K4**

*** ALL THE BEST ***

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – III : Core Subject : Fifth Semester : Paper – I

REAL ANALYSIS

Under CBCS and OBE – Credit 4

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. Two sets A and B are equivalent if there exists a _____ from A to B. **CO1 K1**
(A)injection (B)bijection (C) surjection (D)homomorphism
2. If d is a metric on M the incorrect statement is _____ **CO1 K1**
(A) $\sqrt{d}$ is a metric on M (B) d_1= Min{1,d(x,y)} is a metric on M
(C) d^2 is a metric on M (D)2d is a metric on M
3. Let (M,d) be a metric space. Let A and B be subsets of M. The incorrect statement is _____
(A) A is open $\Leftrightarrow$ A = Int A (B) $A \subseteq B \Rightarrow Int\ A \subseteq Int\ B$ **CO2 K1**
(C) Int (A U B) = Int A U Int B (D)Int ($A \cap B$) = Int A $\cap$ Int B
4. In **R** with usual metric Int**Q** = _____ **CO2 K1**
(A) **N** (B) **Z** (C) **Q** (D)Φ
5. In C with usual metric, let A = {z / |z|<1}. Then the derived set D(A) is given by ____ **CO3 K1**
(A) {z / |z|>1} (B) {z / $|z| \leq 1$} (C) A (D){z / $|z| \geq 1$}
6. Which of the following is a dense set in R with usual metric? **CO3 K1**
(A) **Z** (B) **Q** (C) $[0,\infty)$ (D) $(-\infty,0]$
7. Let (M, d) be a metric space. Let $A \subseteq M$. Let $x \in M$. x is called a limit point of A if ___ **CO4 K1**
(A) $B(x,r) \cap A \neq \phi$ for all r>0 (B) $B(x,r) \cap (A-\{x\}) = \phi$ for all r>0
(C) $B(x,r) \cap (A-\{x\}) \neq \phi$ for all r>0 (D)$B(x,r) \cap A = \{x\}$ for all r>0
8. A connected subset of **R** containing more than one point is _____ **CO4 K1**
(A) bounded (B) finite (C) uncountable (D) countable
9. Let f :**R**$\to$**R** be a continuous function and let A = {$x \in$ **R** / f(x) = 0}. Then ____. **CO5 K1**
(A) A is closed (B)A is open (C) A is bounded (D) A is compact
10. Which of the following pairs of the metric spaces (all with usual metric) are isometric? **CO5 K1**
(A) (0,1) and (0,2) (B) (0,4) and [0,4] (C) (0,4) and (2,6) (D) (0,1) and **R**

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Give an example for usual metric in R. **CO1 K2**
12. For what reason, d^2 is not metric on R. **CO1 K2**
13. Define Cauchy sequence of a Metric space M. **CO2 K2**
14. Let M be a metric space. Let $f: M \to \boldsymbol{R}$ and $g: M \to \boldsymbol{R}$ be two continuous functions.
Prove that f + g is continuous. **CO2 K2**
15. Define homeomorphism of a function. **CO3 K2**
16. Define connected metric space. **CO4 K2**
17. Give an example to show that a subspace of a connected metric space need not be connected.
CO5 K2

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Let (M, d) be a metric space and $d_1(x,y) = min\{1, d(x,y)\}$. Prove that d_1 is metric on M.
CO1 K3

(OR)

b) State and prove Holder's Inequality. **CO1 K3**

19. a) Prove that in any metric space (M, d) each open ball is an open set. **CO2 K3**

(OR)

b) Prove that in any metric space (M, d) each closed ball is a closed set. **CO2 K3**

20. a) State and prove Cantor's Intersection Theorem. **CO3 K3**

(OR)

b) Let (M, d) be a metric space. Then prove that any convergent sequence in M is a Cauchy sequence. **CO3 K3**

21. a) Let (M_1,d_1) and (M_2, d_2) be two metric spaces. Show that $f: M_1 \to M_2$ is continuous iff $f^{-1}(G)$ is open in M_1 whenever G is open in M_2. **CO4 K3**

