B.TECH. SEM -II (2007 COURSE) (ALL BRANCHES) :
SUMMER - 2018
SUBJECT : ENGINEERING MATHEMATICS - II

Day : **Friday**		Time : **10.00 AM TO 01.00 PM**	
Date : **01/06/2018**	**S-2018-2552**	Max. Marks : 80	

N. B. :

1) **Q. No. 1** and **Q. No. 5** are **COMPULSORY**. Out of the remaining attempt **ANY TWO** questions from each section.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer book.
4) Use of non programmable **CALCULATOR** is allowed.
5) Assume suitable data if necessary.

SECTION – I

Q.1 a) Find the Cartesian co-ordinates of the points $\left(3, \frac{\pi}{6}, \frac{3\pi}{4}\right)$. **[05]**

b) Form the differential equation whose general solution is $y = C_1x + C_2x^2 + C_3x^2$. **[04]**

c) A particle is moving in a straight line with an acceleration $k\left(x+\frac{b^4}{x^3}\right)$ directed towards origin. If it starts from rest at a distance 'b' from the origin, prove that it will arrive at origin at the end of time $\frac{\pi}{4\sqrt{k}}$. **[05]**

Q.2 Solve **ANY THREE** of the following: **[13]**

a) $xydx + \left(x^2 - 3y\right)dy = 0$.

b) $(3x + y - 4)dx = (2x + 2y - 5)dx$.

c) $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$.

d) $\left(x^2 - 3yx + 2y^2\right)dx + x(3x - 2y)dy = 0$.

Q.3 a) The equation of an L – R circuit is given by $L\frac{dI}{dt} + RI = 5\sin t$. if I = 0 at t = 0, express I as a function of t. **[05]**

b) If a thermometer is taken outdoors where the temperature is 0^0C, from a room in which the temperature is 31^0C and the reading drops to 11^0C in 2 minutes, how long after its removal will the reading be 6^0C? **[04]**

c) A steam pipe 30 cm in diameter is protected with a covering 8 cm thick for which coefficient of thermal conductivity k = 0.0002 cal/cm. deg. sec. steady state. Find the heat loss per hour through a meter length of the pipe, if the internal surface of the pipe is at 160^0C and the outer surface of the covering is at 40^0C. **[04]**

Q.4 a) Find the centre and radius of the circle $x^2 + y^2 + z^2 = 16;\ 2x + y + 2z = 9$. **[05]**

b) Find the equation of the right circular cone whose vertex is (3, 2, 1), axis has direction ratios $2, -1, 3$ and semi-vertical angle 60^0. **[04]**

c) Find the equation of the cylinder whose generators are parallel to the line $\frac{x}{2} = \frac{y}{-2} = \frac{z}{3}$ and guiding curve is ellipse $x^2 + 2z^2 = 1,\ y = 2$. **[04]**

P.T.O.

SECTION – II

Q.5 **a)** Solve: $\int_0^{\infty}\int_0^{x} x\, e^{-x^2/y}\, dxdy$.. **[05]**

b) Trace the curve $r = a\cos 3\theta$. **[04]**

c) Find the Fourier series for the function $f(x)$ defined as **[05]**

$$f(x)=\begin{cases}0 & -\pi \le x \le 0\\ x & 0 \le x \le \pi\end{cases} \text{ and } f(x+2\pi)=f(x).$$

Q.6 **a)** If $U_n = \int \frac{x^n}{\left(a^2+x^2\right)^{3/2}}\, dx$, , prove that $(n-2)U_n + a^2(n-1)U_{n-2} = \frac{x^{n-1}}{\sqrt{a^2+x^2}}$. **[05]**

b) Evaluate: $\int_0^{\infty} e^{-x^5} dx$. **[04]**

c) Find half range cosine series of $f(x)$ where $f(x)=x^2,\ 0<x<2$. **[04]**

Q.7 **a)** Prove : $\int_0^{\infty} \frac{\cos\lambda y}{y}\left(e^{-ay}-e^{-by}\right)dy = \frac{1}{2}\log\left(\frac{b^2+\lambda^2}{a^2+\lambda^2}\right);\ a>0\ b>0.$ **[05]**

b) Evaluate : $\int_0^1 \sqrt{x}\left(1-\sqrt{x}\right)^3 dx.$ **[04]**

c) Trace the curve $y^2\left(x^2+y^2\right)+b^2\left(x^2-y^2\right)=0.$ **[04]**

Q.8 **a)** Find the volume of the tetrahedron bounded by the co-ordinate planes and the plane $\frac{x}{c}+\frac{y}{d}+\frac{z}{e}=1.$ **[05]**

b) Evaluate : $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_0^{a-\frac{r^2}{a}} r d\theta\, dr\, dz.$ **[04]**

c) Evaluate : $\int_0^1\int_0^{\sqrt{1+y^2}} \frac{dx\,dy}{1+x^2+y^2}.$ **[04]**

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