Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM -101	Course Title: **Differential Calculus**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. Let f be defined on R such that $f(x) = 0 \quad and \quad f(x) = \frac{e^{1/x}}{1+e^{1/x}}\ when\ x \neq 0$

   Does $limt\ exit\ when\ x \rightarrow 0$

2. Let f be defined on R such that $f(x) = 5x - 4\ when\ 0 \leq x \leq 1$

   $$f(x) = 4x^2 - 3\ when\ 1 \leq x \leq 2$$

   $$f(x) = 5x + 4\ when\ x > 2$$

   $is\ f\ continuous\ at\ x = 1\ and\ x = 2$?

3. Show that if faction is differentiable at given point then it is continuous at that point. is the converse true ? Support your answer.

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. Let R be a relation defined in the set of natural numbers N such that

   $R = \{(x, y): 3x + y = 15\}$find the domain and range of R.

5. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a map defined by $f(x) = x^2 \qquad and$

   $$let\ A = \{x \epsilon \mathbb{R} : 1 \leq x \leq 2\}\ find\ f(A)$$

6. If $fx = 2x - 1\ \ and\ \ g(x) = x + 4\ then\ \ find\ (f.g)(x)$.

7. $Consider\ a\ map\ f: \mathbb{R} \rightarrow \mathbb{R}\ such\ that\ \ f(x) = 4x^2 - 3\ \ is\ f\ injective.$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-102	Course Title: **Analytical Geometry**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

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1. Find the point of intersection of the line $\frac{x+1}{1} = \frac{y+3}{3} = \frac{z-2}{2}$ with the plain $3x + 4y + z = 10$
2. Find the equation of the sphere for which the circle $x^2 + y^2 + z^2 + 7y - 2z + 2 = 0,\ 2x + 3y + 4z = 8$ is a great circle.
3. Find the equation of the tenant plains of the sphere $x^2 + y^2 + z^2 - 2x + 4y - 6z + 30 = 0$ which are parallel $2x - y + z = 0$

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. $If\ the\ equation\ x^2 - y^2 - 2x + 2y + \lambda = 0$ $represent\ a\ degenerate\ conic\ then\ find\ the\ value\ of\ \lambda$
5. Find the angle between the pair of straight lines $x^2 + 4y^2 - 7xy = 0$
6. Find the perpendicular distance from the origin to the plain $x + 2y + z = 3$ also find the direction cosines of the normal to the plain.
7. Find the angle between the planes $2x - y + z = 5$ and $x + 3y + 2z = 7$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-103	Course Title: **Integral Calculus**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. Show that $xy = 1$ and $x^2 + y^2 = 2$ $tuch$ $each$ $other$ at two $points$.
2. Under what condition the curves $a_1x^2 + b_1y^2 = 1$ and $a_2x^2 + b_2y^2 = 1$ cut orthogonally
3. Find the angle of the intersection of the curves $y^2 = x$ and $x^2 + y^2 = 4$

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. Show that $\int_0^{\pi/2}(sin^2x)\cos x\,dx = \frac{1}{3}$
5. Integrate $e^{ten\,x}.sec^2x$ $w.r.t.$ x
6. Evaluate $\int_0^{\pi/4}(ten^5x)dx$
7. Integrate $\frac{\sqrt{x}}{1+x^{1/4}}$ $w.r.t.$ x

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-104	Course Title**: Differential Equation**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

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1. Solve that differential equation
   $(1+4xy+2y^2)dx+(1+4xy+2x^2)\,dy=0$
2. Solve $x^2+p^2x=yp$
3. Find the orthogonal trajectories of the cardiod $r=a(1-\cos\theta)$, a being the parameter.

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. Solve $\frac{dy}{dx}=e^{x-y}+x^2e^{-y}$
5. Solve $x.Dy+y=xy^3$
6. Solve $y=cx+{}^{a}/_{c}$
7. Is the following equation excel $\left(1+e^{x/y}\right)dx+e^{x/y}\left(1-{}^{x}/_{y}\right)dy=0$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-105	Course Title**: Mechanics-I (Statics and Dynamics)**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. If T be the tension at any point P of a common catenary and To be the tension at the lowest point A then prove that $T^2 - To^2 = W^2$ $when\ W\ in\ the$ weight of the are AP of the cetenery.
2. Five weight less rods of equal length are joined together so as to from a rhombus ABCD with one diagonal *BD*. at a weight W be attached to C and the system be suspended from A then show that there is a thrust in *BD* equal $w/\sqrt{3}$.
3. The velocities of a pastiche along and perpendicular to the radius vector from a fixed point are $\lambda\ r$ & $\mu\theta$. Find the path of the particle.

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. A particle is allowed to move from the top of a cycloid whose vertex is upward and plane vertical with negligible velocity. Find the point where the particle leaves the cycloid.
5. A body consisting at a core and a hemisphere on the same base rests on a rough horizontal table the hemisphere being in contact with the table of the height of the cone is $\sqrt{3}$ times the radius of the hemisphere . Find whether the equilibrium will be stable or unstable.
6. A particle moves with a central acceleration which varies inversely as the cube of the distance if it is projected from an apse at a distance a from the origin with velocity which is $\sqrt{2}$ time of the velocity for a circle of radius a then show that its path is $r\ \cos\frac{\theta}{\sqrt{2}} = a.$
7. A particle whose mass is m is acted upon by a force $m\mu\left(x + \frac{a^4}{x^3}\right)$ towards the origin if it stats from rest a distance a then show that it will arrive at the origin is time $\frac{\pi}{4\sqrt{\mu}}$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-106	Course Title**: Mechanics-II (Dynamics and Hydrodynamics)**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. Find the moment of inertia of a rod of length $2a$ & mass M about a line through its centre perpendicular to its length.