(OR)

b) Let A, B be subsets of **R**. Prove that $\overline{A\ X\ B} = \bar{A}\ X\ \bar{B}$. **CO4 K3**

22. a) Let M be a metric space. Let A be a connected subset of M. If B is subset of M such that $A \subseteq B \subseteq \overline{A}$ then prove that B is connected. **CO5 K3**

(OR)

b) Let M_1 be a connected metric space. Let M_2 be any metric space. Let $f : M_1 \to M_2$ be a continuous function. Then show that f (M_1) is connected subset of M_2. **CO5 K3**

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. Prove that any open set of **R** can be expressed as a union of a countable number of mutually disjoint open intervals. **CO1 K4**

24. Let M be a metric space and M_1 be a subspace of M. Let A_1 be a subset of M_1. Then prove that A_1 is open in M_1 iff there exists an open set A in M such that A_1 = A∩M. **CO2 K4**

25. State and prove Baire's Category Theorem. **CO3 K4**

26. Let (M_1, d_1) and (M_2, d_2) be two metric spaces. Let $a \in M_1$. Show that $f: M_1 \to M_2$ is continuous at a iff $(x_n) \to a \text{ implies } (f(x_n)) \to f(a)$. **CO4 K4**

27. Prove that a subspace of **R** is connected iff it is an interval. **CO5 K4**

*** ALL THE BEST ***

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – III: Core Subject: Fifth Semester

STATICS

Under CBCS and OBE – Credit 5

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. The resultant of two equal forces P, P at an angle α is ______.
   (a) $P\cos(\alpha/2)$ (b) $2P\cos(\alpha/2)$ (c) $2P\cos\alpha$ (d) None
2. The resultant of P and Q is right angle to P. Then the angle between the forces is _____.
   (a) $\cos^{-1}(-P/Q)$ (b) $\cos^{-1}(P/Q)$ (c) $\cos^{-1}(Q/P)$ (d) None
3. If the parallel forces are not alike, the magnitude of the resultant is the _____ of the forces.
   (a) Sum (b) difference (c) algebraic sum (d) None
4. A couple is positive when its _____ is positive.
   (a) Moment (b) arm (c) axis (d) None
5. When the body is leaning against a smooth surface, the reaction on the body is _____ to the surface.
   (a) Parallel (b) normal (c) making an angle (d)None
6. The _____ of the body acts vertically downwards through its center of gravity.
   (a) Mass (b) weight (c) shape (d) None
7. If the resultant R is least, then the angle between the two forces P and Q will be
   (a) 0 (b) $\pi/4$ (c) π (d) None
8. When O is the centroid of the ΔABC, then area of ΔBOC = _____.
   (a) $2/3\ \Delta ABC$ (b) $1/3 \Delta ABC$ (c) ΔABC (d) None
9. When the body is just on the point of sliding on another, the friction attains its maximum value and is called _____.
   (a) Dynamical (b) statical (c) limiting (d) None
10. The range of friction is _____ to _____.
   (a) $0, \mu R$ (b) $0, \mu F$ (c) 1, F (d) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. Define Triangle of Forces
12. ABCD is a quadrilateral and forces acting at a point are represented in direction and magnitude by BA, BC, CD and DA. Find their resultant.
13. Define like and unlike parallel forces.
14. What is the condition for equilibrium of three coplanar parallel forces?
15. A couple, each of whose force is 9gm and arm is 5cm is replaced by another couple whose arm is 3cm. Find the magnitude of the force for replaced couple.
16. In a couple one of the force 12N and the arm of the couple 2 meters the find the moment of the couple.

17. Define frictional force.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Find the analytical expression for the resultant of two forces acting at a point

(OR)

b) State and prove Lami's Theorem

19. a) OA, OB, OC are the lines of action of two forces P and Q and their resultant R respectively. Any transversal meets the lines in L, M and N respectively, Prove that

$$\frac{P}{OL} + \frac{Q}{OM} = \frac{R}{ON}$$

(OR)

b) Find the resultant of two like parallel forces acting on a rigid body.

20. a) Prove that the effect of a couple upon a rigid body is not altered if it is transferred to a parallel plane provided its moment remains unchanged in magnitude and direction.

