C 61563

(Pages : 3)

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

Reg. No..........................

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION APRIL 2014

(2009 Scheme)

EN 09/PTEN 09 401 B—ENGINEERING MATHEMATICS—IV

(Common for IC, EC, EE, AI, BM CS AND IT)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer **all** *the questions.*
Each question carries 2 *marks.*

1. A random variable follows Poisson distribution such that $\mathcal{P}(X=0)=\frac{2}{3}\mathcal{P}(X=1)$. Find $\mathcal{P}(0)$.

2. Define the Z-transform of $x(n)=a^n\,u(n)-b^n\,u(-n-1)$.

3. State Bessel's equation and Bessel function $J_\gamma(x)$.

4. Solve the PDE $p=e^q$.

5. Classify the PDE $xu_{xx}+u_{yy}=0$.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

6. It is found that the CD's produced by a certain company, 8 % of the CD's are defective. Out of 13 CD's, find the probability that : (i) One CD is defective ; (ii) less than 3 are defective.

7. A quality controller engineer inspects a random sample of 7 batteries from a lot of 10 batteries that is ready to be shipped. If such a lot contains 5 batteries with slight defects, what are the probabilities that the inspector's sample will contain (i) none of the batteries with defects ? (ii) atmost three of the batteries with defects ? iii atleast three of the batteries with defects ?

8. Find $x(n)$ by using convolution for $X(z)=\dfrac{1}{\left(1-\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{4}z^{-1}\right)}$.

Turn over

9. Find the Z-transform of : (i) $e^{3t} \sin 2t$, (ii) $(t+T)\, e^{-(t+T)}$.

10. Prove that $\frac{d}{dx}\left(x\, J_n(x)\, J_{n+1}(x)\right) = x\left[J_n^2(x) - J_{n+1}^2(x)\right]$.

11. Solve $9\left(p^2 z + q^2\right) = 4$.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions as per choice given.*
Each question carries 10 *marks.*

12. (a) In a certain examination, the percentage of candidates passing and getting distinction were 55 and 9 respectively. Estimate the average marks obtained by the candidates, the minimum marks for pass and distinction being 44 and 75 respectively. Find also the standard deviation of marks (Assume the distribution of marks to be normal).

Or

(b) (i) Assume that on the average one telephone out of fifteen called between 2 p.m. and 3 p.m. on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called.

1 Not more than three. 2 Atleast three of them will be busy.

(ii) In a certain factory manufacturing blades there is a small chance of $\frac{1}{500}$ for any blade to be defective. The blades are supplied in packets of 10. Use the Poisson distribution to calculate the approximate number of packets, in a consignment of 10,000 blades, containing.

1 No defective blades.

2 One defective blade.

3 Atmost two defective blades.

13. (a) Find the inverse Z-transform of $\frac{z^3 - 20z}{(z-2)\left(z^2+9\right)}$ by the Residue method.

Or

(b) Find the inverse Z-transform of $X(z) = \dfrac{1 + 2z^{-1}}{1 - 2z^{-1} + z^{-2}}$ if $x(n)$ is :

1 Causal. 2 Anti-causal using long division.

14. (a) (i) Express $x^3 + 2x^2 - 4x + 5$ in terms of Legendre polynomials.

(ii) Prove the following :—

$$J_{\gamma-1}(x) + J_{\gamma+1}(x) = \frac{2\gamma}{x} J_\gamma(x) \text{ and}$$

$$J_{\gamma-1}(x) - J_{\gamma+1}(x) = 2 J_\gamma'(x).$$

Or

(b) Find the solution in series of the differential equation :

$$2x \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0.$$

15. (a) Solve :

(i) $(z^2 - 2yz - y^2) p + (xy + zx) q = (xy - zx)$.

(ii) Solve $yp = 2yx + \log q$.

(iii) $(pq - p - q)(z - px - qy) = pq$.

Or

(b) Obtain D'Alembert's solution of one dimensional wave equation.

(4 × 10 = 40 marks)