B.TECH. SEM -II (CHEMICAL/ CIVIL/ ELECTRICAL/ MECHANICAL/ PRODUCTION/ COMPUTER/ INFO. TECH./ ELECTRONICS / BIO MEDICAL / E & TC) 2014 COURSE

SUBJECT: ENGINEERING MATHEMATICS – II

Day: **Monday** Time: **10.00 AM TO 01.00 PM**

Date: **20/11/2017** **W-2017-2005** Max. Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labelled diagrams **WHEREVER** necessary.
4) Use of non-programmable **CALCULATOR** is allowed.

Q.1 a) Solve: $y\left(x\cos\frac{y}{x}+y\sin\frac{y}{x}\right)-\left(y\sin\frac{y}{x}-x\cos\frac{y}{x}\right)x\frac{dy}{dx}=0$ **(05)**

b) Solve: $\left(3x^2y^4+2xy\right)dx+\left(2x^3y^3-x^2\right)dy=0$ **(05)**

OR

Q.1 a) Solve: $\left(3xy^2-y^3\right)dx+\left(xy^2-2x^2y\right)dy=0$ **(05)**

b) Solve: $\frac{dx}{dy}-x\tan y=x^4\sec y$ **(05)**

Q.2 a) A body of mass m falls from rest under gravity in a fluid whose resistance to motion at any instant is mK times its velocity, where K is a constant. Find the terminal velocity of the body and also the time taken to acquire one-half of its limiting speed. **(05)**

b) If the temperature of the body drops from 100^0C to 60^0C in one minute. When the temperature of the surrounding is 20^0C, what will be the temperature of the body at the end of the second minute? **(05)**

OR

Q.2 a) The equation of the L-R circuit is given by **(05)**

$L\frac{dI}{dt}+RI=10\sin t$, If $I=0$, at $t=0$, express I as a function of t.

b) For steady heat flow through the wall of a spherical shell of inner and outer radii r_1 and r_2 respectively, the temperature T at a distance r from the centre is given by $r\frac{d^2T}{dr^2}+2\frac{dT}{dr}=0$. Integrate for T by substitution $\frac{dT}{dr}=y$, *if* u_1 and u_2 are temperature at inner and outer surfaces, find T in terms of r. **(05)**

Q.3 Determine the Fourier series for the following function **(10)**

$$f(x)=\begin{cases}\cos x, & -\pi<x<0\\ \sin x, & 0<x<\pi\end{cases}$$

OR

Q.3 a) Evaluate: $\int_0^{\pi} x\sin^7 x\cos^4 x\ dx.$ **(05)**

b) Evaluate: $\int_0^{\infty}\frac{x^a}{a^x}dx,\ (a>1).$ **(05)**

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Q.4 **a)** Trace the curve: $a^2x^2 = y^3(2a-y)$ **(05)**

b) Show that: $\int_0^\infty e^{-\left(x^2+\frac{a^2}{x^2}\right)}dx = \frac{\sqrt{\pi}}{2}e^{-2a}$ **(05)**

OR

Q.4 **a)** Trace the curve: $y^2(a^2+x^2) = a^2x^2$. **(05)**

b) Show that: $\int_0^\infty e^{-x^2-2bx}dx = \frac{\sqrt{\pi}}{2}e^{b^2}\left[1-erf(b)\right]$. **(05)**

Q.5 **a)** Find the equation of the sphere passing through points (1,0,0), (0,1,0) (0, 0, 1) and having its radius as small as possible. **(05)**

b) Find the equation of the cone with vertex (5, 4, 3) and with $3x^2+2y^2 = 6, y+z = 0$ as base. **(05)**

OR

Q.5 **a)** A sphere of constant radius r passes through the origin and meets the co-ordinate axes in A,B,C. Show that the locus of centroid of the triangle ABC is a sphere $9(x^2+y^2+z^2) = 4r^2$. **(05)**

b) Find the equation of right circular cylinder of radius 2 whose axis passes through (1,2,3) and has direction cosines proportional to 2, -3, 6. **(05)**

Q.6 **a)** Evaluate by using change of order of integration: **(05)**

$$\int_0^1 \int_0^{\sqrt{1-y^2}} \frac{\cos^{-1}x\,dx\,dy}{\sqrt{(1-x^2-y^2)(1-x^2)}}$$

b) Prove that the volume enclosed between the cylinders **(05)**

$x^2+y^2 = 2ax$ and $z^2 = 2ax$ is $\frac{128\,a^3}{15}$.

OR

Q.6 **a)** Find by double integration the area between the curve **(05)**
$y^2x = 4a^2(2a-x)$ and its asymptote.

b) *Evaluate*: $\iiint \frac{dxdydz}{(1+x+y+z)^3}$ over the volume of tetrahedron bounded by **(05)**
$x=0,\ y=0,\ z=0$ and $x+y+z=1$.

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