Menoufiya University
Faculty of Engineering
Shebin El-Kom
First Semester Examination
Academic Year: 2013-2014

Year: Post Grad.
Department: Basic Engg. Science
Subject: Advanced Fluid Mechanics BES 645
Time Allowed: 3 hours
Date: 23.01.2014

Allowed Tables and Charts: None

Answer all the following Questions *(100 Marks)*

Question (1) *(50 Marks)*

(a) Derive the general energy equation for 3-dimensional incompressible flow. *(25 Marks)*

(b) For 3-dimensinal incompressible flow develop the continuity and Navier-Stokes equations in Cartesian coordinates in its general forms. *(25 Marks)*

Question (2) *(50 Marks)*

(a) Explain how to develop the turbulent Reynolds-stresses tensor matrix in three-dimensional turbulent flow. *(20 Marks)*

(b) To close the system of Reynolds-averaged Navier-Stokes equations (RANS) given in question (2-a), we must find enough equations to solve for our unknowns. Describe how to develop a simple linear turbulence model for solving the RANS equations (k-ε turbulence model). Define all terms in the developed equations. *(30 Marks)*

Best wishes

Assoc. Professor Wageeh El-Askary