## FEBRUARY 2018 / IN - SEM (T1)
## F. Y. B.TECH. (COMMON) (SEMESTER - II)
## COURSE NAME : Engineering Mathematics-II
## (2017 PATTERN)

**Solution Set**

1. **a)**

$$\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$$

$$\sec^2 y\frac{dy}{dx}+2x\tan y=x^3$$ [2]

$$Put\tan y=u, \sec^2 y\frac{dy}{dx}=\frac{du}{dx}$$

$$\frac{du}{dx}+2x\tan y=x^3$$ P= 2x, Q = $x^3$

$$e^{\int 2x dx}=e^{x^2}$$

$$Solutuion: ue^{x^2}=\int e^{x^2}x^3 dx$$ (2)

Put $x^2 = t$ to evaluate the integral

$$Ans: \tan y=\frac{1}{2}(x^2-1)+ce^{-x^2}$$ (2)

**b)** r = a (1+ cos θ)

$$1=a(-\sin\theta)\left(\frac{d\theta}{dr}\right)$$

$$\left(r\frac{d\theta}{dr}\right)=-\frac{a(1+\cos\theta)}{-a\sin\theta}=-\cot(\theta/2)$$ (3)

Diff equation of orthogonal trajectories are given by

$\left(r\frac{d\theta}{dr}\right)=\tan(\theta/2)$, solving this we get r = b (1- cos θ) [3]

**c)** Exact equation soln $x\log(x^2+y^2)=c$ [4]

OR

Q2) **a)** $e^y\left(1+\frac{dy}{dx}\right)=e^x$ , put $e^y$= u, $e^y\frac{dy}{dx}=\frac{du}{dx}$ [3]

$\frac{du}{dx} + u = e^x$, $ue^x = e^{2x}/2 + c$

**b)** $i = \frac{10}{\sqrt{R^2 + L^2}}\left[\sin(t-\varphi) + \sin\phi e^{\frac{-Rt}{L}}\right], \phi = \tan^{-1}\left(\frac{L}{R}\right)$ 4 marks

**c)**

$$\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$$
$$(ax+hy+g)dx + (hx+by+c)dy = 0$$
$$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x} = h$$

Equation is exact, solution is $ax^2/2 + hxy + gx + by^2/2 + cy = c'$ [4]

Q3) **a)** $f(x) = 1 - \frac{1}{2}\cos x - \sum_{2}^{\infty} \frac{2(-1)^n}{n^2-1}\cos nx$

a0 , a1 an 1 marks each, 3 for series

**b)** Find half range sine series f(x) = x $0 < x < \pi/2$.
= $\pi$- x $\pi/2 < x < \pi$. [4]

Ans: $f(x) = \sum_{n=1}^{\infty} \frac{4\sin(n\pi/2)}{n^2\pi} \sin(nx)$

**c)** 77.92 deg

Q4) **a)** Ans: $f(x) = \frac{1}{\pi} + \frac{1}{2}\sin x + \sum_{n=1}^{\infty} I_0\left[\frac{(-1)^{n+1}-1}{\pi(n^2-1)}\right]\cos(nx)$

**b)** $y = 20.83 - 8.33\cos(\pi x/3) - 1.15\sin(\pi x/3)$ [4]

**c)** $v = \frac{dx}{dt} = k\tanh\left(\frac{gt}{k}\right)$ 2 marks

Final answer 2 marks