ASSIGNMENTS-I

(For BA-2nd Year Session 2021-22 January Batch)

BA-Second Year **Course Code: MATH 201 TH**

Course Title: Real Analysis

Attempt any **FOUR** of the following:

1. Find real values of x, which satisfy the inequality

$$\frac{x-2}{x+2} > \frac{2x-3}{4x-1}$$

2. Derive the condition under which

$$|a-b| = |a| - |b|\ ;\ a, b \in R$$

3. Show that 0 is the only limit point of the set

$$\left\{\frac{1}{n} : n \in N\right\}$$

4. Prove that $Lt_{n\to\infty} \sqrt[n]{n} = 1$

5. Prove that

$$Lt_{n\to\infty} \frac{1}{n}\left(1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}\right) = 0$$

6. Prove that the sequence $\{a^n\}, a > 1$ is unbounded.

ASSIGNMENTS-II

(For BA-2nd Year Session 2021-22 January Batch)

BA-Second Year **Course Code: MATH 201 TH**

Course Title: Real Analysis

Attempt any **FOUR** of the following:

1. Show that $\sum_{n=1}^{\infty} \frac{1}{n(n+1)} = 1$
2. Show that the series

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$$

is convergent.

3. Discuss the convergence of the series

$$\sum_{n=1}^{\infty} \frac{1}{x^n + x^{-n}}, \; x > 0$$

4. Show that the sequence

$$f_n(x) = \frac{x}{1 + nx^2}, x \in R$$

converges uniformly on any closed interval.

5. Show that the series

$$\sum_{n=1}^{\infty} \frac{1}{n^2 + x^2}$$

is uniformly convergence on $[0, \infty)$.

6. Find the interval of convergence of the power series

$$\sum_{n=2}^{\infty} \left(\frac{1}{\log n}\right) x^n.$$

ASSIGNMENTS-I

(For B.A. 2nd year session 2021-22 January Batch)

B.A.-2nd Year **Course Code: MATH202TH**

Course Title: Algebra

Attempt any **FOUR** of the following:

1. Let Q^* denotes the set of all rational except -1. Show that Q^* forms an infinite abelian group under operation * defined by $a * b = a + b + ab$, for all $a, b \in Q*$
2. Let a,b, and x be any elements of a group G. Then prove that
   i. $O(a^{-1}) = O(a)$
   ii. $(x^{-1}ax)^k = x^{-1}a^k x$, for all $k \in I$
   iii. $O(a) = O((x^{-1}ax)$
3. Show that the set$\{1, 2, 3, 4, \quad p - 1\}$ where p is a prime number forms a finite abelian group of order p-1 under the composition of multiplication modulo p.
4. If $a^2 b = b^2 a = b$ for all $a, b \in G$(a semi group) then prove that G is abelian.
5. Prove that the intersection of an arbitrary collection of subgroup is again a subgroup of the group.
6. Prove that every subgroup of a cyclic group is cyclic. Is the converse true?

ASSIGNMENTS-II

(For B.A. 2nd year session 2021-22 January Batch)

B.A.-2nd Year **Course Code: MATH202TH**

Course Title: Algebra

Attempt any **FOUR** of the following:

1. State and prove Lagrange's theorem.
2. Prove that a subgroup H of a group G is a normal subgroup of G iff$ghg^{-1} \in H$ for every $h \in H$ and $g \in G$.
3. Prove that necessary and sufficient condition for a homomorphism of a group G into group G' with kernel K to be isomorphism is that $K = \{e\}$.
4. Prove that every field is an integral domain.
5. Prove that intersection of a family of subrings of a ring R is subring of R.
6. Prove that the sum and product of two ideals is again an ideal.

<u>**ASSIGNMENTS-I**</u>

(For B.A. 2nd year session 2021-22 January Batch)

B.A.-2nd Year **Course Code: MATH202TH**

Course Title: Algebra

Attempt any **FOUR** of the following:

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<u>**ASSIGNMENTS-II**</u>

(For B.A. 2nd year session 2021-22 January Batch)

B.A.-2nd Year **Course Code: MATH202TH**

Course Title: Algebra

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3. Prove that necessary and sufficient condition for a homomorphism of a group G into group G' with kernel K to be isomorphism is that $K = \{e\}$.
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ASSIGNMENTS-I

