F 3125 (Pages : 4) Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Common to all branches except CS and IT

EN 010 301 A—ENGINEERING MATHEMATICS—II

(CE, ME, EE, AU, AN, EC, AI, EI, IC, PE, PO, MT, CH AND ST)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary/ST—Regular]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *question briefly.*
Each question carries 3 marks.

1. Find grad ϕ if $\phi = \log\left(x^2 + y^2 + z^2\right)$.

2. If $\vec{f}(t) = t\,\hat{i} + \left(t^2 - 2t\right)\hat{j} + \left(3t^2 + 4t^3\right)\hat{k}$, find $\int_0^1 \vec{f}(t)\,dt$.

3. Evaluate $\Delta^2 E^3 x^2$.

4. Solve $\left(E^2 + 6E + 9\right) y_n = 0$.

5. Find the z-transform of $3^n \sin \frac{n\pi}{2}$.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each carries 5 marks.

6. The position vector of a particle at time t is $\bar{r} = \cos(t-1)\,\hat{i} + \sinh(t-1)\,\hat{j} + \alpha\, r^3\,\hat{k}$. Find the condition imposed on α by requiring that at time $t = 1$, the acceleration is normal to the position vector.

Turn over

7. Find the work done when a force $\overline{F} = \left(x^2 - y^2 + x\right)\hat{i} - (2xy + y)\,\hat{j}$ moves a particle in the xy plane from $(0, 0)$ to $(1, 1)$ along the parabola $y^2 = x$.

8. Prove that $\delta = \Delta\ (1 + \Delta)^{-1/2} = \nabla\,(1 - \nabla)^{-1/2}$.

9. Solve the difference equation $y_{n+2} + 3y_{n+1} + 2y_n = \sin\dfrac{n\pi}{2}$.

10. Find the inverse z-transform of $\dfrac{4 - 8z^{-1} + 6z^{-2}}{\left(1 + z^{-1}\right)\left(1 - 2z^{-1}\right)}$.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) The temperature at a point (x, y, z) in space is given $T(x, y, z) = x^2 + y^2 - z$. A mosquito located at $(1, 1, 2)$ desires to fly in such a direction that it will get warm as soon as possible. In what direction should it fly ?

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

Or

12. (a) A particle moves along the curve $\vec{r}\left(r^3 - 4t\right)\hat{i} + \left(t^2 + 4t\right)\hat{j} + \left(8t^2 - 3t^3\right)\hat{k}$ where t is the time. Find the magnitudes of acceleration along the tangent and normal at time $t = 2$.

(b) Find the directional derivative of $\nabla.\ (\nabla\,\phi)$ at the point $(1, -2, 1)$ in the direction of the normal to the surface $xy^2z = 3x + z^2$, where $\phi = 2x^3\,y^2\,z^4$.

13. (a) Evaluate the line integrals $\int_C \left\{\left(x^2 + xy\right) dx + \left(x^2 + y^2\right) dy\right\}$ where C is the square formed by the lines $y = \pm 1$ and $x = \pm 1$.

(b) Find the circulation of $\vec{F}$ round the curve C, where $\vec{F} = e^x \sin(y)\,\hat{i} + e^x \cos(y)\,\hat{j}$ C is the rectangle whose vertices are (0, 0), (1, 0), $\left(1, \frac{\pi}{2}\right)$ and $\left(0, \pi/2\right)$.

Or

14. Apply stoke's theorem to evaluate $\int_C \left[(x + y)\, dx + (2x - z)\, dy + (y + z)\, dz\right]$ where C is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).

15. Find the interpolation the missing values in the following data :

x	:	0	5	10	15	20	25
y	:	6	10	–	17	–	31

Or

16. Use Newton's divided difference formula to find $f(7)$, if $f(3) = 24$, $f(5) = 120$, $f(8) = 502$, $f(9) = 720$, $f(12) = 1616$.

Or

17. Apply Simpson's rule to find the are a abounded by the x-axis, the lines $x = 1$, $x = 4$ and the curve through the points.

x	:	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	:	2.0	2.4	2.7	2.8	3.0	2.6	2.1

Or

18. Find the complete solution for the following :

(a) $y_{n+2} - 4y_{n+1} + 4y_n = 3n + 2^n$.

(b) $u_{x+2} - 2m\, u_{x+1} + \left(m^2 + n^2\right) u_x = m^x$.

Turn over

19. (a) Using $z(n) = \dfrac{z}{(z-1)^2}$, show that $z(n\cos n\theta) = \dfrac{\left(z^3 + z\right)\cos\theta - 2z^2}{\left(z^2 - 2z\cos\theta + 1\right)^2}$.

(b) Using convolution theorem, find the inverse z-transform of $\dfrac{8z^2}{(2z-1)(4z-1)}$.

Or

20. (a) Solve the following using z-transforms :

$$y(n) - y(n-1) = u(n) + u(n-1).$$

(b) Given $z(u_n) = \dfrac{2z^2 + 3z + 4}{(z-3)^3}$, $|z| > 3$, show that $u_1 = 2, u_2 = 21, u_3 = 139$.

(5 × 12 = 60 marks)