

Federal University of Technology, Owerri

School Of Post Graduate Studies

Department Of Mechanical Engineering

Course: ENG. 602 Advance Engineering Mathematics RAIN Semester Examination

Session: 2017/2018

Time: 3hours

Instruction: Answer All Questions

- (1). (i) If a force  $2x^2yi + 3xyi$  displaces a particle in  $x$ - $y$  plane from  $(0,1)$  to  $(1,4)$  along a curve  $y=4x^2$  find the work done.
- (ii) Evaluate  $\int_V F dV$  where  $V$  is the region bounded by the plane  $x=0, x=2, y=0, y=3, z=0, z=4$  and  $F=xyi+zj-x^2k$ . Draw the region bounded by the plane.
- (iii) Evaluate  $\iint (yzi + zxj + xyk) \cdot ds$  where  $s$  is the surface of the sphere  $x^2+y^2=z^2$  in the first octant.
- (2) (i) Evaluate  $I = \oint_C \{ (2x - y) dx + (2y + x) dy \}$  around the boundary  $c$  of the ellipse  $x^2+9y^2=16$ .
- (ii) Using the Stokes' theorem, evaluate  $\int_C \{ (2x - y) dx + (yz^2) dy - y^2 z dz \}$  Where  $c$  is the circle  $x^2+y^2=1$  corresponding to the surface of unit radius
- (3) Find the moment of inertia  $I$  of a spherical lamina  $s=x^2+y^2+z^2=a^2$  of a constant mass density and total mass  $M$  about the  $z$ -axis.:
- (4). Evaluate the  $\iint_S x^3 d_y d_z + x^2 y d_z d_x + x^2 z d_x d_y$  where  $s$  is the closed surface consisting of the cylinder  $x^2+y^2=a^2$  ( $0 \leq z \leq b$ ) and the circular disk  $z=0$  and  $z=b$  ( $x^2+y^2 \leq a^2$  )
5. ). Evaluate the  $\iint_S \bar{F} \cdot n ds$  where  $F = 4xzi - y^2j + yzk$  and  $s$  is the surface of the cube bounded by  $x=0, x=1, y=0, y=1, z=0, z=1$ .