**INDIAN INSTITUTE OF TECHNOLOGY KANPUR**

DEPARTMENT OF CHEMICAL ENGINEERING

**FLUID MECHANICS AND RATE PROCESSES (ESO204A)**

**Instructor:** Dr. Raghvendra Singh, FB458, Ph. 7605, E mail: raghvend@iitk.ac.in

**Course objectives:** Students taking this course will learn about fluid statics and dynamics, mass, energy, and momentum balances applied to fluids as well as fundamentals of mass and heat transfer. The course prepares the students to take more advance courses in several fields of engineering and science.

**Prerequisites:** None

**Course contents:**

FLUID MECHANICS

Introduction to transport phenomena, Fluid statics; pressure as a scalar, manometry, forces on submerged surfaces, Description of flows; Lagrangian and Eulerian approaches; Euler acceleration formula; streamlines; control volume; Reynolds transport theorem; Conservation of mass; integral and differential approaches, *Linear* momentum balance: stress; deformation; Newton’s law of viscosity; Navier-Stokes’ equation; Applications of Navier-Stokes’ equation for simple 1-D problems; Poiseuille flow, Couette flow, Total energy equation; Bernoulli equation; applications, including flow measurement (Pitot tube, orifice meters), Pipe flows; friction factor; Reynolds’ experiment; losses in fittings, Dimensional analysis; Non-dimensionalization of Navier, Stokes’ equations and boundary conditions, Low Re flows: flow past circular cylinders; stream functions; Stokes’ flow; drag coefficient correlations, High Re flow; basic inviscid flow; need for boundary layer; Magnus-Robin effect, Boundary layer flow; flow on flat plates; separation; flow past, immersed bodies

HEAT TRANSFER

Introduction: Fourier’s law; *unsteady* conduction equation; boundary conditions, Convection: heat transfer coefficient

MASS TRANSFER

Introduction; Fick’s law; unsteady species conservation equations.

**Lecture:** MWF 11:00-11:50

**Lecture Hall:** L19

**Office hour:** 4-5 PM Thursday, FB458

**Evaluation Components & Policies:**

Quizzes (2): 10% each

Mid-semester exam: 25%

Final exam: 40%

Attendance in Lectures: 5%

Tutorial: 10%

**Course Policies:**

* Tutorial marks distribution will be decided by tutors.
* A student may be de-registered from the course if his/her attendance falls short of a minimum of 80%.
* All exams and quizzes will be closed books and notes.
* No make-up exam for missed quizzes & midsem exam will be held.
* End semester exam is compulsory. A student who does not appear in end semester exam will be awarded F grade.
* Any kind of misconduct will lead to deregistration from the course and will be reported to SSAC

**Books and references:**

1. Fluid mechanics. Frank M. White, 7th edition, Mc Graw Hill education.
2. Elements of Heat and Mass transfer. Vijay Gupta, New Age International (P) Limited.

**Tutorial:** Th: 11-11:50

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| Tutor name | Batch | Email | Tutorial room | Tel | Office |
| |  |  | | --- | --- | |  | Dr. [M. IBRAHIM SUGARNO](http://www.iitk.ac.in/new/mohammed-ibrahim-sugarno) | | M1 | Ibrahim | T212 |  |  |
| Mr. GAURAV CHOPRA | M2 | Gchopra | T211 | 7755057830 | NWTF-301 |
| Mr. DEEPAK KUMAR | M3 | deepakkr | WL226 | 9119990865 | Advance Prop. Lab, AE |
| Mr. R. RAGAVENDIRAN | M4 | Ragav | T210 | 6220 | Fluid dynamic lab old SAC |
| Mr. TULSI RAM SAHU | M5 | Tulsiram | T209 | 9454858128 | CFD lab (6603) |
| Mr. MAURYA GYANPRAKASH | M6 | mauryag | T208 | 9454802608 | 6288 |
| Mr. MAYANK AGARWAL | M7 | magarwal | T207 | 9580623858 | 6065 |
| Ms. ANAMIKA MAURYA | M8 | anamikak | T206 | 9455185035 | NL2-203A |
| Ms. JYOTI GUPTA | M9 | Jyotika | T205 | 8953988400 | SL |
| Dr. A. K. SAHA | M10 | Aksaha | T204 | 7869 | SL210 |
| Dr. SACHIN SHINDE | M11 | Sachin | T203 | 6939 | FB439 |
| Dr. PRANAV JOSHI | M12 | jpranavr | T201 | 2023 | NL301 |

**Schedule of Quizzes:**

Quiz1: Aug. 30, 2018, in tutorial from 11-11:50

Quiz2: Oct. 25, 2018, in tutorial from 11-11:50