

## **Syllabus for Level-11 Post Code: NCB/CME-05**

**Material & Energy Balance:** Steady state and unsteady state balances, Heat and mass balance calculations in cement plant

**Fluid mechanics:** Fluid flow through pipes and ducts, Pumps, fans, blowers and compressors, Pressure drop calculations, Flow measurement techniques

**Heat transfer:** Conduction, convection and radiation, Heat exchangers, Thermal efficiency concepts considering cement plants, Waste heat recovery principles

**Mechanical Operations:** Crushing, grinding and size reduction, Screening and classification, Mixing and blending, Separation processes

**Energy management and energy audits:** Types and methodology of energy audits, Data collection and analysis, Energy balance preparation, Identification of energy saving opportunities, ISO 50001 concepts, Monitoring and targeting, Key Performance Indicators (KPIs)

**Alternative fuels and renewable energy:** Co-processing of RDF, biomass and other waste in cement plants, co-processing guidelines

**Process optimization in cement plants:** Process diagnostics including troubleshooting cement plant operation, mills performance optimization, optimization of fuel consumption, Reduction of false air, Quality & Productivity Improvement

**Digitalization & Advanced Process Control:** Expert systems, AI/ML applications in cement plants, Industry 4.0 concepts

**Carbon emission reduction and decarbonisation strategies**

**Plant Design and Economics**

Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as heat exchangers and multistage contactors.