ENVIRONMENTAL ENGINEERING FOR MARITIME ENGINEERS

Introduction to Marine Environmental Systems: Components of marine ecosystems: physical, chemical, and biological interactions; Ocean circulation, productivity, and ecological zones; Human dependence on marine resources: food, trade, energy, minerals;

Marine Pollution and Control: Sources: shipping, offshore drilling, dredging, ballast water, sewage, oil spills; Pollutants: hydrocarbons, heavy metals, microplastics, eutrophication; Pollution pathways, degradation, dispersion; Mitigation technologies: scrubbers, ballast water treatment systems, zero-discharge systems; Environmental Regulations and Compliance :IMO Conventions: MARPOL (Annex I–VI), Ballast Water Management (BWM), Anti-fouling Systems (AFS);

Indian maritime environmental laws and Coastal Regulation Zone (CRZ); Port reception facilities, ship recycling norms (HKC, EU SRR);Sustainable Maritime Development and Blue Economy: Sustainable Development Goals (SDGs) and the maritime sector; Blue economy principles: marine spatial planning, ecosystem-based management; Ocean renewable energy (wave, tidal, offshore wind);

Climate change impacts on ports, coasts, and ocean engineering; Environmental Impact Assessment (EIA):EIA frameworks for ports, harbors, shipyards, offshore installations; Scoping, baseline surveys, risk assessment, mitigation, EMP; Environmental auditing and ISO 14001 Environmental Management Systems ;Innovations in Green Maritime Engineering, Green ship design and eco-ship concepts; Electrification, LNG fuel, hydrogen and ammonia fuel, wind-assist propulsion; Carbon emissions inventory and management (IMO DCS, EEDI, EEXI, CII).

Maritime Structures under Fire, Explosion and Blast Loads

Maritime structures: Types and classifications- Materials for construction

Accidental Loads: Fire, Blast, and explosion loads

Fire chemistry- classification of fire- types of fire-suppression systems- Extinguishers and fire-fighting systems

Explosion chemistry- types of explosions- computing damage from explosions- numeric examples- Matlab programs- Industrial explosions- control and mitigation- safety perspectives- flammability diagrams

Fire load- Fire limit state- code guidelines- design philosophy- discussions from international codes, National Building codes- Fire safety guidelines- planning guidelines for fire safety.

Problems on fire resistance design using Indian and International codes of practice

Numerical model of blast loads- an estimate of blast loads- design for blast loads

Design methods: Reviews and examples- Code provision of the design of Maritime Structure- Design approaches under accidental loads. Fire protection and suppression systems- types- extinguishers- accidental case studies- lessons learned from case studies- layout of fire-fighting systems