Subject Description Form

Subject Code	BSE533
Subject Title	Fire Dynamics
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students a detailed theoretical base of fire dynamics. To study the burning properties of materials, detail fire behaviour of materials, and building fire safety design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. have a clear understanding of the role of fire dynamics in building and wildland fire; b. understand the detailed theoretical base of fire dynamics and the principles of fire safety design; c. appreciate the burning properties of materials and fire design; d. understand detail fire behaviour of materials; e. investigate and appraise current development and research in building fires and services systems.
Subject Synopsis/ Indicative Syllabus	**Fire processes:** Fire triangle, stages of compartment fire, fire load, basic combustion, heat transfer, thermal radiation, laminar and turbulent jet flames, flames from natural fires. **Fire plumes and smoke transportation:** Fire-induced aerodynamics including ceiling jets and plumes, some practical applications. Production, measurement, visibility, toxicity, combustion products, smoke movement. **Heat Release Rate:** Oxygen consumption calorimetry, hazard assessment, full-scale burning tests. **Fire behaviour of materials:** Pilot and spontaneous ignition, thermal inertia, standard fire tests, fire behaviour of materials, fire retardant systems, burning rate, heat release rate of furniture, toxic gas hazards. **Spread of flame:** The phenomenology of flame spread, simple models of flame spread, spread of flame through open fuel beds, applications. **Smouldering fires and wildland fires:** dynamics and features of smouldering combustion and the uniqueness of wildland fire behaviours. **Compartmental fire:** Pre-flashover fire, growth period, flashover, post-flashover, fully-developed fire, empirical equation, fire resistance and fire severity, methods of calculating fire resistance.

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<tr><td></td><td>Use of fire engineer's calculator: Fire Dynamics Simulator (FDS), as an example.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures will be used to introduce topics as listed in the syllabus. Speakers will be invited to give seminars on advanced topics in fire. Tutorials and seminars will be conducted in formats of demonstrations and paper discussions. Physical and numerical experiments will be assigned at appropriate stages. Most of the learning materials are contained in the lecture notes and relevant papers.
Lectures and seminars
Student seminars/tutorials
Laboratory and field work</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a.</td><td>b.</td><td>c.</td><td>d.</td><td>e.</td><td></td></tr>
<tr><td>1. Project</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>2. Lab report</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Assignments</td><td>40%</td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Homework assignments cover key knowledge delivered in lectures.
Lab report examines students’ ability to analyse real fire phenomena
Course project enables students to apply the knowledge and skill, and it includes a presentation that demonstrates students’ ability to explain fire dynamics.</td></tr>
<tr><td>Reading List and References</td><td>Drysdale, D.D. (2011). An Introduction to Fire Dynamics, 3rd Ed., Wiley-Interscience, New York, NY, USA.

Hurley M.J. et al. (Editor) (2016). SFPE Handbook of Fire Protection Engineering, 5th Ed., Quincy, MA, Society of Fire Protection Engineers, Boston, MA, USA.

Quintiere, J.G. (2017). Principles of Fire Behaviour, Delmar Publishers, Albany, NY, USA.</td></tr>
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