MA 1116 - VECTOR ANALYSIS WITH APPLICATIONS
COURSE OBJECTIVES

This course develops the calculus of vector-valued functions and functions of vector arguments. This subject express relationships between quantities changing continuously over space and/or time, so this material is applicable to many fields, and is essential for students of engineering or physical sciences.

Upon completion of this course, the student should be able to satisfy the following objectives.

1. Use vectors to represent displacement, force and torque, linear and angular momentum, velocity and acceleration, fluid and heat flow, electric and magnetic fields.
2. Combine vectors using addition, multiplication by a scalar, the scalar product, the vector product, and the scalar triple product.
3. Resolve a vector into parts parallel and perpendicular to another given vector.
4. Write down the vector equation of a line or plane in either parametric or nonparametric form.
5. Given the position vector to a moving particle, find the unit tangent, normal and binormal vectors and curvature of the path, and obtain the components of velocity and acceleration along these vectors.
6. Find and interpret geometrically the gradient of a scalar field of two or three variables, find the directional derivative of a scalar field in a given direction, and find the maximum or minimum of a scalar field subject to constraints.
7. Find and give a physical interpretation of the divergence and curl of a vector field.
8. Recite basic identities regarding the "del" operator ∇ applied to various combinations of scalar and vector fields.
9. Find and give a physical interpretation of the line integral of a vector function over a space curve.
10. If a vector field is conservative, find a scalar potential function and use it to evaluate line integrals.
11. If a vector field is solenoidal, find a vector potential function.
12. Given the equation of a surface in either implicit, explicit, or parametric form, find a unit normal vector to the surface.
13. Find and give a physical interpretation of the flux integral of the normal component of a vector function over a curved surface.
14. Evaluate a volume integral of a scalar function over a region of space.
15. Recite and apply Green's, Stokes', and the divergence theorems.
16. Give coordinate-free definitions of the divergence and curl of a vector field.
17. Calculate a gradient, divergence, curl, Laplacian, line integral, surface integral, or volume integral in cylindrical or spherical or some other orthogonal curvilinear coordinate system.

Ca 1/04