JAIPUR NATIONAL UNIVERSITY

Jagatpura, Jaipur

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MID TERM EXAMINATION-I, NOV 2021

School of Engineering and Technology

B. Tech. I Year (Common for all Branches except BT & FT)

ENGINEERING MATHEMATICS-I

BSC-103

Time Allowed: 2 Hrs **Max Marks: 20**

Q.1 Attempt any 8 questions: (1*8=8)

a) Write the definition of asymptotes.

b) What do you understand by parallel asymptotes and oblique asymptotes?

c) Define concavity and convexity?

d) Define double point in curve tracing.

e) Define node, cusp and conjugate point.

f) Identify that the given curve intersects with axes or not. If yes find the intersection points.

$$9ay^2 = (x-3a)^2$$

g) Find the symmetry in the following curve

$y^3 + x^3$=3axy. Where 'a' is a constant.

h) Write the definition of partial differentiation.

i) If $u = sin^{-1}\left(\frac{\sqrt{x}-\sqrt{y}}{\sqrt{x}+\sqrt{y}}\right)$, $show\ that\ \frac{\partial u}{\partial x} = -\frac{x}{y}\frac{\partial u}{\partial y}$.

j) Write the statement of Euler's theorem.

k) Write the definition of homogeneous function.

l) If $u = tan^{-1}\left(\frac{x-y}{x+y}\right)$. Is it homogeneous or not. If yes then find the degree.

Q.2 Attempt any part. (2x3)

a)Find the asymptotes of the following curve:

$$y^3 - xy^2 - x^2y + x^3 + x^2 - y^2 - 1 = 0$$

b) Trace the curve $x^3 + y^3$=3axy.

Or

Q2. a) Show that the four asymptotes of the curve. (2x3)

$$(x^2 - y^2)(y^2 - 4x^2) + 6x^3 - 5x^2y - 3xy^2 + 2y^3 - x^2 + 3xy - 1 = 0$$

Cut the curve in eight points which lie on the circle $x^2 + y^2 = 1$.

b). Find the double point and their nature of the following curve

$$y(y-6) = x^2(x-2)^3 - 9$$

Q3. a) Define Homogeneous function with example

(2x3)

b)State and Prove Euler's Theorem.

Or

3a).If $u = \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{1}{2}\cot u$. (2x3)

3b). If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$.

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School of Engineering and Technology

II MID TERM EXAMINATIONS: JANUARY 2022

B.Tech. Semester-I

ENGINEERING MATHEMATICS-I

BTEBE103

Time: 2 Hour **M.M.: 20**

Q.1 Attempt any 8 questions: **(1*8=8)**

a) Find the second order Taylor's polynomial approximation of $f(x,y) = xe^y + 1$ about (1,0).

b) Find the second order Taylor's polynomial approximation of $f(x,y) = \sqrt{xy}$about (1,3).

c) If f(x,y)(function of two independent variables), then what is the condition of 'f' for maxima and minima?

d) Write the necessary condition of Lagrange's function for extreme points.

e) Write the Taylor's Series for two variables.

f) Write the formula of double integration in polar form.

g) What are the applications of double integral?

h) Evaluate $\int_0^3 \int_1^3 xy(1 + x + y)dxdy$.

i) Write the relation between beta and gamma function.

j) Prove that: -$\Gamma(n+1) = n\Gamma n$.

k) Evaluate $\int_1^2 \int_0^3 (1+8xy)\,dx\,dy$

l) What is point of inflexion?

Q.2 Find the extreme point of x^3+2y^3+3x^2+12y^2+24=0. [6]

OR

Q.2 Find the dimensions of the rectangular box open at the top of maximum capacity whose surface is 108 sq.cm.

Q.3 Evaluate. [6]

$$\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dy\,dx.$$

OR

Q.3 Prove that: -$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

BETBE103/BSC103

JAIPUR NATIONAL UNIVERSITY, JAIPUR

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BETBE103/BSC103

SCHOOL OF ENGINEERING & TECHNOLOGY

B.Tech.

I SEMESTER END EXAMINATION: JANUARY 2022

ENGINEERING MATHEMATICS – I
(EXCEPT BT & FT)

Time: 3 Hrs. Max. Marks: 70

All questions are compulsory & carrying equal marks.

Q.1 (a) Trace the curve: 7

$$x^3 + y^3 = 3axy$$

(b) Find the asymptotes of 7

$$(x^2 - y^2)(y^2 - 4x^2) + 6x^3 - 5x^2y - 3xy^2 + 2y^3 - x^2 + 3xy - 1 = 0$$

OR

Q.1 (a) Trace the curve: 7

$$9\,ay^2 = (x - 3a)^2$$

(b) Find the asymptotes of 7

$$x^3 + 3x^2y - 4y^3 + x + y + 3 = 0$$

Q.2 (a) State and prove the Euler's theorem. 7

(b) If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ 7

$\sin 2u$

OR

Q.2 (a) If the function 7

$$f(x) = \begin{cases} \frac{1-\cos x}{x^2} & for\ x \neq 0 \\ k & x = 0 \end{cases}$$

is continuous at x = 0, then find the value of k.

(b) If $u = \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ 7

$-\frac{1}{2}\cot u$

Q.3 (a) Find the extreme point and value of 7

$x^3 + 2y^3 + 3x^2 - 12y^2 + 24 = 0$

(b) Find the second order Taylor's polynomial 7

approximation of:

(i) $f(x, y) = xe^y + 1$ about (1, 0)

(ii) $f(x, y) = \sqrt{xy}$ about (1, 3)

OR

Q.3 If u = sin A sin B sin C. 14

Sub. to the constraints. A + B + C = π

find the extreme value of 'u'.

Q.4 (a) Prove the relation between Beta & Gamma function. 7

(b) Evaluate the area of region bounded by parabola $x = y^2$ 7

and the line y = x.

OR

Q.4 (a) Prove that: $\Gamma\frac{1}{2} = \sqrt{\pi}$ 7

(b) Evaluate: $\int_{-6}^{6}\int_{-\sqrt{36-x^2}}^{\sqrt{36-x^2}}(x^2 + y^2)\,dy\,dx$ 7

Q.5 (a) Write the statement of: 7

(i) Green's theorem

(ii) Gauss divergence theorem

(iii) Stoke's theorem

(b) Evaluate by Stoke's theorem $\int_c \vec{F}\cdot d\vec{r}$ where $\vec{F} =$ 7

$y^2\hat{\imath} + x^2\hat{\jmath} - (x + z)\hat{k}$ and C is the boundary of the

triangle with vertices at (0, 0, 0), (1, 0, 0) and (1, 1, 0).

OR

Q.5 **(a)** Evaluate $\iiint_v \vec{\nabla} \times \vec{A}\,dv$, where $\vec{A} = (x + 2y)\hat{\imath} - 3z\hat{\jmath} + x\hat{k}$ and V is the closed region in the first octant bounded by the plane $2x + 2y + z = 4$. 7

(b) Use Green's theorem for $\vec{F} = (3x^2 - 8y^2)\hat{\imath} + (4y - 6xy)\hat{\jmath}$ for the region lying inside $x = 0$, $y = 0$ and $x + y = 1$. 7