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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2013
Engineering Mathematics – IV

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer FIVE full questions, selecting at least TWO questions from each part.
2. Use of Statistical tables permitted.

PART – A

- 1 a. Use modified Euler's method to solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ at $x = 0.1$ for three iterations taking $h = 0.1$. (06 Marks)
- b. Solve $\frac{dy}{dx} = x + y$, $x = 0$, $y = 1$ at $x = 0.2$ using Runge-Kutta method. Take $h = 0.2$. (07 Marks)
- c. Using Milne's predictor-corrector method find $y(0.3)$ correct to three decimals given, (07 Marks)

x	-0.1	0	0.1	0.2
y	0.908783	1.0000	1.11145	1.25253

- 2 a. Approximate y and z at $x = 0.2$ using Picard's method for the solution of $\frac{dy}{dx} = z$, $\frac{dz}{dx} = x^3(y + z)$ with $y(0) = 1$, $z(0) = 1/2$. Perform two steps (y_1, y_2, z_1, z_2). (10 Marks)
- b. Using Runge-Kutta method solve $y'' = x(y')^2 - y^2$ at $x = 0.2$ with $x_0 = 0$, $y_0 = 1$, $z_0 = 0$ take $h = 0.2$. (10 Marks)
- 3 a. If $f(z) = u + iv$ is analytic prove that Cauchy-Reimann equations $u_x = v_y$, $u_y = -v_x$ are true. (06 Marks)
- b. If $w = z^3$ find dw/dz . (07 Marks)
- c. If the potential function is $\phi = \log \sqrt{x^2 + y^2}$. Find the stream function. (07 Marks)
- 4 a. Find the bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = j, o, -i$. (06 Marks)
- b. Discuss the conformal transformation $w = e^z$. Any horizontal strip of height 2π in z -plane will map what portion of w -plane. (07 Marks)
- c. State and prove Cauchy's integral formula. (07 Marks)

PART – B

- 5 a. Prove that $J_{1/2}^{(x)} = \sqrt{\frac{2}{\pi x}} \sin x$. (06 Marks)
- b. State and prove Rodrigues formula for Legendre's polynomials. (07 Marks)
- c. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomial. (07 Marks)

- 6 a. The probabilities of four persons A, B, C, D hitting targets are respectively $1/2$, $1/3$, $1/4$, $1/5$. What is the probability that target is hit by atleast one person if all hit simultaneously? (06 Marks)
- b. i) State addition law of probability for any two events A and B.
 ii) Two different digits from 1 to 9 are selected. What is the probability that the sum of the two selected digits is odd if '2' one of the digits selected. (07 Marks)
- c. Three machine A, B, C produce 50%, 30%, 20% of the items. The percentage of defective items are 3, 4, 5 respectively. If the item selected is defective what is the probability that it is from machine A? Also find the total probability that an item is defective. (07 Marks)

- 7 a. The p.d.f of x is

x	0	1	2	3	4	5	6
p(x)	k	3k	5k	7k	9k	11k	13k

Find k. Also find $p(x \geq 5)$, $p(3 < x \leq 6)$.

(06 Marks)

- b. A die is thrown 8 times. Find the probability that '3' falls,
 i) Exactly 2 times
 ii) At least once
 iii) At the most 7 times. (07 Marks)
- c. In a certain town the duration of shower has mean 5 minutes. What is the probability that shower will last for i) 10 minutes or more; ii) less than 10minutes; iii) between 10 and 12 minutes. (07 Marks)
- 8 a. What is null hypothesis, alternative hypothesis significance level? (06 Marks)
- b. The nine items of a sample have the following values: 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5. Apply student's t-distribution at 5% level of significance. ($t_{0.05}$ for 8df = 2.31). (07 Marks)
- c. In experiments on a pea breeding, the following frequencies of seeds were obtained:

Round-yellow	Wrinkled yellow	Round green	Wrinkled green	Total
315	101	108	32	556

Is the experiment is in the agreement of theory which predicts proportion of frequencies 9:3:3:1 ($\chi^2_{0.05, 3df} \approx 7.815$). (07 Marks)

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