Applied Mathematics II

Question set – FEC201 – CBCGS/CBGS Sep. 2020

1. Solve $\left(x^2+y^2\right)dx-(x^2+xy)dy=0$.

   i. $\log x-\dfrac{y^4}{4x^4}=c'$

   ii. $\dfrac{y}{x}=\log\dfrac{x}{(x-y)^2}+c$

   iii. $2y\log x-\dfrac{y^2}{2}=c$

   iv. $3\left(x^2+y^2\right)^{\frac{3}{2}}-xy=c$

2. What is the formula for evaluation of area of any region R using double integration.

   i. $\int\int_R$ xdxdy
   ii. $\int\int_R$ ydxdy
   iii. $\int\int_R$ dxdy
   iv. $\int\int_R$ xydxdy

3. Euler's method is

   i. $y_n=y_{n-1}-hf\left(x_{n-1},y_{n-1}\right)$

   ii. $y_n=y_{n+1}+hf\left(x_{n+1},y_{n+1}\right)$

   iii. $y_n=y_{n-1}+hf\left(x_{n-1},y_{n-1}\right)$

   iv. $y_n=y_{n+1}-hf\left(x_{n-1},y_{n-1}\right)$

4. In Runge-Kutta fourth order method k_3 is

   i. $k_3=hf\left(x_0,y_0\right)$

   ii. $k_3=hf\left(x_0+\dfrac{h}{2},y_0+\dfrac{k_1}{2}\right)$

   iii. $k_3=hf\left(x_0+h,y_0+k_3\right)$

   iv. $k_3=hf\left(x_0+\dfrac{h}{2},y_0+\dfrac{k_2}{2}\right)$

5. The reducible form of linear DE $y\frac{dy}{dx}+\frac{4x}{3}-\frac{y^2}{3x}=0$ is

i. $\frac{1}{y^3}.\frac{dy}{dx}+\frac{1}{y^2}x=x^3$

ii. $y\frac{dy}{dx}-\frac{y^2}{3x}=-\frac{4x}{3}$

iii. $y\frac{dy}{dx}+\frac{4x}{3}=\frac{y^2}{3x}$

iv. $y\frac{dy}{dx}+\frac{4x}{3}-\frac{y^2}{3x}$

6. Solve $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=0.$.

i. $y=(c_1+c_2x)e^{2x}$

ii. $y=c_1e^x+c_2e^{-2x}+c_3e^{3x}$

iii. $y=c_1\cos\sqrt{2}x+c_2\sin\sqrt{2}x$

iv. $3(x^2+y^2)^{\frac{3}{2}}-xy=c$

7. Particular integral of $D^2y-4y=2\cos h(2x)$

i. $y_p=\frac{x}{2}sin\,h\frac{x}{2}$

ii. $y_p=\frac{x}{2}sin\,h\,x$

iii. $y_p=\frac{x}{2}sin\,h\,2x$

iv. $y_p=x\,sin\,h\,2x$

8. Find the value of integral $\int_0^{\pi/2}\int_0^2 drd\theta.$

i. pi

ii. pi/2

iii. pi/4

iv. 2

9. $Solve\int_0^4\int_0^{2\sqrt{z}}\int_0^{\sqrt{4z-x^2}}dzdxdy.$

i. pi

ii. 2*pi

iii. 8*pi

iv. 6*pi

10. The differential equation for a circuit in which self-inductance and capacitance neutralize each other is $L\frac{d^2i}{dt^2}+\frac{i}{C}=0.$Given that I is maximum current and i = 0 when t = 0, then what is the current i as a function of t ?

i. $i = I \sin \frac{t}{\sqrt{LC}}$

ii. $i = I \cos \frac{t}{\sqrt{LC}}$

iii. $i = I \sin \frac{\sqrt{LC}}{t}$

iv. $i = \frac{I}{\sin \frac{t}{\sqrt{LC}}}$

11. $If \frac{\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}}{M} = g(y), then I.F. is$

(a) $\frac{1}{Mx + Ny}$ (b) $e^{\int g(y)dy}$ (c) $\frac{1}{Mx - Ny}$ (d) $e^{\int f(x)dx}$

12 For a differential equation $P_0 \frac{d^2y}{dx^2} + P_1 \frac{dy}{dx} + .P_2 y = X$ symbolic form is

(a) $CS = CF + PI$ (b) $f(D)\ y = X$

(c) $f(D)\ y = 0$ (d) none of the above

13. For $\frac{dy}{dx} = 2x + y$ with y(0)=0 by Taylor's Series the value of y at 0.2 is

(a) 0.4907 (b) 0.0428 (c) 0.1836 (d) 0.4345

14. $\Delta x^2 \quad is$

$(a)\ (x-h)^2 - x^2 \quad (b)\ (x+h)^2 - x^2 \quad (c)\ x^2 - (x-h)^2 \quad (d)\ x^2 - (x+h)^2$

15. Trapezoidal rule is :

$(a) \int_a^b f(x)\,dx = \frac{h}{2}[X + 2O]$ $(b) \int_a^b f(x)\,dx = \frac{h}{2}[X + 2T]$

$(c) \int_a^b f(x)\,dx = \frac{h}{2}[X + 2R]$ $(d) \int_a^b f(x)\,dx = \frac{h}{2}[2X + 3T]$

16. Using DUIS the value of $\int_0^\infty \frac{\sin x}{x} dx$ can be given as

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi^2}{2}$ (d) $\frac{\pi^2}{4}$

17 $\lceil -12$ is

(a) 122! (b) 124! (c) *not defined* (d) *None*

18. Evaluate $\int_0^{2a} \frac{x^3}{\sqrt{2ax - x^2}}\, dx$

(a) $8a^3\ B(\frac{1}{2}, \frac{7}{2})$ (b) $\frac{\pi^2}{4}$ (c) $\frac{\pi^2}{2}$ (d) $\frac{1}{10} B\left(3, \frac{1}{2}\right)$

19. Length of the cardioide $r = a(1+\cos\theta)$ is found using the formula

(a) $s = \int_{x_1}^{x_2} \sqrt{1+\left(\frac{dy}{dx}\right)^2}\, dx$ (b) $s = \int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

(c) $s = \int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta$ (d) $s = \int_{y_1}^{y_2} \sqrt{1+\left(\frac{dx}{dy}\right)^2}\, dy$

20. The area enclosed by the curve $y^2 = x^3$ and the line $y = x$ is

(a) 32/3 (b) 1/10 (c) 3/32 (d) 10

21. Using triple integration find the volume of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$

(a) πabc (b) $\frac{4}{3}\pi abc$ (c) $\frac{4}{15}\pi a^3 bc$ (d) $\frac{41}{3}\pi abc$

22. The general solution of the differential equation $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$ is

(a) $Ax + Bx^2$ (b) $Ax + B \log x$ (c) $Ax + B x^2 \log x$ (d) $Ax + B x \log x$
where A & B are constants.

23. VPM is an alternate method to Type 1 to Type 7 to find the particular integral

(a) agree (b) disagree (c) can't decide

24. The length of the arc of the curve $y = \log \sec x$ from x=0 to $x = \frac{\pi}{3}$ is

(a) $\log\left(2+\sqrt{3}\right)$ (b) $\log\left(\sqrt{2}+3\right)$ (c) $\log\left(\sqrt{2}+1\right)$ (d) $\log\left(\sqrt{3}+1\right)$

25. The value of the integral $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sin(x+y)\, dx\, dy$

(a) 0 (b) π (c) -2 (d) 2