(OR)

b) State and prove two Trigonometrical theorems.

21. a) Find the Equation to the line of action of the resultant.

(OR)

b) If a system of forces act on a rigid body and the algebraic sum of their moments about each of three non-collinear points is zero separately, then prove that the system of forces will be in equilibrium

22. a) A particle of weight 30 kgs, resting on a rough horizontal plane is just on the plane of motion when acted on by horizontal forces of 6kg wt. and 8kg. wt. at right angles to each other. Find the coefficient of friction between the particle and the plane and the direction in which the friction acts

(OR)

b) Find the equation of the common catenary

SECTION – D

Answer Any Three Questions: **(3 X 10 = 30 Marks)**

23. ABC is a given triangle. Forces P, Q, R acting along the lines OA, OB, OC are in equilibrium. Prove that

(i) P: Q: R = $a^2\left(b^2+c^2-a^2\right):b^2\left(c^2+a^2-b^2\right):c^2\left(a^2+b^2-c^2\right)$ if O is the cicumcentre of the triangle.

(ii) P:Q:R $= \cos\frac{A}{2} : \cos\frac{B}{2} : \cos\frac{C}{2}$ if O is the incentre of the triangle.

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 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. If six forces, of relative magnitudes 1,2,3,4,5 and 6 act along the sides of a regular hexagon taken in order, show that the single equivalent force is of relative magnitude 6 and that it acts along a line parallel to the force 5 at a distance from the centre of the hexagon $3\frac{1}{2}$ times the distance of a side from the centre.

27. A body is at rest on a rough incline plane of inclination α to the horizon, being acted on by a force making an angle θ with the plane; find the limits between which the force must lie.

**** BEST WISHES ****

Course Code: 05EP5A

VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

Course Title: Linear Programming

Under CBCS and OBE – Credit 5

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. A constraint in an LPP is expressed as
   a) an equation with $'='$ sign
   b) inequalities with $'\leq'$ sign
   c) inequalities with $'\geq'$ sign
   d) any one of the above
2. Which of the following is correct?
   a) Linear programming takes into consideration the effect of time and uncertainty.
   b) An LPP can have only two decision variables.
   c) Decision variables in an LPP may be more or less than the number of constraints
   d) Linear programming deals with problems involving only a single variable.
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. A basic solution to the system is called_________ if one or more of the basic variables vanish
   a) Infeasible b) Degenerate c) Non-degenerate d) Unbounded
5. Dual simplex method is applicable to these LPP's that start with
   a) an infeasible solution b) an infeasible but optimum solution
   c) a feasible solution d) a feasible and optimum solution
6. Which of the following is correct
   a) If the primal problem is in its standard form, dual variables will be non-negative.
   b) Dual simplex method is applicable to an LPP, if initial basic feasible solution is not optimum.
   c) Dual simplex method always leads to degenerate basic feasible solution.
   d) If the number of primal variables is very small and the number of constraints is very large, then it is more efficient to solve the dual rather than the primal problem.
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. For a transportation problem, choose the statement which is not correct
   a) The problem allows for the shipment of goods from one source to another and from one destination to another
   b) There is a no real distinction between sources and destinations
   c) An *"m"* source, *"n"* destination transportation problem, when written as a transhipment problem would have $m + n$ sources and n destinations
   d) A transhipment problem is not likely to involve a lower cost than a transportation problem in a given situation
9. Hungarian Assignment method is also called
   a) reduced matrix method b) MODI method c) all the above d) none of them
10. The minimum number of lines covering all zeros in a reduced cost matrix of order *n*can be
    a) at most *n* b) at least *n* c) *n – 1* d) *n + 1*

SECTION – B

Answer Any Five Questions **(5 X 2 = 10 Marks)**

11. Solve the following LPP

    Maximize $z = 6x + y$

    Subject to constraints $2x + y \geq 3$ and $y - x \geq 0$ and $x, y \geq 0$.

12. Define surplus variable.
13. Write the dual of the LPP Minimum $z = 4x_1 + 6x_2 + 18x_3$

    Subject to the constraints $x_1 + 3x_2 \geq 3$, $x_2 + 2x_3 \geq 6$ and $x_1, x_2, x_3 \geq 0$.

