F 2968 (Pages : 3) Reg. No.................................

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

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

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 AND PO)

[New Scheme—Regular/Improvement/Supplementary]

Time : Three Hours Maxi m : 100 Marks

Part A

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

1. Evaluate grad $\left(\frac{1}{r}\right)$ where $r = |\bar{r}|$ and $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$.

2. If R is a region bounded by a simple closed curve C, then using Gree theorem show that the area of R is given by $\frac{1}{2}\oint_c [xdy - ydx]$.

3. Prove that $\Delta \log f(x) = \log\{1 + \Delta f(x)\}$.

4. What is numerical differentiation ? Explain.

5. Find $Z\{\sin(3n+5)\}$.

(5 × 3 = 15 marks)

Part B

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

6. If $\bar{f} = xyz\bar{i} + 3x^2y\bar{j} + \left(xz^2 - y^2z\right)\bar{k}$ find div $\bar{f}$ and curl $\bar{f}$ at (1, 2, 3).

7. If $\bar{F} = \left(3x^2 + 6y\right)\bar{i} - 14yz\bar{j} + 20xz^2\bar{k}$ evaluate $\int_C \bar{F} \cdot d\bar{r}$ from (0, 0, 0) to (1, 1, 1) along the path $x = t, y = t^2$ and $z = t^3$.

8. Prove that : (a) $E^{1/2} - \frac{1}{2}f - \mu = 0$ and (b) $\Delta = \frac{1}{2}f^2 + f\sqrt{1 + \frac{f^2}{4}}$.

Turn over

9. Solve $y_{x+2} - 4yx = 9x^2$.

10. Prove that $Z\left\{\frac{1}{n}\right\} = z\log\frac{z}{z-1}$.

(5 × 5 = 25 marks)

Part C

*Answer any **one** full question from each module.*
Each full question carries 12 marks.

Module I

11. (a) Find the directional derivative of $\phi(x,y,z) = 4xz^3 - 3x^2yz^2$ at (2, –1, 2) along the z-axis.

(5 marks)

(b) Prove that $\text{div}\{\bar{f} \times \bar{g}\} = \bar{g}\cdot(\text{curl } \bar{f}) - \bar{f}\cdot(\text{curl } \bar{g})$. (7 marks)

Or

12. (a) Prove that $\bar{f} = (2x + yz)\bar{i} + (4y + zx)\bar{j} - (6z - xy)\bar{k}$ is both solenoidal and irrotational. Also find the scalar potential of $\bar{f}$.

(7 marks)

(b) Prove that $\nabla^2\left\{\nabla\cdot\left(\frac{\bar{r}}{r^2}\right)\right\} = 2r^{-4}$. (5 marks)

Module II

13. Verify Stoke's theorem for $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C its boundary.

(12 marks)

Or

14. Verify divergence theorem for $\bar{F} = 4xz\bar{i} - y^2\bar{j} + yz\bar{k}$ and S is the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.

(12 marks)

Module III

15. Find y_{32} given $y_{20} = 14.035$, $y_{25} = 13.674$, $y_{30} = 13.257$, $y_{35} = 12.734$, $y_{40} = 12.089$ and $y_{45} = 11.309$.

(12 marks)

Or

16. Using Lagrange's interpolation formula obtain the polynomial from the following data :

x	:	0	1	3	4
y	:	−12	2	6	12.

Hence determine y when $x = 2$ and $x = 5$.

(12 marks)

Module IV

17. From the following data find dy/dx and d^2y/dx^2 at $x = 1.5$.

x	:	1.0	1.1.	1.2	1.3	1.4
y	:	43.1	47.7	52.1	56.4	60.8

(12 marks)

Or

18. Determine the value of $\int_0^1 e^{-x^2} dx$ correct to four places of decimals using Simpson's rule with $h = 0.1$.

(12 marks)

Module V

19. Using the inversion integral method find the inverse z transform of :

$$\frac{z(2z-1)}{2(z-1)\left(z+\frac{1}{2}\right)}.$$

(12 marks)

Or

20. Using z-transform solve $u_{n+2} - 2u_{n+1} + u_n = 3_{n+5}$.

(12 marks)

[5 × 12 = 60 marks]