BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M. Tech. **SEMESTER : II**
BRANCH: SER **SESSION : SP/22**

SUBJECT: SR 614 Turbulence Modeling in CFD

TIME: 2.00 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.

Q.1(a) Briefly discuss on the viscous sublayer, buffer layer and logarithmic layer in a turbulent flow over solid wall. [5]

Q.1(b) Explain the Dirichlet and Neumann boundary conditions with an example. [5]

Q.2(a) Discuss on the time and ensemble averaging of a flow variable φ. [5]

Q.2(b) For a velocity field $d\bar{u}/dy > 0$, show that correlation $\overline{u'v'}$ is negative. [5]

Q.3(a) Briefly explain the Prandtl's mixing length hypothesis. [5]

Q.3(b) Write a modern variant of the mixing-length model for flow near solid boundaries. [5]

Q.4(a) Explain the physical significance of the production, dissipation and diffusion terms appearing in transport equation for the turbulence kinetic energy. [5]

Q.4(b) Describe the Menter SST k-ω two-equation turbulence model. [5]

Q.5(a) Write the advantages and limitations of Reynolds-Averaged Navier-Stokes (RANS) and Large-Eddy Simulation (LES). [5]

Q.5(b) Assess the performance of different turbulence models in aerospace applications. [5]

:::::04/05/2022:::::