



**JB-3142**  
**Second Year B. Sc. (Sem. III) Examination**  
**March/April - 2013**  
**Mathematical Methods - I (I.D.S.)**

Time : 3 Hours]

[Total Marks : 70

**Instructions :**

(1)

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| <p>नीचे दृशावेव निशानीवाणी विगतो उत्तरवाडी पर अवश्य लपवी.<br/>Fillup strictly the details of signs on your answer book.</p> <p>Name of the Examination :</p> <p><b>S. Y. B. Sc. (Sem. 3)</b></p> <p>Name of the Subject :</p> <p><b>Mathematical Methods - 1 (I.D.S.)</b></p> <p>Subject Code No. : <b>3</b> <b>1</b> <b>4</b> <b>2</b> Section No. (1, 2,.....): <b>Nil</b></p> | <p>Seat No. :</p> <table border="1" style="width: 100%; height: 20px;"><tr><td style="width: 15%;"></td><td style="width: 15%;"></td><td style="width: 15%;"></td><td style="width: 15%;"></td><td style="width: 15%;"></td><td style="width: 15%;"></td></tr></table> <div style="border: 1px solid black; border-radius: 15px; width: 100%; height: 60px; margin-top: 10px; display: flex; align-items: center; justify-content: center;">Student's Signature</div> |  |  |  |  |  |  |
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- (2) Digits to the right indicate full marks.
- (3) Follow the usual notations.
- (4) Scientific non-programmable calculator is allowed.

1 Answr any **five** of the following questions : **10**

- (1) Find the value of  $\Delta^3 y_n$ .
- (2) Find the value of  $\left(\frac{\Delta^2}{E}\right)^n$ , where the increment in n is 1.
- (3) Determine  $\Delta^3 \{(1+x)(1-3x)(1+5x)\}$ .
- (4) Construct the forward difference table for the following data :  
 $f(1) = 8, f(3) = 3, f(5) = 0, f(7) = -1, f(9) = 0$ .
- (5) If  $u_0 = 1, u_1 = 11, u_2 = 21, u_3 = 28$  and  $u_4 = 29$  then find  $\Delta^4 u_0$ .
- (6) Find the function whose first difference is  $e^x$ .
- (7) Find order and degree of the difference equation :  
 $f^3(x)f^4(x+1) + 3f(x)f(f+2) - 7f^2(x+3) = (x+5)^6$ .

- 2 (a) Using the method of separation of symbols, show that 5

$$\Delta^n u_{x-n} = u_x - nu_{x-1} + \frac{n(n-1)}{2}u_{x-2} - \dots + (-1)^n u_{x-n}.$$

**OR**

- (a) Show that  $e^x \left( u_0 + x\Delta u_0 + \frac{x^2}{2!} \Delta^2 u_0 + \dots \right) = u_0 + u_1 x + u_2 \frac{x^2}{2!} + \dots$  5

- (b) Answer any **two** of the following : 10

(1) Prove that  $e^x = \left[ \frac{\Delta^2}{E} \right] e^x \frac{Ee^x}{\Delta^2 e^x}.$

- (2) Prove that :

(i)  $E^{1/2} \equiv \mu + \frac{1}{2}\delta$

(ii)  $\Delta \log f(x) = \log \left[ 1 + \frac{\Delta f(x)}{f(x)} \right].$

- (3) Show that  $\delta \equiv E^{1/2} - E^{-1/2}$ . Hence prove that

$$\mu^2 \equiv 1 + \frac{1}{4}\delta^2.$$

- 3 (a) Define  ${}_x^{(n)}$ , where  $n \in \mathbb{Z}$ . Also show that  $\Delta^n {}_x^{(n)} = n! h^n$ . 5

**OR**

- (a) For a positive integer n, show that  ${}_x^{(-n)} = \frac{1}{(x+n)^{(n)}}.$  5

- (b) Answer any **two** of the following : 10

- (1) Find the missing term in the following data :

$$f(0)=1, f(1)=3, f(2)=9, f(3)=?, f(4)=81.$$

- (2) By constructing a difference table, find the 6th term of the following series : 8, 12, 19, 29, 42.

- (3) Find  $\Delta^{10} \left\{ (1-2x)(1-3x^2)(1-4x^3)(1-5x^4) \right\}.$

- 4 (a) Express  $x^2 - 3x + 1$  in factorial notation. Hence find its third difference. 5

OR

- (a) Obtain a function whose first difference is  $x^3 + 3x^2 + 5x + 12$ . 5

- (b) Answer any **two** of the following : 10

(1) Given that  $u_0 = 580$ ,  $u_1 = 556$ ,  $u_2 = 520$ ,  $u_4 = 385$  then find  $u_3$ .

(2) Find the relation between  $\alpha$ ,  $\beta$ ,  $\gamma$  so that  $\alpha + \beta x + \gamma x^2$  may be expressible in one term in the factorial notation.

(3) Find the successive differences of  $2x^3 - 3x^2 + 3x - 10$ , when the interval of differencing is unity.

- 5 (a) Given that  $u_x = c_1 2^x + c_2 3^x + \frac{1}{2}$ . Find the corresponding difference equation. 5

OR

- (a) Find linearly independent solutions of the difference equation : 5

$y_{k+2} - 6y_{k+1} + 8y_k = 0$  and thus write the general solution.

- (b) Solve any **two** of the following difference equations : 10

(1)  $y_{k+2} + 5y_{k+1} + 4y_k = 0$ .

(2)  $x_n = x_{n-1} + x_{n-2}$ .

(3)  $u_{x+2} + u_{x+1} + u_x = 0$ .