EN14-102 - ENGINEERING MATHEMATICS II
(Common for all branches)
MODEL QUESTION PAPER.

Time. 3 Hrs

Total Marks: 100

Part A.
Answer any Eight.

(1) Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \cdot \sin(\log x)$

(2) solve $(x^2 - ay)dx = (ax - y^2)dy$.

(3) Express in terms of Gamma function and hence evaluate
$$\int_0^\infty x^3 e^{-4x} dx$$

(4) prove that $\frac{\beta(m, n+1)}{n} = \frac{\beta(m+1, n)}{m} = \frac{\beta(m, n)}{m+n}$

(5) find $L[e^{3t} \cos 5t]$

(6) Show that $\nabla r^n = n r^{n-2} \vec{r}$

(7) Show $\nabla \times \vec{f} = 0$ if $\vec{f} = (y^2 + 2xz^2)\vec{i} + (2xy - z)\vec{j} + (2x^2z - y + 2z)\vec{k}$.

(8) Show that $\iint_S \vec{r} \cdot \hat{n}\, ds = 3v$

(9) Evaluate $\int_C \phi \, d\vec{r}$, where C is the curve $x = t$, $y = t^2$, $z = (1-t)$ and $\phi = x^2 y (1+z)$ from $t = 0$ to $t = 1$.

(10) State Gauss's divergence theorem.

$(8 \times 5) = 40$ mark

Part B.

Answer Section (a) or Section (b) of all questions.

11. (a) Solve $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - \frac{dy}{dx} - y = 0$

or

(b) Solve $\frac{d^2y}{dx^2} + a^2y = \tan ax$, by the method of variation of parameters.

12. (a) Given $\mathcal{L}^{-1}\left[\frac{1}{s^2+4}\right] = \frac{1}{16}(\sin 2t - 2t\cos 2t)$

find $\mathcal{L}^{-1}\left[\frac{1}{(s^2+4)^2}\right]$

or

(b) Using Laplace transform, solve

$\frac{d^3y}{dt^3} - 3\frac{d^2y}{dt^2} + 3\frac{dy}{dt} - y = t^2e^t$, $y(0) = 4$, $y'(0) = 0$, $y''(0) = 2$

13. (a) If $u = x^2yz$ and $V = xy - 3z^2$

find $\nabla \times (\nabla u \times \nabla v)$ at the point $(1, 1, 0)$.

or

(b) Find the constants a, b, c so that

$\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$

is irrotational

14. (a) Verify green's theorem in a plane, for $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$. Where C is the boundary of the region defined by the lines $x=0$, $y=0$ and $x+y=1$.

Or

(b) Verify Stoke's theorem for $\vec{F} = (x+y-z)\vec{i} + (4+yz)\vec{j} - (xz)\vec{k}$ where S is the surface of the cube $x=0, y=0, z=0, x=2, y=2, z=2$ above the XY-plane.

(4 x 15 = 60 marks)

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