14. Find the initial basic feasible solution for the following transportation problem by using North west corner rule

	I	II	Availablity
A	2	6	10
B	3	1	3
Requirement	7	6	

15. Define Two persons zero sum geme.
16. Solve the game

Player	I	II
1	5	0
2	0	2

17. Define canonical form of LPP.

SECTION – C

Answer ALL Questions: **(5 X 5 = 25 Marks)**

18. a) Explain the general mathematical formuation of LPP.

(OR)

b) A company has two grades of inspectors 1 and 2 who are to be assigned to a quality control inspection. It is required that at least 1800 pieces be inspected per 8-hr day. Grade 1 inspectors can check pieces at the rate of 25 per hour, with an accuracy of 98 percent. Grade 2 inspectors check at the rate of 15 pieces per hour, with an accuracy of 95 percent. The wage rate of a grade 1 inspector is Rs.40/hr, while that of grade 2 inspectors is Rs.30/hr. Each time an error is made by an inspector, the cost to the company is Rs.20. The company has available for the inspection job 8 grade 1 inspectors and 10 grade 2 inspectors. The company wants to formulate assignment of inspectors that will minimize the total cost of the inspection.

19. a) Use simplex method to solve the following LPP

    Maximize $z = 4x_1 + 10x_2$.

    Subject to constraints

    $2x_1 + x_2 \leq 50$, $2x_1 + 5x_2 \leq 100$, $2x_1 + 3x_2 \leq 90$ and $x_1, x_2 \geq 0$.

(OR)

b) Use two phase method to solve the LPP

   Maximize $z = 5x + 3y$

   subject to the constraints

   $2x + y \leq 1$, $x + 4y \geq 6$ and $x, y \geq 0$.

20. a) Distinquish between primal and dual of the LPP with suitable examble.

(OR)

b) Solve the given LPP by using dual simple method

   Maximize $z = 7x_1 + 5x_2$

Subject to constraints : $3x_1 + 2x_2 \leq 240$

$2x_1 + 3x_2 \leq 200$,

$x_1 , x_2 \geq 0.$

21. a) A company manufacturing air – coolers has two plants lacated at Mumbai and Kolkata with a weekly capacity of 200 units and 100 units, respectively. The company supplies air - coolers to its 4 showrooms situated at Ranchi, Delhi, Lucknow and Kanpur which have a demand of 75, 100, 100 and 30 units, respectively. The cost of transportation per units (in Rs.) is shown in the following table:

Cities	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	100
Kolkata	50	70	130	85

Plan the production programme so as to minimize the total cost of transportation by using Vogel's approximation method.

(OR)

b) By using least cost method to estimate the initial basic transportation cost.

Warehouse / Plant	W1	W2	W3	Supply
P1	7	6	9	20
P1	5	7	3	28
P3	4	5	8	17
Demand	21	25	19	65

22. a) Find the minimum Assignment cost for the following problem

Men/ Task	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

(OR)

b) Determine an optimum Assignment cost for the following informations

Deficit cities

		a	b	C	d	e
Surplus cities	A	85	75	65	125	75
	B	90	78	66	132	78
	C	75	66	57	114	69
	D	80	72	60	120	72
	E	76	64	56	112	68

SECTION – D

<u>Answer Any Three Questions:</u> **(3 X 10 = 30 Marks)**

23. A company makes two kinds of leather belts. Belt A is a high quality belt, and belt B is of lower quality. The respective profits are Rs. 4.00 and Rs. 3.00 per belt. Each belt of type A requires twice as much time as a belt of type B, and if all belts were of type B, the company cloud make 1000 belts per day. The supply of leather is sufficient for only 800 belts per day (Both A and B combined). Belt A requires a fancy buckle and only 400 buckles per day are available. There are only 700 buckles a day available for belt B. Determine the optimal product mix

24. Solve the given LPP by using Big M Method

Maximum $z = 5x_1 + x_2$

Subject to the constraints: $5x_1 + 2x_2 \leq 20$, $x_1 \geq 3$, $x_2 \leq 5$ and $x_1, x_2 \geq 0$.

