Seat No:______________ Enrollment No:______________

PARUL UNIVERSITY

FACULTY OF APPLIED SCIENCE

B.Sc./IMSC Summer 2017-18 Examination

Semester: 4 **Date: 12/05/2018**

Subject Code: 11106251 **Time: 10:30am-1:00pm**

Subject Name: Vector Calculus **Total Marks: 60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1. A) Find the equation of plane passing through points A(0,0,1), B(-1,0,0) C(0,3,1).Also find the intersecting point of this plane with the line **(08)**

L: $x = 4 + t, y = -2t, z = 1 - t$

OR

Q.1. A) If ϕ *and* ψ are scalar function then show that $grad(\phi\psi) = \phi grad(\psi) + \psi grad(\phi)$.

Then find the values of constants a,b,c. Show that the directional derivative of $\phi = axy^2 + byz + cz^2x^3$ *at* $(1,-2,-1)$ has a maximum magnitude 36 in a direction parallel to z- axis.

Q.1. B) Answer the following questions (Any two)

(a) Prove that: $grad\ r^m = mr^{m-2}\mathbf{r}$. Where **r** is position vector and r is magnitude of **r**. **(04)**

(b) For the curve $x = t, y = t^2\ z = t$. Find the curvature κ . **(04)**

(c) Show that the vector v= $(xi + yj)/(x\text{^}2 + y\text{^}2\ )$ is solenoidal. **(04)**

Q.2. A) Answer the following questions.

(a) Find the distance from the point p(2,0,5) to the line **(04)**

L: $x = 1 + t\ , y = 3 - 2t\ , z = 2 + t$

(b) Find a scalar potential for the field $F = e^{y+2z}(i + xj + 2xk)$ **(04)**

Q.2. B) Answer the following multiple choice questions **(03)**

a) If the vectors $2i + 3j - 4k$ *and* $4i + bj + 5k$ *are perpendicular, then* $b =$

a) 1 b) 2 c) 3 d)4

b) The curvature of the straight line is

a) 0 b) 1 c) finite d) infinite

c) Let the vector $\overrightarrow{PQ} = -6i - 4j$ *and Q is the point* $(3,3)$ *then* $P =$

a) (-9,-7) b) (-3,-1) c) (9,7) d) (3,1)

Answer the following (True/ False) **(03)**

a) Slope of the vector $2i + 5j$ is -5/2

b) For a scalar function ϕ , div(curl ϕ) = 0

c) A vectore field $\vec{F}$ is conservative if div$\vec{F}$ = 0

Q.3. A) In usual notation State and prove Stoke's theoram. **(08)**

OR

Q.3. A) In usual notation state and prove green's theoram for plane.

Q.3. B) Answer the following questions (Any two)

a) If $f = 3xyi - y^2j$, *evaluate* $\int_C f.dr$, *where C is the arc of the parabola* $y = 2x^2$ from (0,0) to (1,2) **(04)**

b) Evaluate $\iint A.dS$ *over a surface S. where* $A = xi + (z^2 - zx)j - xyk$ *and S is the surface of the triangle with vertioces* (2,0,0), (0,2,0), (0,0,4) **(04)**

c)If $f = (2x^2 - 4z)i - 2xyj - 8x^2k$, *then evaluate* $\iiint div\ f\ dV$, *over V, where* V is bounded by the planes $x = 0, y = 0, z = 0, x + y + z = 1$ **(04)**

Q.4. A) Answer the following questions.

a) Using green's theoram , evaluate $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundry of the region bounded by $y^2 = x$ *and* $x^2 = y$ **(04)**

b) Verify stoke's theoram for F= $xy^2i + yj + z^2xk$ for the surface of a rectangular lamina bounded by $x = 0, y = 0, x = 1, y = 2, z = 0$ **(04)**

Q.4. B) Answer the following multiple choice questions

a) If C is the boundry of the circle $x^2 + y^2 = 1$ in xy- plane and **(03)**

if R= $xi + yj\ then\ \int_c\ R.dR\ \ equals\ to$

a) 1 b) 2 c) 3 d) 0

b)$\int_c\ f.dr$ is independent of the path joining any two points if and only if $f\ is$

a) rotational b) irrotatinal c)conservative d) none of the above

c)A necessary and sufficient condition that line integral $\int_c\ A.dr = 0\ for\ every\ closed\ curve$ is that

a) div A=0 b) curl A=0 c) div A$\neq$ 0 d) curl A$\neq$ 0

Answer the following (True/ false) **(03)**

a) Greens's theoram in plane is a particular case of stoke's theoram.

b) If $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$everywhere in a simply connected region R, then $\int_c\ Mdx + Ndy\ = 0$

c) Gauss divergence theoram transforms surface integrals into volumn integral.