

| Course code   | Course Name   | L-T-P-Credits | Year of Introduction |
|---|---|---------------|----------------------|
| ME371   | Nuclear Engineering   | 3-0-0-3       | 2016                 |
| <b>Prerequisite : Nil</b>   |   |               |                      |
| <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To explore the engineering design of nuclear power plants using the basic principles of reactor physics, thermodynamics, fluid flow and heat transfer.</li> <li>• To provide an overview on reactor principles, nuclear safety, and reactor dynamic behaviour.</li> <li>• To understand the standards of radiation protection and need for nuclear waste disposal</li> </ul> |   |               |                      |
| <b>Syllabus</b><br>Review of Elementary nuclear physics, Nuclear fission, Boiling water reactor, Structural materials, Nuclear fuels, Reactor heat removal, Safety and disposal   |   |               |                      |
| <b>Expected Outcome:</b><br>The students will be able to <ol style="list-style-type: none"> <li>1. understand the theories and principles of nuclear power generation</li> <li>2. understand the heat removal techniques applied to reactor heat transfer systems.</li> <li>3. acquire knowledge about safe disposal of nuclear wastes</li> </ol>   |   |               |                      |
| <b>Text books/ Reference books</b> <ol style="list-style-type: none"> <li>1. S. Glasstone and A. Sesonske, <i>Nuclear Reactor Engineering</i>, D. Van Nostrand Company, INC. 1967.</li> <li>2. S Glasstone, Source book on atomic energy, Krieger Pub Co., 1979</li> </ol>  |   |               |                      |
| <b>Course Plan</b>  |   |               |                      |
| Module  | Contents  | Hours         | End Sem. Exam. Marks |
| <b>I</b>  | Review of Elementary nuclear physics: Atomic structure – nuclear energy and nuclear forces – Nuclear fission. Nuclear reactions and radiations – Principles of radioactive decay interactions of an ray with matter – Neutron cross sections and reactions –The fission process – Chain reactions | <b>7</b>      | <b>15%</b>           |
| <b>II</b>   | Basic principles of controlled fusion .Nuclear reactor principles – Reactor classification – Critical size. Basic diffusion theory - Slowing down of neutrons – Neutrons – Neutron flux and power – Four factor formula – Criticality condition – Basic features of reactor control .             | <b>7</b>      | <b>15%</b>           |
| <b>FIRST INTERNAL EXAMINATION</b>   |   |               |                      |

|                                    |  |          |            |
|------------------------------------|--|----------|------------|
| <b>III</b>                         | Boiling water reactor . Description of reactor system – Main components –Control and safety features .Materials of reactor construction – Fuel , moderator , coolant   | <b>7</b> | <b>15%</b> |
| <b>IV</b>                          | Structural materials – Cladding –Radiation damage,<br>Nuclear fuels : Metallurgy of Uranium – General principles of solvent extraction – Reprocessing of irradiated fuel – Separation process fuel enrichment .                            | <b>7</b> | <b>15%</b> |
| <b>SECOND INTERNAL EXAMINATION</b> |  |          |            |
| <b>V</b>                           | Reactor heat removal / equations of heat transfer as applied to reactor cooling– Reactor heat transfer systems – Heat removed in fast reactors. Radiation safety : Reactor shielding – Radiation doses – Standards of radiation protection | <b>7</b> | <b>20%</b> |
| <b>VI</b>                          | Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation               | <b>7</b> | <b>20%</b> |
| <b>END SEMESTER EXAMINATION</b>    |  |          |            |

### Question Paper Pattern

**Maximum marks: 100**

**Time: 3 hrs**

The question paper should consist of three parts

**Part A**

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.

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