25. Use duality to solve the following LPP

Maximize $z = 2x_1 + x_2$

Subject to constraints:

$x_1 + 2x_2 \leq 10$,

$x_1 + x_2 \leq 6$,

$x_1 - x_2 \leq 2$,

$x_1 - 2x_2 \leq 1$, $x_1, x_2 \geq 0$.

26. Find the optimal solution of the given transportation problem.

	D1	**D2**	**D3**	**D4**	**Supply**
S1	6	1	9	3	70
S2	11	5	2	8	55
S3	10	12	4	7	90
Demand	85	35	50	45	

27. Solve the following game by graphically

	Player B				
Player A		B_1	B_2	B_3	B_4
	A_1	1	3	-3	7
	A_2	2	5	4	-6

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VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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B.A/B.Sc. Degree (Semester) Examinations, November 2020

Part – IV : NME : First Semester : Paper – I

FUNDAMENTAL OF MATHEMATICS

Under CBCS – Credit 2

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

1. 1 +2+3+……………+n is equal to [CO1K1]

a) n^2 b) 0 C) n/2 d)n(n+1)/2

2. in the ratio 3:2=a:8 the value of a is [CO1K1]

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

3. The slope of the straight line ax + by+ c=0 is [CO2K1]

a) c/a b) c/b c) b/a d) -a/b

4.write the equivalent ratio for 32/96 [CO2K1]

a) ½ b) 1/3 c) ¼ d) 1/5

5 . The fifth term in the G.p. 3,6,12,………..is [CO3K1]

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

6. Find the duplicate of the ratio a:b is [CO3K1]

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

7) The distance between (0, 0) and (6, 8) points is by a [CO4K1]

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

8. Find the scalar matrix [CO5K1]

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) $\begin{pmatrix} 1 & 0 \\ 0 & 5 \end{pmatrix}$

9. Find the identify matrix [CO5K1]

a) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} 0 & 0 & 1 \\ 2 & 0 & 1 \\ 1 & 0 & 2 \end{pmatrix}$ c) $\begin{pmatrix} 0 & 2 & 1 \\ 1 & 0 & 1 \\ 1 & 2 & 3 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

10. Find the diagonal matrix [CO5K1]

a) $\begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 5 \\ 3 & 1 & 4 \end{pmatrix}$ b) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ d) None

Section - B

Answer Any Five Questions **(5x2=10 marks)**

11. How many times the ratio 3: 4 is the ratio 6:1 [CO1K2]

12. Find the compound ratio of 2:3, 5:6 and 7:9 [CO1K2]

13. Find the third proportional to 15 and 75 [CO1K2]

14. If A=$\begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$and B)$\begin{pmatrix} 2 & 0 \\ 1 & 5 \end{pmatrix}$ to find A+B [CO2K2]

15. If A=$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ and B=$\begin{pmatrix} 1 & 3 \\ 1 & 1 \end{pmatrix}$ to find A-B [CO2K2]

16. Find the mean proportional to 20 and 180 [CO1K2]

17. Find the Distance between points A(3,2) and B(4,3) [CO5K2]

Section –C

Answer any three questions **(3x9=27 marks)**

18. a) Find the value of x if (3x +4): (4x+7) is the Duplicate ratio of 4:5 [CO1K3]

or

b) The present age of two brothers are in the ratio of 3:4 five years back their ages were in the ratio of 5:7 Find their present age [CO2K3]

19. a) Find the value of x when (x+2) : (x-3) = (x+8):(x-1) [CO3K3]

or

b) Check the parallelogram A(8,0) and B(4.0) c(5,1) d(9,1) [CO4K3]

20. a) Find the quadratic equation of $2x^2+9x+10$ [CO5K3]

or

b) Find the sum of series 51+52+53+-----------+100 [CO4K3]

Section –D

Answer any Two question **(2x14=28 marks)**

21. A and B can do piece of work in 10 days B and C in 15 days .C and A in 20 days all of them work at it for 2 days and then A leaves After 4 days of work B leaves. In how many days will C complete the remaining work? [CO1K3]

