उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

Bachelor of Science कार्यक्रम अधिन्यास सत्र 2020-21

कोर्स कोड : Course Code: **UGMM-101**	कोर्स शीर्षकः– (Course Title) **Differential Calculus**	अधिकतम अंक : 30 **Maximum Marks : 30**

खण्ड अ — **अधिकतम अंक : 18**

Section-A — **Maximum Marks : 18**

नोट– (Instructions): Section A consists of long answer questions. Answer should be in 800 to 1000 words. All questions are compulsory.

1. How many relations can be defined in a set containing 10 elements? If A = {1, 2, 3} then write down the smallest and biggest reflexive relations in the set A.
2. Prove that $f: X \rightarrow Y$ is injective iff $f^{-1}(\{y\}) = \{x\}\ \forall y \in f(X)$, and some $x \in X$
3. If $\lim_{x\to a} f(x) = l$ then show that $\lim_{x\to a} |f(x)\} = |l|$

(Hint: Use |f(x) –l| ≥ | | f(x) | - |l| |)

खण्ड ब — **अधिकतम अंक : 12**

Section –B — **Maximum Mark : 12**

नोट– (Instructions): Section B consists of short answer questions. Answer should be in 200 to 300 words. All questions are compulsory.

4. Show that $\lim_{x\to 0} \frac{e^{\frac{1}{x}} - e^{\frac{-1}{x}}}{e^{\frac{1}{x}} + e^{\frac{-1}{x}}}$ does not exist.
5. Find $\frac{dy}{dx}$ if $x = a\cos^3 t$, $y = a \sin^3 t$
6. Expand $\log(x + a)$ in powers of x by Taylor's theorem.
7. Verify Lagrange's formula for the function $f(x) = 2x - x^2$ on $[0,1]$.

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कोर्स कोड : Course Code: **UGMM-102**	कोर्स शीर्षकः— (Course Title) **Analytical Geometry**	अधिकतम अंक : 30 **Maximum Marks : 30**

खण्ड अ — **अधिकतम अंक : 18**

Section-A — **Maximum Marks : 18**

नोट— (Instructions): Section A consists of long answer questions. Answer should be in 800 to 1000 words. All questions are compulsory.

1. Show that the equation $12x^2 - 10xy + 2y^2 + 11x - 5y + 2 = 0$ represents a pair of straight lines. Find their equations.
2. Find the coordinates of the centre of the conic $41x^2 + 24xy + 9y^2 - 130ax - 60ay + 116a^2 = 0$.
3. The coordinates of a point A are $(2, 3, -5)$. Determine the equation to the plane through A at right angles to the line OA, where O is the origin.

खण्ड ब — **अधिकतम अंक : 12**

Section –B — **Maximum Mark : 12**

नोट— (Instructions): Section B consists of short answer questions. Answer should be in 200 to 300 words. All questions are compulsory.

4. Find the equation of the sphere which passes through the points $(0,0,0), (a, 0,0), (0, b, 0)$ and whose centre lies on the plane $x + y + z = 0$
5. Find the equation of the cylinder with generators parallel to the x-axis and passing through the circle $x^2 + y^2 + z^2 = 9, 2x = y + z$.
6. Find the equation of the cone reciprocal to the cone
$$fyz + gzx + hxy = 0$$
7. Show that the plane $7x + 5y + 3z = 30$ touches the ellipsoid $7x^2 + 5y^2 + 3z^2 = 60$. Find the point of contact.

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कोर्स कोड : Course Code: **UGMM-103**	कोर्स शीर्षकः— (Course Title) **Integral Calculus**	अधिकतम अंक : 30 **Maximum Marks : 30**

खण्ड अ **अधिकतम अंक : 18**

Section-A **Maximum Marks : 18**

नोट— (Instructions): Section A consists of long answer questions. Answer should be in 800 to 1000 words. All questions are compulsory.

1. Evaluate the following integrals
   (a) $\int a^{2x} \cos 4x \, dx$ (b) $\int e^{3x} \sin 3x \, dx$ (c) $\int e^{4x} \cos x \cos 2x \, dx$

2. Prove : If $C_n = \int e^{ax} \cos^n x dx$, then
$$C_n = \frac{ae^{ax}\cos^n x}{n^2+a^2} + \frac{ne^{ax}\cos^{n-1} x \sin x}{n^2+a^2} + \frac{n(n-1)}{n^2+a^2} C_{n-2}$$

3. Evaluate $\int \frac{x^2+2x+3}{\sqrt{x^2+x+1}}$

खण्ड ब **अधिकतम अंक : 12**

Section –B **Maximum Mark : 12**

नोट— (Instructions): Section B consists of short answer questions. Answer should be in 200 to 300 words. All questions are compulsory.

4. Prove that the line $2x+3y=1$ touches the curve $3y=e^{-2x}$ at a point whose X-coordinate is zero.
5. Show that the curve
   $x^3+2x^2+2xy-y^2+5x-2y=0$
   has a single cusp & first species at the point (-1 , -2)
6. Find the area of the curve $x = a(3\sin\theta - \sin^3\theta)$, $y = a\cos^3\theta$, $0 \le \theta \le 2\pi$.
7. Find the area of the surface generated by revolving the circle $r = a$ about the x-axis thus verify that the surface area of a sphere of radius a is $4\pi a^2$.

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कोर्स कोड : Course Code: **UGMM-104**	कोर्स शीर्षकः– (Course Title) **Differential Equation**	अधिकतम अंक : 30 **Maximum Marks : 30**

खण्ड अ — **अधिकतम अंक : 18**

Section-A — **Maximum Marks : 18**

नोट– (Instructions): Section A consists of long answer questions. Answer should be in 800 to 1000 words. All questions are compulsory.

1. Verify that the function $y = a\cos x + b\sin x$, where a, b Є R is a solution of the differential equation $\frac{d^2y}{dx^2} + y = 0$.
2. Show that the differential equation $\frac{dy}{dx} = \frac{x^2 + y^2}{x^2 + xy}$ is homogeneous and solve it.
3. Solve the equation $x\frac{dy}{dx} = x^2 + 3y, \quad x > 0.$

खण्ड ब — **अधिकतम अंक : 12**

Section –B — **Maximum Mark : 12**

नोट– (Instructions): Section B consists of short answer questions. Answer should be in 200 to 300 words. All questions are compulsory.

4. Solve the differential equation $xdy + ydx = \frac{a^2(xdy - ydx)}{x^2 + y^2}$.
5. Solve the differential equation $y = x + a\tan^{-1} p$
6. Determine the curve whose sub-tangent is twice the abscissa of the point of contact and passes through the point (1, 2).
7. With reference to the following figure, which consists of a resistor of resistance R = 3 Ω, connected in series with an inductor of inductance L = 5 H, and an applied constant voltage $E = 240\,Volts$.
   (i) Obtain a differential equation giving the current I at time t.
   (ii) Solve the differential equation for the initial condition, when t = 0, I = 0.