GIET UNIVERSITY, GUNUPUR – 765022

RD19BTECH002

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AR-19

B.TECH 1ST SEMESTER EXAMINATIONS (REGULAR), NOV/DEC 2019

Code- BBSBS1010, Engineering Mathematics -I

Time : 3 Hours | Maximum : 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 1=10 Mark

Q.1. Answer *All* Questions.

a If $u = x^y$, then $\frac{\partial u}{\partial y} =$ [CO1] [PO1]
(a) $y.x^{y-1}$ (b) $x.y^{x-1}$ (c) $x^y.\log x$ (d) None

b A function f(x,y) will have a maximum value at a point (a,b) if [CO1] [PO1]
(a) $rt-s^2 > 0, r>0$ (b) $rt-s^2 > 0, r<0$ (c) $rt-s^2 < 0, r>0$ (d) None

c Integrating factor for $\frac{dy}{dx} + Py = Q$, where P,Q are functions of x, is [CO2] [PO1]
(a) $e^{\int Q\, dx}$ (b) $e^{\int P\, dy}$ (c) $e^{\int P\, dx}$ (d) None

d An equation of the form $M\,dx + N\,dy = 0$ where M, N are functions of x and y is exact if and only if [CO2] [PO1]
(a) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ (b) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial y}$ (c) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial x}$ (d) None

e $\frac{dy}{dx} = \frac{-(3x^2y+y)}{(x^3+x)}$ is [CO2] [PO1]
(a) a first order homogeneous equation
(b) an equation of variables separable type
(c) a first order non-homogeneous equation
(d) None

f Fourier series of an odd periodic function contains only [CO3] [PO1]
(a) cosine terms (b) sine terms (c) both cosine and sine terms (d) None

g By the half range Fourier series of a function we mean an expansion of the function in an interval of the type [CO3] [PO1]
(a) (0, L) (b) (-L, L) (c) (-L, 2L) (d) None

h Condition for consistency of a system of linear simultaneous equations AX = B is [CO4] [PO1]
(a) $\rho(A) < \rho(A:B)$ (b) $\rho(A) > \rho(A:B)$ (c) $\rho(A) = \rho(A:B)$ (d) None

i If λ is an eigen value of a non singular matrix A, then $1/\lambda$ is an eigen value of [CO4] [PO1]
(a) A^T (b) A^{-1} (c) A^2 (d) None

j Cayley-Hamilton theorem states that every square matrix satisfies its own [CO4] [PO1]

(a) Normal form (b) Echelon form (c) Characteristic equation (d) None

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PART – B: (Short Answer Questions) 10x2=20 Marks

Q.2. Answer *ALL* questions

a Determine $\lim_{x\to 1, y\to 2} \frac{2x^2 y}{x^2+y^2+1}$ [CO1] [PO2]

b Determine whether the function $u(x,y)=\frac{x+y}{\sqrt{x}+\sqrt{y}}$ is homogeneous or not. If yes, what is its degree? [CO1] [PO2]

c Determine dz/dt if $z = u^2 + v^2$ where $u = a t^2$ and $v = 2 a t$. [CO1] [PO2]

d Solve the linear differential equation of first order $\frac{dy}{dx}+y=x$. [CO2] [PO2]

e Determine the complimentary function for the equation $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=\sin x$. [CO2] [PO2]

f Determine the particular integral for $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+5y=e^{2x}$. [CO2] [PO2]

g Determine the general coefficient of the sine terms (b_n) in the Fourier series of the function f(x) = x in (-π, π). [CO3] [PO2]

h Write general form of Fourier series of an even periodic function f(x) of period 2c. [CO3] [PO1]

i Determine the rank of the matrix $A=\begin{bmatrix}1&2&3\\1&4&2\\2&6&5\end{bmatrix}$. [CO4] [PO2]

j Test whether the matrix $P=\frac{1}{3}\begin{bmatrix}-2&1&2\\2&2&1\\1&-2&2\end{bmatrix}$ is orthogonal . [CO4] [PO2]

PART – C: (Long Answer Questions) 4x10=40 Marks

Answer *ALL* questions

Q.3

a If $u=\sin^{-1}(\frac{x^2+y^2}{x+y})$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\tan u$. [CO1] [PO2]

b Discuss the maxima and minima of the function $u=x^3+y^3-3xy$ [CO1] [PO2]

(5 +5)

OR

c Determine the points at which the function $f(x,y)=2(x^2-y^2)-x^4+y^4$ assumes maximum or minimum values. [CO1] [PO2]

d Apply Leibnitz rule for differentiation under the integral sign to evaluate $\int_0^1 \frac{x^a-1}{\log_e x}dx, a\geq 0.$ [CO1] [PO2]

(5 +5)

Q.4

a Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$. [CO2] [PO2]

b When a resistance R Ohms is connected in series with an inductance L Henries [CO2] [PO2]

(5 +5)

and an e.m.f. E volts, the current i amperes at time t is given by $L\frac{di}{dt}+Ri=E.$ If E = 10 volts and i = 0 when t = 0,
find i as a function of t.

OR

c Determine the complete solution of $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=e^x\cos x$. [CO2] [PO2]

(5 +5)

d Solve $\frac{d^2y}{dx^2}+y=\tan x$ by the method of variation of parameters. [CO2] [PO2]

Q.5

a Expand $f(x)=x-x^2$ as a Fourier series in the interval (-π,π). [CO3] [PO2]

(5 +5)

b Develop $f(x)=\begin{cases}1+2x/\pi, & -\pi\le x\le 0\\ 1-2x/\pi, & 0\le x\le\pi\end{cases}$ in a Fourier series in (-π,π). [CO3] [PO2]

OR

c Expand $f(x)=c,$ (where c is a constant) in a half range sine series in the interval (0,π). [CO3] [PO2]

(5 +5)

d Expand $f(x)=x^2$, as a half-range cosine series in the interval (0,2). [CO3] [PO2]

Q.6

a Apply Gauss Elimination method to solve the system of equations
4y + 3z = 13, x - 2y + z = 3, 3x + 5y = 11. [CO4] [PO2]

(4 +6)

b Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix}1&0&3\\2&1&-1\\1&-1&1\end{bmatrix}$ and hence find its inverse. [CO4] [PO2]

OR

c Reduce the quadratic form Q=$6x^2+3y^2+3z^2-4xy+4zx-2yz$ to its canonical form and specify the matrix of transformation. [CO4] [PO2]

(7+3)

d Verify whether the matrix $A=\frac{1}{\sqrt{3}}\begin{bmatrix}1&1+i\\1-i&-1\end{bmatrix}$ is Unitary. [CO4] [PO2]

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