SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	For any function $\phi(x)$, show that $\int_a^b \phi(x)dx = -\int_b^a \phi(x)dx$.	4	CO1
Q 2	Define the improper integrals of second kind with the help of an example.	4	CO2
Q 3	Prove that $\Gamma(1+n)\Gamma(1-n) = \frac{n\pi}{\sin n\pi}$.	4	CO2
Q 4	Show that the area of the circle $x^2 + y^2 = a^2$ is πa^2 using the double integration.	4	CO3
Q 5	For any position vector $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and $|\vec{r}| = r$. Show that $\nabla r^n = nr^{n-2}\vec{r}$.	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	If $u_n = \int_0^{\frac{\pi}{2}} x^n \sin mx\, dx$, prove that $$u_n = \frac{n\pi^{n-1}}{m^2 2^{n-1}} - \frac{n(n-1)}{m^2}u_{n-2},$$ if m is of the form $4r + 1$. **OR** Find the reduction formula for $\int e^{ax}\sin^n bx\ dx$.	10	CO1
Q 7	Check whether the integral $\int_0^\infty e^{-a^2x^2}\cos bx\, dx$ converges absolutely or not?	10	CO2
Q 8	Evaluate $\iint_R y^2 dx\, dy$ over the area outside $x^2 + y^2 - ax = 0$ and inside $x^2 + y^2 - 2ax = 0$.	10	CO3

Q 9	A particle moves along the curve $\vec{r} = (t^3 - 4t)\hat{\imath} + (t^2 + 4t)\hat{\jmath} + (8t^2 - 3t^3)\hat{k}$, where t is the time. Find the magnitude of the tangential components of its acceleration at $t = 2$.	10	CO4
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Transform $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sqrt{\left(\frac{\sin\phi}{\sin\theta}\right)} \, d\phi d\theta$ by the substitution $x = \sin\phi\cos\theta$, $y = \sin\phi\sin\theta$ and show that its value is π. **OR** Find the volume cut off from the sphere $x^2 + y^2 + z^2 = a^2$ by the cylinder $x^2 + y^2 = ax$.	20	CO2
Q 11	State and prove the Green's theorem for a plane.	20	CO4