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B. Tech Degree I & II Semester (Combined) Examination June 2008

IT/CS/EC/CE/ME/SE/EB/EI/EE 102
ENGINEERING MATHEMATICS II
(2000 Scheme)

Time : 3 Hours | Maximum Marks : 100

(All questions carry ***EQUAL*** marks)

I. (a) Discuss the convergence of

(i) $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}+\sqrt{n+1}}$

(ii) $1+\frac{x}{2}+\frac{x^2}{5}+\frac{x^3}{10}+\ldots\infty$

(b) Prove that the following series converges absolutely $\frac{\cos x}{1^2}+\frac{\cos 2x}{2^2}+\frac{\cos 3x}{3^2}+\ldots\infty$.

(c) Find the first three non zero terms of the Taylor series expansion of $e^x \sin x$ about $x=0$.

OR

II. (a) Discuss the convergence of

(i) $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\ldots\infty$

(ii) $1+x+x^2+\ldots\infty$

(b) Find the Taylor series expansion of $\cos x$ about $x=0$.

(c) If $y=\sin^{-1}x$, show that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0$.

III. (a) Solve the following system of equation by Gauss Elimination method :

$$7x+6y-5z=30$$
$$3x-4y+z=0$$
$$x+2y-3z=10$$

(b) Using Cayley Hamilton theorem obtain the inverse of $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & -1 \\ 1 & 2 & 1 \end{bmatrix}$

OR

IV. (a) Find the eigen values of $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ and find eigen vector corresponding to the smallest eigen value.

(Turn Over)

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(b) Express the following matrix as the sum of a symmetric and a skew-symmetric matrix :

$$\begin{bmatrix} 4 & 2 & -3 \\ 1 & 3 & -6 \\ -5 & 0 & -7 \end{bmatrix}$$

V. (a) Solve $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = e^{3x} + x\sin x$

(b) Solve $\frac{dx}{dt} - y = e^t$

$\frac{dy}{dt} + x = \sin t$ given that $x = 0,\ y = 0$

when $t = 0$

OR

VI. (a) Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 2(1 + x - x^2)$

(b) Solve $\frac{d^3y}{dx^3} + y = \sin 2x + x^2e^{-x}$

VII. (a) Find the Laplace transforms of (i) $\sin 2t\cos 2t$ (ii) t^3e^{-3t}

(b) Find the inverse Laplace transform of (i) $\frac{4s+5}{(s-1)^2(s+2)}$ (ii) $\frac{s}{(s-3)(s^2+4)}$

OR

VIII. (a) Solve using Laplace transform $\frac{d^4y}{dt^4} - k^4y = 0$ given that $y(0) = 1,\ y'(0) = y''(0) = y'''(0) = 0$.

(b) Use convolution theorem to find $L^{-1}\left\{\frac{1}{s(s^2+4)}\right\}$

IX. (a) Find the values of the constants a, b, c for which the vector $\bar{f} = (x + y + az)\bar{i} + (bx + 3y - z)j + (3x + cy + z)\bar{k}$ is irrotational.

(b) If $\bar{r} = xi + yj + zk$, prove that $div(r^n\bar{r}) = (n+3)r^n$

OR

X. (a) Verify Stoke's theorem for $F = (x^2 + y^2)i - 2xyj$ taken around the rectangle bounded by the lines $x = \pm a, y = 0, y = b$.

(b) Verify divergence theorem for $\bar{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ taken over the rectangular parallelopiped $0 \le x \le a, 0 \le y \le b, 0 \le z \le c$.

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