Graphic Era Hill University, Dehradun
(Answer Sheet for Online Examination Jan. 2022)
Please tick (√) your campus: (DEHRADUN/BHIMTAL/HALDWANI)

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Date: 12.Jan22 Course: BCA Branch: .... Sem.: 03 Section: H
Subject Name: CBNST Subject Code: TBC-302 Page No. ....

Ques 4-(b) $\int_0^{\pi/2} \sqrt{\sin x}\, dx$ let $n=6$, $h = \frac{\pi/2 - 0}{6} = \pi/12$

x_0	0	y_0	0
x_1	$\pi/12$	y_1	0.5087
x_2	$2\pi/12$	y_2	0.7071
x_3	$3\pi/12$	y_3	0.8409
x_4	$4\pi/12$	y_4	0.9306
x_5	$5\pi/12$	y_5	0.9828
x_6	$6\pi/12$	y_6	1

using trapezoidal rule

$\frac{h}{2}[0+1 + 2(0.5087 + 0.7071 + 0.8409 + 0.9306 + 0.9828)]$

$= \underline{1.1703}$ → using trapezoidal rule

using ~~trap~~ simpson's 1/3 rule

$\frac{h}{3}[0+1+ 4(0.5087 + 0.8409 + 0.9828) + 2(0.7071 + 0.9306)]$

$= \underline{1.1873}$ → using simpson's 1/3 rule

using weddles rule

$\frac{3h}{10}[0 + 5(0.5087) + 0.7071 + 6(0.8409) + 0.9306 + 5(0.9828) + 1]$

$= \underline{1.18914}$ → using Weddle's rule

trapezoidal rule = 1.1703
Simpson's 1/3 rule = 1.1873
Weddle's rule = 1.18914

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① (a) given equation is

$$f(x) = \cos x - 3x + 1 = 0$$

$$f(0) = 2 \longrightarrow a \text{ (positive)}$$

$$f(1) = -1.4597 \longrightarrow b \text{ (negative)}$$

a	b	f(a)	f(b)	c = a - f(a) (b-a) / f(b) - f(a)	f(c)	Sign
0	1	2	-1.4597	0.5781	0.1032	+ve
0.5781	1	0.1032	-1.4597	0.606	0.0039	+ve
0.606	1	0.0039	-1.4597	0.607	0.0004	+ve
0.607	1	0.0004	-1.4597	0.6071	0.000006	+ve
0.6071	1	0.000006	-1.4597	0.6071		

Hence the required root correct upto 3 decimal places is 0.6071

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2 (a) The given system of linear equations is

$$x+y+2z=4$$
$$3x+y-3z=-4$$
$$2x-3y-5z=-5$$

Augmented matrix $[A:B]$ =

$$\begin{bmatrix} 1 & 1 & 2 & 4 \\ 3 & 1 & -3 & -4 \\ 2 & -3 & -5 & -5 \end{bmatrix}$$

applying $R_2 \rightarrow R_2 - 3R_1$, $R_3 \rightarrow R_3 - 2R_1$

$$\begin{bmatrix} 1 & 1 & 2 & 4 \\ 0 & -2 & -9 & -16 \\ 0 & -5 & -9 & -13 \end{bmatrix}$$

applying $R_3 \rightarrow R_3 - (5/2)R_2$

$$\begin{bmatrix} 1 & 1 & 2 & 4 \\ 0 & -2 & -9 & -16 \\ 0 & 0 & 13.5 & 27 \end{bmatrix}$$

applying $R_1 \rightarrow R_1 + (1/2)R_2$

$$\begin{bmatrix} 1 & 0 & -2.5 & -4 \\ 0 & -2 & -9 & -16 \\ 0 & 0 & 13.5 & 27 \end{bmatrix}$$

applying $R_1 \rightarrow R_1 - (-2.5/13.5)R_3$, $R_2 \rightarrow R_2 - (-9/13.5)R_3$

$$\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & -2 & 0 & 2 \\ 0 & 0 & 13.5 & 27 \end{bmatrix}$$

solving augmented matrix we get

$$x = 1/1 = 1$$
$$y = -2/2 = -1$$
$$z = 27/13.5 = 2$$

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(3)(b) different methods for interpolation for unequal intervals :

