CODE NO: NR422101 SET NO.1

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH. II SEMESTER SUPPLEMENTARY EXAMINATIONS
BOUNDARY LAYER THEORY
(AERONAUTICAL ENGINEERING)

JULY -2005

TIME: 3 HOURS
MAX MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks

1. *Estimate the thermal conductivity of helium at 420oC and 1 atm. Compare with the measured value of 0.28 W / (m . K).*

2. *Write about general of stress state of deformable bodies. Explain the stress Tensor?*

3. *Consider the plane stagnation-point °ow. Derive the equation for displacement thickness and boundary layer thickness.*

4. *Develop an implicit numerical algorithm for the two-dimensional unsteady viscous di®usion relation. Comment on a possible solution procedure and possible instability.*

5. *Derive a relation for skin-friction coe±cient Cf as a function of local Reynolds number Rex for boundary-layer °ow toward a point sink. Compare your result with the Falkner-Skan relations.*

6. *Assume a boundary-layer velocity pro¯le approximating a Pohlhausen polynomial with any nonzero value of ^ (have each member of the class select a di®erent ^). Estimate the critical (instability) value of Re±¤ for this pro¯le.*

7. *Consider fully developed turbulent °ow through a duct of square cross section. Taking advantage of the double symmetry, analyze this problem using the log-law, plus a suitable assumption about variation of shear stress around the cross section. Compare your result for ^ with the hydraulic-radius concept.*

8. *Water at 20oC and 1 atm °ows at 6m /s past a smooth °at plate 1 m long and 60 cm wide. The plate surface temperature is 50oC. Estimate the total heat loss (in W) from one side of the plate.*