22. If A=$\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$; B=$\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}$& C=$\begin{pmatrix} 1 & 2 \\ 0 & 2 \end{pmatrix}$, find $A^2+B^2+2AB+2C$ [CO3K3]

23. Monthly income of A and B are in the ratio of 5:6 and their expenses in the ratio of 4:5. If each save Rs. 200 per months. Find their incomes. [CO2K3]

24. Find the inverse of $A = \begin{bmatrix} 2 & 3 & 4 \\ 3 & 2 & 1 \\ 1 & 1 & -2 \end{bmatrix}$. [CO4K3]

*** ALL THE BEST ***

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VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

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

MATHEMATICAL LOGIC

Under CBCS – Credit 2

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

SECTION – A

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

1. $P \vee 0 =$ ____________.

   a) p b) 0 c) 1 d) q

2. $P \wedge 7p =$____________.

   a) 0 b) 1 c) 9 d) q

3. $p \vee 1=$______________.

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

4. $p \to q =$ ____________.

   a) $p \vee q$ b) $7p \vee q$ c) $7p \wedge q$ d) None

5. 7(7p) =______________.

   a) 1 b) 0 c) p d) q

6. $p \vee (p \wedge q)=$___________.

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

7. $p \wedge (P \vee q)=$____________.

a) 7p b) 7q c) p d) None

8. $7\,(p \vee q)=$_______________.

a) $7p \wedge 7q$ b) $7p \wedge 7q$ c) $7p \wedge q$ d) None

9. $7(p \wedge q)=$______________.

a) $7p \wedge 7q$ b) $7p \vee 7q$ c) $7q \wedge p$ d) None

10. $P \wedge 1=$_________________.

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

SECTION – B

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

11. Define Conditional Operator?

12. Write the Truth table for biconditional operator?

13. Define tautology.

14. Write the Distributive Law.

15. Write the Demorgan Law.

16. Write the absorption Law.

17. Write the commutative Law.

SECTION – C

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

18. a) Give truth table for $(P \wedge q) \wedge r$

[OR]

b) Give truth table for $(p \rightarrow q) \rightarrow (7p \vee q)$

19. a) Check for the tautology $i)\ p \rightarrow (p \vee q)$ $ii)\ p \rightarrow (p \wedge q)$

[OR]

b) Check for the tautology $q \vee (p \wedge q) \vee (7p \wedge 7q)$

20. a) Prove that $(p \rightarrow q) \Rightarrow (7p \rightarrow 7q)$

[OR]

b) Prove that $(p \vee \mathrm{q}) \wedge (7p \wedge (7p \wedge q)) \Rightarrow (7p \wedge q)$

SECTION – D

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

21. i) Prove that @ $7(p \wedge q) \rightarrow (7p \vee (7p \vee q)) \Rightarrow (7p \vee q)$

ii) Prove that $(p \rightarrow q) \Rightarrow (7p \wedge q)$

22. Give that trust table for $(p \vee q) \vee (r \vee s)$

23. Give that trust table for $(p \rightarrow (q \rightarrow r)) \Rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow q)$

24. Obtain the PDNF for $(p \wedge q) \vee (7p \wedge R) \vee (q \wedge R)$

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B.Sc. Mathematics Degree (Semester) Examinations, November 2020

Part – IV : SBS : Fifth Semester : Paper – I

QUANTITATIVE APTITUDE

Under CBCS – Credit 2

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

SECTION – A

Answer ALL Questions: **(10 X 1 = 10 Marks)**

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? CO1K1
(a) 5 days (b) 6 days (c) 8 days (d) 9 days

2. If A can complete a piece of work in 12 days and B is twice as A, then B can complete the same work in ______ days. CO1K1
(a)12 (b) 6 (c) 3 (d) 24

