F 3049 (Pages : 3) Reg. No..................................

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B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Computer Science and Engineering/Information Technology

EN 010 501 B—ENGINEERING MATHEMATICS—IV (CS, IT)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Evaluate $\Delta x \log x$, the interval of differencing being h.

2. Find the z-transform of $(t+\text{T})\, e^{-(t+\text{T})}$.

3. Find the coefficient of X^{16} in $(1+X^4+X^8)^{10}$.

4. Find p such that the function $f(z)$ expressed in polar co-ordinates as $f(z)=r^2\cos 2\theta + ir^2 \sin p\theta$ is analytic.

5. State and explain Little's theorem.

(5 × 3 = 15 marks)

Part B

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

6. Express $f(u)=u^4-3u^2+2u+6$ in terms of factorial polynomials. Hence show that $\Delta^4 f(u)=24$.

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

8. Solve the recurrence relation :

$$F_{n+2}=F_{n+1}+F_n \text{ where } n\geq 0 \text{ and } F_0=0, F_1=1.$$

9. Evaluate $\oint_c \dfrac{\sin \pi z^2+\cos \pi z^2}{(z-1)^2(z-2)}\,dz$, where C is the circle $|z|=3$.

10. Derive an expression for the average queue occupancy and average time delay through the queue for state dependent queues.

(5 × 5 = 25 marks)

Turn over

Part C

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

Module 1

11. Distance in nautical miles of the visible horizon for given heights in meters above the surface of the earth are given by the following table :

x (heights) :	100	150	200	250	300	350	400
y (distance) :	12	15	21	28	36	50	71

Find the value of y when x = 275 meters.

Or

12. (a) Using Simpson's rule, taking five ordinates, to find an approximate value of $\int_1^2 \sqrt{\left(x-\frac{1}{x}\right)}\, dx$ to two decimal places.

(b) Evaluate $\int_0^1 \left(\frac{dx}{1+x}\right)$ correct to 3 decimals by Trapezoidal rule with h = 0.5, 0.25 and 0.125.

Module 2

13. (a) Find the convolution of $\cos\frac{n\pi}{2} * \sin\frac{n\pi}{2}$.

(b) Find the inverse Z-transform of $\frac{4z^{-1}}{(1-z^{-1})^2}$.

Or

14. (a) Solve $y_{n+3}+y_{n+2}-8y_{n+1}-12y_n=0,\ y_0=1,\ y_1=y_2=0$.

(b) Show that $z(\cosh n\theta)=\frac{z(z-\cosh\theta)}{z^2-2z\cosh\theta+1}$.

Module 3

15. (a) Find discrete numeric function corresponding to the generating function $A(z)=\frac{2}{1-4z^2}$.

(b) Solve the recurrence relation $a_r=a_{r-1}+a_{r-2}$, $r\geq 2$ and $a_0=1, a_1=1$.

Or

16. (a) Express the generating function for the sequence 1, 0, 1, 0, 1, 0,.... in a simpler form.

(b) Find a particular solution of $a_r-2a_{r-1}=7r$.

Module 4

17. (a) Expand $\frac{1}{z^2 - 4z + 3}$, for $1 < |z| < 3$ in Laurent's series.

(b) If $f(z)$ is an analytic function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|Rf(z)|^2 = 2|f'(z)|^2$.

Or

18. (a) Show that the function $f(z) = \frac{x^2 y^3 (x+iy)}{x^6 + y^{10}}$, $z \neq 0$, $f(0) = 0$, is not analytic at the origin even though it satisfies Cauchy-Riemann equations at the origin.

(b) Evaluate by contour integration $\int_0^{2\pi} \frac{d\theta}{(5 - 3\cos\theta)^2}$.

Module 5

19. Customers arrive in a hotel at a rate of 5 per minute and wait to receive their order for an average of 5 minutes. Customers eat in the hotel with probability 0.5 and carry out their order without eating with probability 0.5. A meal requires an average of 20 minutes. What is the average number of customers in the hotel ?

Or

20. Derive the expression for the average number of customer's queue in an M/M/1 queuing system, from first principles.

(5 × 12 = 60 marks)