(b) Find the constants 'a' and 'b' so that the vector $\vec{F} = (axy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (bxz^2 - y)\vec{k}$ is irrotational and find ϕ such that $\vec{F} = grad\ \phi$. **(7 Marks)**

(c) Evaluate $\int_C xy\,dx + xy^2\,dy$ by stokes' theorem where C is the square in the xy plane with vertices $(1,0)$, $(-1,0)$, $(0,1)$&$(0,-1)$. **(6 Marks)**

PART - C

5. (a) Solve : $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x} + cos\ 2x + 4$ **(7 Marks)**

(b) Solve : $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^2 - 4x - 6$ **(7 Marks)**

(c) Solve : $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2 = e^x\ tan\ x$ using method of variation of parameters. **(6 Marks)**

6. (a) Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$ subject to the conditions $\frac{dy}{dx} = 2, y = 1\ at\ x = 0$. **(7 Marks)**

(b) Using method of undetermined coefficients solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 3y = x^2 + cos\ x$. **(7 Marks)**

(c) Solve $(3x-2)^2\frac{d^2y}{dx^2} - 3(3x-2)\frac{dy}{dx} = 9(3x-2)\ sin\ (log(3x-2))$ **(6 Marks)**

PART D

7. (a) Find the Laplace transforms of

i) $te^{2t} - 2\frac{sin\ 3t}{t}$

ii) $\int_0^t e^{-t}\ sin\ 2t\ sin 3t\ dt$ **(7 Marks)**

(b) A periodic function of period $\frac{2\pi}{\omega}$ is definded by

$$f(t) = \begin{cases} E\ sin\ \omega t, & 0 \le t \le \frac{\pi}{\omega} \\ 0, & \frac{\pi}{\omega} \le i < \frac{2\pi}{\omega} \end{cases}$$

where E&ω are constants. Show that

$L[f(t)] = \frac{E\omega}{(s^2+\omega^2)(1-e^{\frac{-\pi s}{\omega}})}$ **(7 Marks)**

(c) Express the following function in terms of Heaviside unit step function & hence find its Laplace transform where

$$f(t) = \begin{cases} t^2, & 1 < t \le 2 \\ 4t, & t > 2 \end{cases}$$ **(6 Marks)**

8. (a) Find inverse Laplace transform of $\frac{s+1}{(s-1)^2(s+2)}$ **(7 Marks)**

(b) Using convolution theorem obtain the inverse Laplace transform of $\frac{s}{(s+2)(s^2+9)}$ **(7 Marks)**

(c) Using Laplace transform solve the equation $y'' + 6y' + 9y = 12t^2e^{-3t}$ subject to the conditions $y(0) = 0, y'(0) = 0$. **(6 Marks)**

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