Hall Ticket Number:

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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) III-Semester Supplementary (New/Old) Examinations, June-2019

Bridge Course: Fundamentals of Linear Algebra and Vector Calculus

(Civil, ECE & Mech. Engg.)

Time: **3** hours Max. Marks: **50**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (5 × 2 = 10 Marks

1. If $z = \frac{\cos y}{x}$ and $x = u^2 - v, y = e^v$, find $\frac{\partial z}{\partial v}$
2. Evaluate $\int sin^{-1} x \, dx$.
3. If $\bar{r} = x\bar{\imath} + y\bar{\jmath} + z\bar{k}$, show that grad$r = \frac{\bar{r}}{r}$
4. Evaluate $\int_1^2 \int_1^3 xy^2 \, dxdy$
5. State Gauss's divergence theorem in a plane.

Part-B (5 × 8 = 40 Marks)
(All sub-questions carry equal marks)

6. a) Define Total derivative of a function ,find $\frac{du}{dt}$ If $u = \sin\frac{x}{y}, x = e^t, y = t^2$

   b) If $u = f(y - z, z - x, x - y)$ Prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

7. a) Evaluate $\int \frac{xe^x}{(x+1)^2} dx$

   b) Evaluate $\int \frac{\sin x \cos x}{a^2 cos^2 x + b^2 sin^2 x} dx$

8. a) Define Irrotational Vector. Show that the vector field $\bar{F} = (\sin y + z)\bar{\imath} + (x \cos y - z)\bar{\jmath} + (x - y)\bar{k}$ is irrotational.

   b) Calculate the angle between the normals to the surface $xy = z^2$at the points (4,1,2) and (3,3,-3).

9. a) If $\bar{F} = (x^2 + y^2)\bar{\imath} - 2xy\bar{\jmath}$ evaluate $\oint_c \bar{F}.\overline{dr}$ where c is the rectangle in xy plane bounded by $y = 0, y = 1, x = 0, x = 2$.

   b) Evaluate $\int_s \bar{F} .\bar{n} \, ds$ where $\bar{F} = z\bar{\imath} + x\bar{\jmath} - 3y^2z\bar{k}$ and S is the Surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between z=0 and z=5.

10. a) Evaluate $\int_v div \ \bar{F} \ dv$ where $\bar{F} = 4xi - 2y^2j + z^2k$ bounded by the Region $x^2 + y^2 = 4, z = 0 \ and \ z = 3$.

    b) Using Green's theorem , Evaluate $\int_c (x^2 - xy^3)dx + (y^2 - 2xy)d\,y$, Where c is the square with vertices (0,0),(2,0), (2,2), (0,2).

11. a) If $f = \frac{1}{\sqrt{x^2+y^2+z^2}}$ Prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$.

    b) Evaluate $\int e^x \cos^2 x dx$.

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12. Answer any *two* of the following:

a) Find the Directional derivative of $\emptyset = x^2yz + 4xz^2$ at (1,-2,-1) in the direction of 2i-j-2k.

b) If $\bar{F} = 3xy\bar{\imath} - y^2\bar{\jmath}$, evaluate $\oint_c \bar{F}.\overline{dr}$,where c is the arc of the parabola $y = 2x^2$from (0,0) to (1,2).

c) Apply Stokes theorem, to evaluate $\int_c (ydx + zdy + xdz)$ where c is the curve of intersection of the sphere $x^2 + y^2 + z^2 = a^2 and\ x + z = a$.