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 MATRIC NO: - 19/MHSOL/295
 DEPARTMENT: - MBBS

1. $\int \sin^6 x$

$\int \sin^2 x (\sin^2 x)^2 dx$
 $\sin^2 x = \frac{1 - \cos 2x}{2}$

$\int \left(\frac{1 - \cos 2x}{2}\right) \left(\frac{1 - \cos 2x}{2}\right)^2 dx$

$\frac{1}{8} \int (1 - \cos 2x)(1 - 2\cos 2x + \cos^2 2x)$

$\frac{1}{8} \int (1 - 2\cos 2x + \cos^2 2x - \cos 2x + 2\cos^2 2x - \cos^3 2x)$

$\frac{1}{8} \int (1 - 3\cos 2x + 3\cos^2 2x - \cos^3 2x)$

$\int \cos^3 2x dx = \int \cos 2x \cos^2 2x dx$

$= \int \cos 2x (1 - \sin^2 2x) dx$

$\int \cos^3 2x dx = \int (\cos 2x - \cos 2x \sin^2 2x) dx$

Let $u = \sin 2x$, $\frac{du}{dx} = 2\cos 2x$, $dx = \frac{du}{2\cos 2x}$

$\frac{\sin 2x}{2} - \int \cos 2x u^2 \cdot \frac{du}{2\cos 2x}$

$\int \cos^3 2x dx = \frac{\sin 2x}{2} - \frac{u^3}{6} = \frac{\sin 2x}{2} - \frac{\sin^3 2x}{6}$

$\int \sin^6 x = \frac{1}{8} \int (1 - 3\cos 2x + 3\cos^2 2x - \cos^3 2x)$

$= \frac{1}{8} \left(x - \frac{3\sin 2x}{2} + \left(\frac{3x}{2} + \frac{3\sin 2x}{4}\right) - \left(\frac{\sin^2 x}{2} - \frac{\sin^3 2x}{6}\right) \right) dx$

$= \frac{1}{8} \left(x - \frac{3\sin 2x}{2} + \frac{3x}{2} + \frac{3\sin 2x}{4} - \frac{\sin^2 x}{2} + \frac{\sin^3 2x}{6} \right) + C$

$= \frac{1}{8} \left(\frac{5x}{2} - \frac{3\sin 2x}{4} + \frac{3\sin 2x}{4} - \frac{\sin^2 x}{2} + \frac{\sin^3 2x}{6} \right) + C$

$= \frac{5x}{16} - \frac{\sin^2 x}{16} + \frac{3\sin^2 x}{32} + \frac{\sin^3 x}{48} + C$

2.) $\int \cos^4 x \sin^3 x$

$u = \cos x$

$\frac{du}{dx} = -\sin x$, $dx = -\frac{du}{\sin x}$

$\int u^4 \sin^2 x \cdot -\frac{du}{\sin x}$

$= -\int u^4 \sin^2 x \cdot du$

$= -\int u^4 (1 - \cos^2 x) du$

$= -\int u^4 (1 - u^2) du$

$= -\int u^4 - u^6 du$

$= -\left(\frac{u^5}{5} - \frac{u^7}{7}\right) + C$

$= -\frac{\cos^5 x}{5} + \frac{\cos^7 x}{7} + C$

$\frac{\cos^7 x}{7} - \frac{\cos^5 x}{5} + C$

3.) $\int \cos x \sin^3 x dx$

$\int \cos x \sin x \sin^2 x dx$

$\sin^2 x = 1 - \cos^2 x$

$\int \cos x \cdot \sin x (1 - \cos^2 x) dx$

$\int \cos x \sin x - \sin x \cos^3 x dx$

Let $u = \cos x$

$\frac{du}{dx} = -\sin x$, $dx = -\frac{du}{\sin x}$

$= -\sin x \cos x - \int \sin x u^3 \cdot -\frac{du}{\sin x}$

$= -\sin x \cos x + \frac{u^3}{3} + C$

$= -\sin x \cos x + \frac{\cos^3 x}{3} + C$