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(Pages : 2)

Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

EN 04 102—ENGINEERING MATHEMATICS—II

(Common to all Branches—2004 admissions)

Time : Three Hours | Maximum : 100 Marks

Part A

Each question carries 5 marks.

I. 1 Find the particular integral of $(D - 1)^3 y = 2 \cosh x$.

2 Solve : $(D^2 - 4D + 4) y = e^{2x}$.

3 Find the Laplace transform of $e^{-3t} t^3$.

4 Find the inverse Laplace transform of $\frac{2s + 5}{s^2 + 4s - 5}$.

5 A particle is moving along a curve $x = e^t$, $y = 2 \cos 3t$, $z = 2 \sin 3t$ where t is the time. Determine the velocity and acceleration at $t = 0$.

6 Find a unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(1, 2, -1)$.

7 Find the work done by the force $E = xi + 2yj$ when it moves a particle along the curve $2y = x^2$ from $(0, 0)$ to $(2, 2)$.

8 Show that area bounded by a simple closed curve. C is given by $\frac{1}{2} \int_C x dy - y dx$.

(8 x 5 = 40 marks)

Part B

II. (a) (i) Solve $(D^2 - 6D + 9) y = e^{3x}$. (7 marks)

(ii) Solve $3 e^x \tan y \, dx + (1 + e^x) \sec^2 y \, dy = 0$. (8 marks)

Or

(b) (i) Use the method of variation of parameters to solve $\frac{d^2y}{dx^2} + 4y = \sec 2x$. (7 marks)

(ii) Solve $x \frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + \frac{y}{x} = x^2$. (8 marks)

III. (a) Find the Laplace transforms of the following :—

(i) $\sin^2 2t$.

(ii) $e^{-2t} \cos^2 t$.

(iii) $\frac{e^{-at} - e^{-bt}}{t}$.

(3 x 5 = 15 marks)

Or

(b) Using Laplace transform solve the equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dt} + y = e^t$, given $y(0) = 2, y'(0) = -1$.

(15 marks)

IV. (a) (i) If $\overline{F} = \nabla\left(x^3 + y^3 + z^3 - 3xyz\right)$ find $\nabla . \overline{F}$ and $\nabla \times \overline{F}$. (7 marks)

(ii) Find the value of a so that the vector $\overline{A} = (x + 3y)i + (y - 2z)j + (x + az)k$ is solenoidal.

(8 marks)

Or

(b) (i) Find div curl $\overline{F}$ where $\overline{F} = x^2zi - 2y^3z^2j - xy^2zk$. (7 marks)

(ii) If $\overline{F} = \left(x^2 - yz\right)i + \left(y^2 - xz\right)j + \left(z^2 - xy\right)k$ show that $\overline{F}$ is irrotational and find its scalar potential.

(8 marks)

V. (a) Verify Green's theorem in the plane for $\int_C \left(xy + y^2\right)dx + x^2dy$ where C is bounded by $y = x$ and $y = x^2$.

(15 marks)

Or

(b) Verify Divergence theorem for $\overline{F} = \left(x^2 - yz\right)i + \left(y^2 - xz\right)j + \left(z^2 - xy\right)k$ over the rectangular parallelopiped $0 \le x \le a, 0 \le y \le b, 0 \le z \le c$.

(15 marks)

[4 × 15 = 60 marks]