Reg.No										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL UNIVERSITY, MANIPAL - 576 104

Second Semester B.Tech Degree (Make up) Semester Examination - July2013

MAT 102: Engineering Mathematics II

(Revised Credit System - 2011)

Time: 3 Hrs. **Max. Marks: 50**

Note : a) Answer any FIVE full questions. b) All questions carry equal marks (3 + 3 + 4).

1a. Expand $xy^2 + \cos(xy)$ in powers of $(x - 1)$ and $\left(y - \frac{\pi}{2}\right)$ using Taylor's series.

1b. Using Gram- Schmidt's process construct an orthonormal basis for the vectors $\{(1, -1, 0), (2, -1, -2), (1, -1, -2)\}$.

1c. Solve the differential equations

(i) $xy(1 + xy^2)\frac{dy}{dx} = 1$ (ii) $(x + 2y - 3)\,dx + (2x + y - 3)dy = 0$

2a. Solve $\frac{d^2y}{dx^2} + 4y = \text{Sec}2x$.

2b. Evaluate: $\iint_R e^{-(x^2+y^2)}dxdy$ where R is the region between the two circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.

2c. Evaluate the following using Beta and Gamma functions

(i) $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ (ii) $\int_0^{\frac{\pi}{2}} \sqrt{\tan\theta}\, d\theta$

3a. Using double integration find the area lying between the parabola $y = 4x - x^2$ and $y = x$

3b. Examine the maximum and minimum values of $xy(a - x - y)$, $a>0$.

3c. Solve the simultaneous equations

$$\frac{dx}{dt} - 7x + y = 0,\ \frac{dy}{dt} - 2x - 5y = 0$$

4a. Using triple integrals, find volume of the tetrahedron bounded by the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ and the coordinate planes.

4b. Solve $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 12y = x^3 \log x$

4c. Express the following function f(t) in terms of unit step functions and hence find the Laplace transform.

$$f(t) = \begin{cases} t^2 & 0 < t < 1 \\ 4t & t > 1 \end{cases}$$

5a. Test for consistency, if consistent solve by Gauss elimination method:

$3x + 3y + 2z = 1;\quad x + 2y = 4,\quad 10y + 3z = -2,\quad 2x - 3y - z = 5.$

5b. Solve the differential equation using Laplace transform

$\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 9y = 16e^t$, $y(0) = 0$ and $y'(0) = 0$

5c. (i) Solve: $\frac{dy}{dx} + x\sin(2y) = x^2\cos^2 y$

(ii) Form the differential equation by eliminating the arbitrary constants from the equation $y^2 = 4a(x + a)$.

6a. Find the inverse of the matrix $\begin{bmatrix} 5 & -2 & 4 \\ -2 & 1 & 1 \\ 4 & 1 & 0 \end{bmatrix}$ using elementary row operations.

6b. A circuit consists of resistance R, an induction L and a constant e.m.f E switch is closed at t = 0 and removed at t = T. Find current at any time t.

6c. Evaluate:

(i) $L\{t^2 \sin t\}$ (ii) $L^{-1}\left\{\log\left(\frac{s+a}{s+b}\right)\right\}$

***  ***