(For BA-2nd Year Session 2021-22 January Batch)

BA-Second Year **Course Code: MATH 309 TH (SEC 1)**

Course Title: Integral Calculus

Attempt any **FOUR** of the following:

1. Evaluate $\int \frac{2x^2+x+1}{(x-1)^2(x+2)}\,dx$

2. Integrate $\int \frac{dx}{(x+2)\sqrt{x+3}}$

3. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\tan x}}$

4. Obtain a reduction formula for $I_n = \int x^n e^x\,dx$. Hence evaluate I_4 .

5. If $I_n = \int_0^{\frac{\pi}{4}} tan^n x\,dx$, prove that $I_n + I_{n-2} = \frac{1}{n-1}$, n being a positive integer > 1. Hence evaluate I_5 .

6. Write down the value of $\int_0^{\frac{\pi}{2}} sin^5\theta\,cos^6\theta\,d\theta$.

ASSIGNMENTS-II

(For BA-2nd Year Session 2021-22 January Batch)

BA-Second Year **Course Code: MATH 309 TH (SEC 1)**

Course Title: Integral Calculus

Attempt any **FOUR** of the following:

1. Find the length of the arc of the parabola $y^2 - 4y + 2x = 0$ which lies in the first quadrant.
2. Find the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, the ordinates $x = c, x = d$ and the x-axis. Deduce the area of the whole ellipse.
3. Show that the volume of the solid obtained by revolving the area included between the curves $y^2 = x^3$ and $x^2 = y^3$ about the x-axis is $\frac{5\pi}{28}$.
4. Evaluate $\iint (x^3 + y^3)\, dx\, dy$ over A where A is the rectangle, bounded by the lines $x = 0, x = 1$ and $y = 0, y = 2$. .
5. Change the order of integration and hence evaluate $\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$
6. Find the volume of the solid bounded by the coordinate planes and the planes
$$2x + y + z = 2,\ 2x + y + z = 4.$$

ASSIGNMENTS-I

(For B.A. 2nd year session 2021-22 January Batch)

B.A. -2nd Year

Course Code: MATH310TH (SEC II)

Course Title: Vector Calculus

Attempt any **FOUR** of the following:

1. Find λ for which points A(3,2,1), B(4, λ, 5),C(4,2,-2) and D (6,5,-1) are coplanar.
2. Find the volume of tetrahedron whose vertices are the points A(2,-1,-3), B(4, 1, 3),C(3,2,-1) and D (1,4,2).
3. Given $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}, \vec{c} = \hat{i} + 3\hat{j} - \hat{k}$ find the reciprocal traids $\vec{a}', \vec{b}'\vec{c}'$.
4. A particle moves so that its position vector is given by $\vec{r} = \cos wt\hat{i} + \sin wt\hat{j}$. Show that the velocity $\vec{v}$ of the particle is perpendicular to $\vec{r}$ and $\vec{r} \times \vec{v}$ is a constant vector.
5. Find the directional derivative of $xy + yz + zx$ in the direction of the vector $\hat{i} + 3\hat{j} + 3\hat{k}$ at point (1,3,0)
6. Show that the vector $(\sin y + z)\hat{i} + (x\cos y - z)\hat{j} + (x - y)\hat{k}$ is irrotational.

ASSIGNMENTS-I

(For B.A. 2nd year session 2021-22 January Batch)

B.A. - 2nd Year

Course Code: MATH310TH

Course Title: Vector Calculus

Attempt any **FOUR** of the following:

1. Evaluate $\int_2^1 (\frac{d\vec{r}}{dt} \times \frac{d^2\vec{r}}{dt^2})dt$where $\vec{r} = 2t\hat{i} + 3t^2\hat{j} - t^3\hat{k}$.
2. Evaluate $\iiint_V \emptyset dV$, where $\emptyset = 45x^2y$ and V isclosed region bounded by planes $4x + 2y + z = 8, x = 0, y = 0, z = 0$
3. Evaluate by Stokes' theorem $\oint_C (yzdx + zxdy + xydz)$where $C = x^2 + y^2 = 1, z = y^2$.
4. Verify Green's theorem for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region bounded by $x = 0, y = 0, x + y = 1$.
5. Express $\nabla^2\emptyset$ in orthogonal curvilinear coordinates.
6. Express $curl\ \vec{F}$in orthogonal curvilinear coordinates