3. An athlete runs 200 metres race in 24 seconds. His speed is CO2K1
(a) 20 kmph (b) 24 kmph (c) 28.5 kmph (d)30 kmph

4. A speed of 14 metres per second is the same as CO2K1
(a) 28 kmph (b) 46.6 kmph (c) 50.4 kmph (d) 70 kmph

5. Which of the following trains is the fastest? CO3K1
(a) 25 m/s (b) 1500 m/s (c) 90 km/hr (d) 30 km/hr

6. A train 280 m long, running with a speed of 63 kmph will pass a tree in CO3K1
(a) 15 sec (b) 16 sec (c) 18 sec (d) 20 sec

7. If Principal P, Rate R% & time T years are given, then Simple Interest is CO4K1
(a) PRT/100 (b) 100xS.I/RT (c) 100xS.I/ PT (d) 100xS.I / PR

8. What will be the simple interest in a sum of Rs. 25,000 for 3 years at the rate of 12 %p.a? CO4K1
(a) Rs. 9000 (b) Rs. 9720 (c) Rs. 10123.20 (d) Rs. 8720

9. The simple interest at x% for x years will be Rs. x in a sum of : CO5K1
(a) Rs. x (b) Rs. 100/x (c) Rs. 100 x (d) Rs. 100 / x^2

10. When the interest is compounded Half yearly, the amount is CO5K1
(a) $P[1+R/100]^n$ (b) $P[1+(R/2)/100]^{2n}$ (c) $P[1+(R/4)/100]^{4n}$ (d) None

SECTION – B

Answer Any Five Questions: **(5 X 2 = 10 Marks)**

11. A and B 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 B alone complete that work? CO1K2
12. A is twice as good as B and together they finish a piece of work in 18 days. In how many days will A alone finish the work? CO2K2
13. A man travelled from the village to the post office at 25 kmph & return back by walk at 4 kmph. What is his average speed? CO2K2
14. A train 100m long is running at the speed of 30 kmph. Find the time taken by it passes a man standing near the railway station? CO3K2
15. A train is moving at a speed of 132 km/hr. If the length of the train is 110 metres, how long will it take to cross a railway platform 165 metres long? CO4K2
16. At what rate percent per annum will a sum of money double in 16 years? CO4K2
17. A sum of Rs. 12,500 amounts to Rs. 15,500 in 4 years at the rate simple interest. What is the rate of interest? CO5K2

SECTION – C

Answer ALL Questions: **(3 X 9 = 27 Marks)**

18. a) An Aero plane flies along the four sides of a square at a speeds of 200,400,600 & 800km/h respectively. Find the average speed of the plane around the field. CO1K3

(OR)

b) Walking at $\frac{5}{6}$ of its usual speed, a train is 10 minutes late. Find its usual time to cover the journey. CO1K3

19. a) A train 150 m long is running with a speed of 68 kmph. In what time will it pass a man who is running at 8 kmph in the same direction in which the train is going? CO2K3

(OR)

b) A sum of Rs. 800 amounts to Rs. 920 in 3 years at simple interest. If the interest rate is increased by 3 %, it would amount to how much? CO3K3

20. a) A certain sum of money amounts to Rs. 1008 in 2 years and to Rs. 1164 in 3 ½ years. Find the sum and the rate of interest? CO4K3

(OR)

b) Find the compound interest on Rs. 10,000 in 2 years at 4 % per annum, the interest being compounded half yearly? CO5K3

SECTION – D

Answer Any Three Questions: **(2 X 14 = 28 Marks)**

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 in 8 days. In how many days can 2 men and 1 boy do the work? CO1K4
22. A thief is spotted by a police man from a distance of 100 metres. When the police man starts the chase, the thief also starts running. If the speed of the thief be 8 km/h and that of the police man 10 km/h, how far the thief will have run before he is overtaken? CO2K4
23. A train running at 54 kmph takes 20 seconds to pass a platform. Next it takes 12 seconds to pass a man walking at 6 kmph in the same direction in which the train is going. Find the length of the train & length of the platform? CO3K4
24. Adam borrowed some money at the rate of 6 % p.a. for the first two years, at the rate of 9 % p.a. for the next three years, and at the rate of 14 % for the period beyond 5 years. If he pays a total interest of Rs. 11,400 at the end of nine years, how much money did he borrow? CO4K4

*** ALL THE BEST ***