C 61562

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Name...

Reg. ....

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

(2009 Scheme)

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

(Common for ME, CE, PE, CH, BT, PT, AM and AN)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. A continuous random variable X has the p.d.f. $f(x) = \begin{cases} \dfrac{k}{1+x^2}, & -\infty < x < \infty \\ 0, & \text{elsewhere} \end{cases}$

   where k is a constant . Find k.

2. Two independent samples of sizes 9 and 8 have variances 17.78 and 11.38 respectively. Examine whether the samples have been drawn from normal population having the same variance.

3. Express $2x^2 - x - 1$ in terms of Legendre polynomial.

4. Solve the PDE $p^2 - q^2 = 1$.

5. Solve the PDE $(px + qy - z)^2 = 1 + p^2 + q^2$.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. A manufacturer who produces medicine bottles, finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 1,000 bottles. A drug manufacturer buys 500 boxes from the producer of bottles. Using Poisson distribution, find how many boxes will contain (i) no defective ; (ii) at least 2 defectives.

2. The mean produce of wheat of a sample of 100 fields is 200 lbs per acre with a SD of 10 lbs. Another sample of 150 fields gives the mean of 220 lbs with a SD of 12 lbs. Can the two samples be considered to have been taken from the same population whose SD is 11 lbs ? Use 5% level of significance.

Turn over

3. The content of nitrate in every quintal bag of certain fertiliser is set at 12 kg. In a sample of 10 such bags the content of nitrate are found to be 11, 14, 13, 13, 14, 12, 12, 10, 11, 10. Is there reason to believe that the difference from the set value is significant.

4. Prove that $J_{1/2}(x) = \sqrt{\dfrac{2}{\pi x}} \sin x.$

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

6. While finding the thickness of a certain wire, the error made is a random variable which follows uniform density from $-\cdot 01$ and $0 \cdot 01$. Find the probabilities that such an error will : (a) be between -0.002 and 0.003 and (b) exceed 0.005 in absolute value.

$(4 \times 5 = 20 \text{ marks})$

Part C

Answer any four questions.

1. If 15% of a normal distribution lies below the value 30 and 10% of the population lies above 42. Calculate the mean and standard deviation of the under lying population.

Or

2. (a) A shipment of 20 tape-recorders contain 5 that are defective. If 10 of them are randomly selected for inspection. What is the probability that at most two of them are defective.

   (b) If X is a Poisson variate such that $\mathscr{P}(X = 2) = 9\,\mathscr{P}(X = 4) + 90\,\mathscr{P}(X = 6)$. Find the standard deviation.

3. The following table shows the distribution of digits in number chosen at random for a telephone directory :

Digit	...	0	1	2	3	4	5	6	7	8	9
Frequency	...	1026	1107	997	966	1075	933	1107	972	964	853

Using Chi-square test examine whether the digits may be taken to occur equally frequently in the directory.

Or

4. From the following two sample values find out whether they have come from identical normal populations :

Sample	I	...	18	28	16	24	26	28	26	22	16
Sample	II	...	15	15	19	15	16	19	14	20	

5. State and prove Rodrigue's formula for Legendre's polynomials.

<div align="center">Or</div>

6. Prove the following :

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

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

7. Solve the following PDE's :

  (a) $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.

  (b) $p^2q^2 + x^2 y^2 = x^2 q^2 (x^2 + y^2)$.

<div align="center">Or</div>

8. Obtain D' Alembert's solution of one dimensional wave equation.

<div align="right">(4 × 10 = 40 marks)</div>