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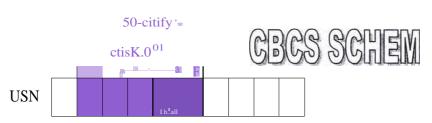
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18MAT21

Second Semester B.E. Degree Examination, June/July 2019 **Advanced Calculus and Numerical Methods**

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

a. If $F = V(x3 + y^3 + z^3 - 3xyz)$, find div F and curl f. (06 Marks)

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 = 3$ at the point (2, -I, 2).

c. Find the value of a, b, c such that $f = (axy + bz^3)i + (3x^2 - CZ)j^4 + (3)(Z^2 - y)k$ is irrotational, also find the scalar potential (I) such that F = V4). (07 Marks)

OR

a. Find the total work done in moving a particle in the force field F = 3xyi - 5z + 10xkalong the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from t = 1 to t = 2. (06 Marks)

b. Using Green's theorem, evaluate

 $_{\mathbf{f}}(xy + y^2)dx + x^2dy$, where C is bounded by y = x and $y = x^2$. (07 Marks)

Using Divergence theorem, evaluate if ds, where $F = (x^2 - yz)i + (y^2 -)3 + (z^2 - xy)k$

taken over the rectangular parallelepiped $0 \times a$, $0 \le y \le b$, 0 < z < C. (07 Marks)

Module-2

a. Solve $(D^2 - 3D + 2)y = 2x^2 + \sin 2x$.

(06 Marks)

Solve $(D^2 + 1)y = \sec x$ by the method of variation of parameter.

(07 Marks)

c. Solve $x^2y'' - 4xy' + 6y = \cos(2 \log x)$

(07 **Marks**)

OR

a. Solve $(D^2 - 4D + 4)y = e^{2x} + \sin x$.

(06 Marks)

b. Solve $(x+1)^2y'' + (x+1)y' + y = 2\sin[\log_e(x+1)]$

(07 Marks)

The current i and the charge q in a series containing an inductance L, capacitance C, emf E, satisfy the differential equation L $\frac{dt^2}{dt^2}$ = E, Express **q and i interms of 't'** given that L, C, E are constants and the value of i and q are both zero initially. (07 Marks)

Module-3

a. Form the partial differential equation by elimination of arbitrary function from

$$(0(x + y + z, x^2 + y^2 + z^2) = 0$$

(06 Marks)

b. Solve $\frac{z^{8^3}}{ax^2ay} - \cos(2x + 3y)$

(07 Marks)



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OR

6 a. Solve
$$\frac{a^2}{ax} + z = 0$$
 such that $z = ey$ where $x = 0$ and $\frac{oz}{ax} = 1$ when $x = 0$. (06 Marks)

b. Solve
$$(mz - ny) = \frac{az}{ax} + (nx - e) = ey mx$$
 (07 Marks)

c. Find all possible solutions of one dimensional wave equation

method of separation of variables. a'uat

at

a'u

ax

(07 Marks)

Module-4

7 a. Discuss the nature of the series
$$\frac{1}{n-1} \frac{(n+1)^n}{n^{n+1}} x^n$$
. (06 Marks)

b. With usual notation prove that
$$J_{i:2}(x) = \frac{2}{nx} \sin x$$
 (07 Marks)

c. if $x^3 + 2x^2 - x + 1 = aP3 + bP2$ el $^9! + dPo$, find a, b, c and d using Legendre's polynomial. (07 Marks, _

OR

8 a. Discuss the nature of the series

$$\frac{x}{12} \frac{x^2}{3.4} \frac{x}{3.4} \tag{06 Marks}$$

h. Obtain the series solution of Legendre's differential equation in terms of $P_n(x)$

$$(1-x^2)y'' - 2xy' + n(n+1)y = 0$$
 (07 Marks)

c. Express $x^4 - 3x^2 + x$ in terms of Legendre's polynomial. (07 Marks)

<u> Module-5</u>

- 9 a. Find the real root of the equation $x\sin x + \cos x = 0$ near $x = \pi$ using Newton-Raphson method. Carry out 3 iterations. (06 Marks)
 - b. From the following data, find the number of students who have obtained (i) less than 45 marks (ii)between 40 and 45 marks.

Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of Students	31	42	51	35	31

(07 Marks)

e. Evaluate $\int_{-\infty}^{\infty} dx$ using Simpson's — rule by taking 7 ordinates. (07 Marks)

OR

- 10 a. Find the real root of the equation $x_{login} = L2$ which lies between 2 and 3 using Regula-Falsi method. (06 Marks)
 - b. Using Lagrange's int iven data:

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	X	0	1	2	5	
	y	2	3	12	147	

(07 Marks)

c. Evaluate i'log_e x dx using Weddle's rule by taking six equal parts.

(07 Marks)