



KD-410

Seat No. _____

B. Sc. (Sem. III) Examination

October / November - 2017

Mathematics : CC MATH-302

(Numerical Analysis)

Time : 3 Hours]

[Total Marks : 70

- Instructions :** (1) There are four questions.
(2) Figures to the right indicate the marks of corresponding questions.

- 1 (a) State and prove : Gregory - Newton forward interpolation formula. 8

OR

- (a) Define factorial polynomials $u^{[r]}$ and $u^{[-r]}$; 8
where $r \in N \cup \{0\}$. Show that :

$$\frac{u^{[n]}}{u^{[m]}} = (u - m)^{[n-m]} \text{ and}$$

$$u^{[n]}(u - n)^{[m]} = u^{[n+m]} \text{ where } n, m \in Z.$$

- (b) Attempt any two : 10

- (1) Express $p(x) = 4x^3 - 5x + 1$ in the form of $(x - 2)^{[r]}$; where $h = 2$.

- (2) If $h = 1$; then show that :

$$(\nabla + \Delta)^2 (x^2 + x + 1) = 8$$

- (3) Find $y(4)$; by using Gregory-Newton backward interpolation formula from the following data :

$$y(0) = 1, y(1) = 0; y(2) = 1 \text{ and } y(3) = 10$$

- 2 (a) State and prove : Newton's divided difference interpolation formula. 6

OR

- (a) State and prove : Lagrange's interpolation formula for unequal intervals. 6

- (b) State and prove : Stirling's interpolation formula. 6

- (c) Attempt any two : 6

(1) If $f(x) = x^3 - x$; then find $f(0, 1, 2, 3)$

(2) Prove : $\mu^2 = 1 + \frac{1}{4}\delta^2$

(3) Prove : $\delta^3 y_{\frac{1}{2}} = y_2 - 3y_1 + 3y_0 - y_{-1}$

- 3 (a) Discuss the Taylor's method for solving 6

the differential equation $\frac{dy}{dx} = f(x, y)$ with initial condition $y = y_0$ when $x = x_0$.

OR

- (a) State and prove : Simpson's $\frac{3^{th}}$ rule. 6

(b) Attempt any **two** : 12

(1) Prove : $Q_{22}(0) = \frac{h}{3}(y_0 + 4y_1 + y_2) - \frac{h}{90} \Delta^4 y_0$

(2) Prove : $Q_{31}(1) = \frac{h}{24} \{-1, 13, 13, -1\}$

(3) Calculate an approximate value of $\int_0^{\frac{\pi}{2}} \sin x \, dx$ by the Trapezoidal rule.

4 (a) State and prove : Simpson's $\frac{1}{3}^{rd}$ rule. 8

OR

(a) Discuss the Picard's method for solving the differential equation $\frac{dy}{dx} = f(x, y)$ with initial condition $y = y_0$ when $x = x_0$. 8

(b) Attempt any **two** : 8

(1) Prove : $\Delta_{b, c, d, e}^3 \left(\frac{1}{a} \right) = \frac{1}{abcde}$

(2) Obtain the missing term from the following table :

x	5	6	7	8	9
y	1	3	-	31	81

Note : Assuming $\Delta^4 y = 0$

(3) Prove : $\delta^3 y_{\frac{3}{2}} = \Delta^3 y_0 = \nabla^3 y_3$