2. Find the moment of inertia of a circular disc of radian $'a'$ about its diametre.

3. At the vertex c of a tangle ABC which is a right angle at c show that the principle axis in the plane are inclined to the sides at an angle $\frac{1}{2}\ tan^{-1}\frac{ab}{a^2-b^2}$.

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. One end of a light string is fixed to a point of the rim of a uniform circular disc of radian 'a' & mass 'm' and the string is wound several times round the rim. the free end is attached to a fixed point and the disc is held so that the part of the string not in contact with the vertical of the disc be let go find the acceleration & tension of the string.
5. Find the moment of inertia of a right circular cylinder about a straight line through its centre of gravity perpendicular to its axis.
6. A straight uniform rod can turn freely about one end O, hangs from O vertically. Find the least angular velocity with which it must begin to moves so that it may perform complete revolution in a vertical plane.
7. Show that the moment of inertia of the area bounded by $r^2 = a^2cos\ 2\theta$ about its axis is $\frac{Ma^2}{16}(\pi - 8/3\,)$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-107	Course Title**: Linear Algebra**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. Find all eign values and eign vectors of a linear transformation
   $T : IR^3 \; IR^3, \; defined \; as \;\; T(x, y, z) = (2x + y, \; y - z, 2y + 4z)$. Is T diagonolizatble
2. If w_1 and w_2 are any two finite subspaces of a vector space V then show that
   $$dim\,(w_1 + w_2) = dim\, w_1 + dim\, w_2 - dim\,(w_1 \cap w_2)$$
3. Find the eigen Values and eigen vectors of the matrix $A = \begin{pmatrix} 1 & 1 & 3 \\ 3 & 2 & 4 \\ 3 & 4 & 5 \end{pmatrix}$

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. Let V be a vector space over a field F such that it has no proper subspace. Then show that either
   $$V = \{\, o \,\} \; or \; dim\, V = 1.$$
5. Which of the following is a linear transformation where $T : IR^2 \rightarrow IR^2$
   (a) $T(x_1, x_2) = (1 + x_1, x_2)$
   (b) $T(x_1, x_2) = (x_2, x_1)$
6. A function f is defined on IR^2 as follows:
   $$f(x, y) = (x_1 - y_1)2 + x_1 y_2, where \; x = (x_1 - x_2) \; and \; y = (y_1, y_2)$$
   $$Is \; f \; a \; bilinear \; forms? \; Verify.$$

Uttar Pradesh Rajarshi Tandon Open University

School of Science, Assignment Session 2021-22

Course Code: UGMM-108	Course Title**: Calculus of function of several variable and Vector Calculus**	Maximum Marks : 30

(Section 'A')

(Long Answer Questions)

NOTE: Answer each question in 500 to 800 words. All carry equal marks.

Maximum Marks: 18

1. at $u = e^{xyz}$ *then show that* $\frac{\partial^3 u}{\partial x \partial y \partial z} = (1 + 3xyz + x^2y^2z^2)$ is it also equal to $\frac{\partial^3 u}{\partial y \partial z \partial x}$?
2. Show that $\frac{\partial(u,v)}{\partial(x,y)} \times \frac{\partial(x,y)}{\partial(u,v)} = 1$
3. A particle moves so that its position vector in given by $\bar{r} = \hat{\imath}\cos wt + \hat{\jmath}\sin wt$ Show that the velocity $\bar{v}$ is perpendicular $\bar{r}$ and $\bar{r} \times \bar{v}$ is constant vector.

(Section – B)

(Short Answer Questions)

Maximum Marks: 12

Note : Answer each question in 200 to 300 Words. All carry equal marks.

4. Find the deviational derivative of $f(x) = \mathrm{xy}^2 + \mathrm{yz}^3$ at the point $(1, -1, 1)$ along the vector $\hat{\mathrm{i}} + 2\hat{\mathrm{j}} + 2\hat{\mathrm{k}}$
5. at $\mathrm{u} = \tan^{-1}\left(\frac{\mathrm{x}^3+\mathrm{y}^3}{\mathrm{x}-\mathrm{y}}\right)$ then show that $\mathrm{x}\frac{\partial \mathrm{u}}{\partial \mathrm{x}} + \mathrm{y}\frac{\partial \mathrm{u}}{\partial \mathrm{y}} = \sin 2\mathrm{u}$
6. Determine the point where the function $\mathrm{x}^4 + \mathrm{y}^4 - 2\mathrm{x}^2 + 4\mathrm{xy} - 2\mathrm{y}^2$ has a maximum are minimum.
7. Find curl (curl $\bar{\mathrm{F}}$) at the point (0,1,2) where $\bar{\mathrm{F}} = (\mathrm{x}^2\mathrm{y})\hat{\imath} + (\mathrm{xyz})\hat{\jmath} + (\mathrm{z}^2\mathrm{y})\hat{\mathrm{k}}$

   Or

   Evaluate $\int \bar{F}.d\bar{r}$ *whre* $\bar{F} = (3x^2)\hat{\imath} + (2xz - y)\hat{\jmath} + z\hat{k}$ along the straight line joinery (0,0,0) & (2,1,3)