① Lagrange's Interpolation

② Newton Divided Differences formula

The given table is:

x	$u = f(x)$
4	48
5	100
7	294
10	900
11	1210

we need to find u_8,

$$u_8 = \frac{(8-5)(8-7)(8-10)(8-11)(48)}{(4-5)(4-7)(4-10)(4-11)} + \frac{(8-4)(8-7)(8-10)(8-11)(100)}{(5-4)(5-7)(5-10)(5-11)}$$

$$+ \frac{(8-4)(8-5)(8-10)(8-11)(294)}{(7-4)(7-5)(7-10)(7-11)} + \frac{(8-4)(8-5)(8-7)(8-11)(900)}{(10-4)(10-5)(10-7)(10-11)}$$

$$+ \frac{(8-4)(8-5)(8-7)(8-10)(1210)}{(11-4)(11-5)(11-7)(11-10)}$$

$$= 448$$

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Ques 5 - (b) **Picard Method** - $y_{n+1} = y_0 + \int_{x_0}^{x} f(x, y_n)\, dx$

given $f(x) = y - x^2$

$y(0) = 1$, $x_0 = 0$

$h = 0.1$

put $n = 0$,

$$y_1 = y_0 + \int_0^x f(x, y_0)\, dx$$

$$= 1 + \int_0^x (y_0 - x^2)\, dx$$

$$= 1 + \int_0^x (1 - x^2)\, dx$$

$$= 1 + \left| x - \frac{x^3}{3} \right|_0^x = 1 + x - \frac{x^3}{3}$$

Second approximation, $n = 1$

$$y_2 = 1 + \int_0^x (y_1 - x^2)\, dx$$

$$= 1 + \left| 1 + x - \frac{x^3}{3} - x^2 \right|_0^x$$

$$= 1 + x + \frac{x^2}{2} - \frac{x^4}{12} - \frac{x^3}{3}$$

~~Third approximation, $n = 2$~~

$$\cancel{y_3 = 1 + \int_0^x (y_2 - x^2)\, dx}$$

$$\cancel{= 1 + \left| 1 + 1 + x - \frac{x^3}{3} - x^2 - x^2 \right|^x}$$

Third approximation, $n = 2$

$$y_3 = 1 + \int_0^x (y_2 - x^2)\, dx$$

$$= 1 + \int_0^x \left(1 + x + x^2/2 + x^4/12 - \frac{x^3}{3} - x^2\right) dx$$

$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3}$$

4th approximation, $n = 3$

$$y_4 = 1 + \int_0^x (y_3 - x^2)\, dx$$

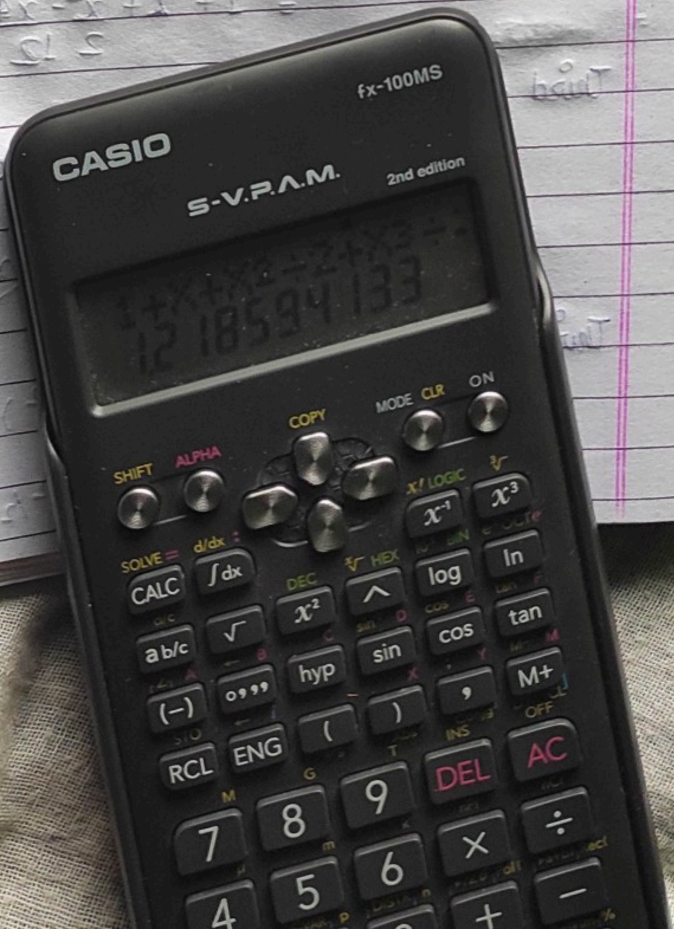
$$= 1 + \int_0^x \left(1 + x + \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3} - x^2\right) dx$$

$$= 1 + \left[x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^6}{120} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3}\right]_0^x$$

$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^6}{120} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3}$$

$y(0.1) = 1.104829$

$y(0.2) = 1.218594$



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$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3}$$

4th approximation, $n = 3$

$$y_4 = 1 + \int_0^x (y_3 - x^2)\, dx$$

$$= 1 + \int_0^x \left(1 + x + \frac{x^2}{2} + \frac{x^3}{6} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3} - x^2\right) dx$$

$$= 1 + \left| x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^6}{120} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3} \right|_0^x$$

$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^6}{120} - \frac{x^5}{60} - \frac{x^4}{12} - \frac{x^3}{3}$$

$y(0.1) = 1.104829$

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