Reg. No.										

MANIPAL UNIVERSITY

SECOND SEMESTER B.E. DEGREE EXAMINATION – NOV/DEC 2007

SUBJECT: ENGINEERING MATHEMATICS – II (MAT 102)

(CREDIT SYSTEM)

Monday, December 17, 2007

Time: 3 Hrs. Max. Marks: 100

✍ **Answer any FIVE full questions.**

1A. i) Obtain the differential equation of all circles with fixed radius 'r' and having tangent to the y –axis.

ii) Solve $(1+y^2)dx = (\tan^{-1} y - x)dy$.

1B. Find the L.T of

$$F(t) = \begin{cases} Sinwt, & 0 < t < \dfrac{\pi}{w} \\ 0, & \dfrac{\pi}{w} < t < \dfrac{2\pi}{w} \end{cases} \text{ and } F\left(t+\frac{2\pi}{w}\right) = F(t).$$

1C. Test the following system of linear equations for consistency and solve it by Gauss elimination method if it is consistent.

$2x+y+4z = 12$

$8x-3y+2z = 20$

$4x-11y-z = 33$

(8+6+6 = 20 marks)

2A. Solve $\dfrac{dy}{dx} = \dfrac{2y-x-4}{y-3x+3}$.

2B. Find: i) $L\left[\dfrac{t - Sinh\, t}{t}\right]$ ii) $L^{-1}\left[\dfrac{S+3}{S^2+2S+5}\right]$.

2C. Using Gram-Schmidt process construct orthonormal basis from (2, 3, 0), (6, 1, 0) and (0, 2, 4) in E^3.

(6+8+6 = 20 marks)

3A. Solve: i) $3e^x \tan y\, dx+(1-e^x) \sec^2 y dy = 0$ ii) $ydx - xdy - 3x^2y^2e^{x^2}\, dx = 0$.

3B. Change the order of integration and evaluate $\displaystyle\int_o^a \int_y^a \frac{x}{x^2+y^2}\, dxdy$.

3C. By double integration find the area lying inside r = a sin θ and outside r = a (1-cos θ).

(8+6+6 = 20 marks)

4A. Solve $(2x+1)^2 \dfrac{d^2y}{dx^2} - 2(2x+1)\dfrac{dy}{dx} - 12y = 6x$.

4B. With the usual notation prove that $\sqrt{\pi}\ \Gamma(2m) = 2^{2m-1}\ \Gamma m\,\Gamma\left(m+\frac{1}{2}\right)$.

4C. Find the extreme values of x^2+y^2 subject to the condition $5x^2+6xy+5y^2-8 = 0$.

(6+8+6 = 20 marks)

5A. Solve by Laplace transform method

$w''(x)+2w'(x)+w(x) = 0$ with $w(0)=-3$, $w(1) = -1$.

5B. Find the volume of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ by triple integrals.

5C. Solve by the method of variation of parameter $(D^2-3D+2)y = \cos(e^{-x})$.

(6+8+6 = 20 marks)

6A. Solve the following system of differential equations

$$\frac{dx}{dt}+5x-2y=t.$$

$$\frac{dy}{dt}+2x+y=0,\ \text{given } x = y = 0 \text{ when } t = 0.$$

6B. Expand $e^x \log(1+y)$ in powers of x and y upto terms of third degree.

6C. A voltage $E = E_0e^{-\alpha t}$, where E_0 and α are constants is applied at time $t = 0$ to an LR electric circuit of inductance L and resistance R. Find the current at time $t>0$.

(6+8+6 = 20 marks)

7A. Find: i) $L^{-1}\left[\frac{S}{\left(S^2+a^2\right)^2}\right]$ ii) $L^{-1}\left[\frac{S+2}{\left(S^2+2S+5\right)^2}\right]$.

7B. Solve $(D^2-5D+6)y = e^{2x}x^3$.

7C. Define Beta function and gamma function. Prove that $\beta(m, n) = \frac{\Gamma m\Gamma n}{\Gamma(m+n)}$.

(8+6+6 = 20 marks)