

102 ✓

E

C 15004

(Pages : 2)

Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING)
DEGREE EXAMINATION, MAY 2011

EN 09 102/PTEN 09—ENGINEERING MATHEMATICS—II

(2009 admissions)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.
Each question carries 2 marks.

1. Solve $(D^4 - 2D^3 + D^2)_y = 0$.
2. If $L^{-1} \left\{ \frac{s}{(s^2+1)^2} \right\} = \frac{t}{2} \sin t$, find $L^{-1} \left\{ \frac{s}{(s^2+\alpha^2)^2} \right\}$.
3. Find ϕ , if $\text{grad } \phi = (y^2 - 2xyz^3)\mathbf{i} + (3 + 2xy - x^2z^3)\mathbf{j} + (6z^3 - 3x^2yz^2)\mathbf{k}$.
4. Find the equation of the tangent plane to the surface $2xz^2 - 3xy - 4x = 7$ at the point $(1, -1, 2)$.
5. State Green's theorem.

(5 × 2 = 10 marks)

Part B

Answer any four questions.
Each question carries 5 marks.

6. Find the orthogonal trajectories of the family of confocal conics $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$, where λ is the parameter.
7. Solve $(x^2 + y^2 - a^2)xdx + (x^2 - y^2 - b^2)ydy = 0$.
8. Find using convolution theorem to the inverse Laplace transforms of $\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$.
9. Find $\text{div } \vec{F}$ and $\text{curl } \vec{F}$, where $\vec{F} = \text{grad } (x^3 + y^3 + z^3 - 3xyz)$.
10. Find the area of a circle of a radius a using Green's theorem.

Turn over

11. Evaluate $\iint_S \vec{F} \cdot d\vec{S}$, where $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$ and S is the part of the sphere $x^2 + y^2 + z^2 = 1$ that lies in the first Octant.

(4 × 5 = 20 marks)

Part C

*Answer Section (a) or (b) of each question.
Each question carries 10 marks.*

12. (a) Solve $(D^2 + a^2)y = \sec ax$.

Or

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

13. (a) Find the inverse Laplace transform of $\tan^{-1}\left(\frac{2}{s^2}\right)$.

Or

- (b) Find the Laplace transform of $L\left\{\frac{e^{at} - \cos bt}{t}\right\}$.

14. (a) If $r = |\vec{r}|$, where \vec{r} is the position vector of the point (x, y, z) with respect of the origin, prove that $\nabla f(r) = \frac{f'(r)}{r} \vec{r}$.

Or

- (b) Find the constants a, b, c, so that $\vec{F} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ may be irrotational.

15. (a) Use divergence theorem to evaluate $\iiint_S (yz^2\hat{i} + 2x^2\hat{j} + 2z^2\hat{k}) \cdot d\vec{S}$, where \vec{S} is the closed surface bounded by the xoy-plane and the upper half of the sphere $x^2 + y^2 + z^2 = a^2$ above this plane.

Or

- (b) If S is any closed surface enclosing a volume V and if $\vec{A} = ax\hat{i} + by\hat{j} + cz\hat{k}$ prove that $\iiint_S \vec{A} \cdot d\vec{S} = (a + b + c) V$.

(4 × 10 = 40 marks)