MARINE ELECTRICAL TECHNOLOGY

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 61	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:

The students should be able to have:

- Theoretical and practical knowledge of the Electrical systems on Board ships.
- Grasp of the troubleshooting aspects of marine electrical systems.

COURSE OUTCOMES:

At the end of this course, student will be able to:

- Have a knowledge of Different Types of Electrical distribution Systems
- Have knowledge of Regulations observed onboard ships regarding electrical equipments.
- Have knowledge of Different types of electrical Instruments and Switch Gear used on board Ship.
- Have knowledge of using electrical instruments, to find out and rectify various kinds of faults onboard ships.
- Have a knowledge of maintenance of electrical equipments, instruments, system components etc

Module 1:

Power Distribution and Regulations: 10 Hours

The marine environment – effects of inclination – Generators – Power supply commonly available – main switchboard – motor controls – emergency services – emergency stop panel – ships auxillary services – load analysis – electrical diagrams – inherent dangers and avoidance of disastrous consequences – active and passive safety measures – Do‟s and Don‟ts – Electric shock – first aid – conditions of shock risk – selection of AC and DC generators for use on ships – merits and demerits – location and Installation of generator sets. Requirements & Regulations – safe electrical equipments for hazardous areas – American safety standards – common definitions – British and European standards –tanker installations – Installations Ashore – Indian Standards. Systems of AC distribution – general concept – single, two and three phase systems with 2,3 and 4 wires – power distribution – general Distribution scheme – specific systems for ship's service – tankers schemes – primary power bus – need for emergency power supply – method of supply – passenger and cargo vessels requirements – shore supply – precautions to be taken while consuming shore supply –arrangement to ensure proper phase supply – remote switches to ventilating fans – fuel pumps – lubricating oil pumps and purifiers.

Module 2:

Instrumentation and Switch gear: 10 Hours

Insulated & Earthed neutral systems – introduction – circuit faults – causes –prevention – earth fault indicators – detection and clearance – alternators. AVR: excitation systems – carbon pile regulator – vibrating contact and static automatic regulator – transient voltage dip and alternator response – effect of kW and Kvar Loading. Panel instrumentation: Introduction – system terminology – phase sequence indicators. Paralleling of Alternators: Manual and auto synchronizing – lamps – parallel operation – excitation and throttle control – load sharing – kW, kVAR and Manual. Switchboards & Switchgear: Main and sub switchboard-Rating and Characteristics of Main switchboards – group starter boards – distribution Fuse boards – bus bars – instrumentation & controls – circuit breakers – alternator CB‟s – MCCB‟s – miniature CB‟s- RCCB‟s – arc fault Current Interrupts – fused Isolators – fault protection devices – introduction – over-voltage-surge-transients – ripple – spikes – DC generator protection –alternator and system protection – protection through fuses – protection Discrimination Motor Protection.

Module 3:

Cables and Lighting Systems: 10 hours

Electrical Cables: Cables- conductors – Wire Sizes-Current Rating – testing-codes- Practical tips. Insulation – protection and temperature ratings – insulation classes – A, B, E, F,H Insulation for High temperatures – Insulating Materials – Cable insulation & Sheath– Cable gland – Degrees of Protection – Temperature Ratings – Temperature Rise – Determination of hot temperature. Lighting Systems: Introduction – Incandescent Lamps – Discharge lamps – HCLPMF lamps – High pressure

Mercury Fluorescent lamps – High and Low pressure sodium vapour lamps – Lamp caps – Effect of voltage on lamp performance – Navigation & signal lights – Signals for a power driven ship under way (At night) – Emergency lighting – Requirement of lighting of Deck and pump house of oil tankers. Alarm Indication Systems: Fire alarms and Detection – Heat detectors – Smoke detectors – Combustion detectors – Miscellaneous alarm indicator systems – Scanning type system – Sequential starting and cut outs for an automatic fired boiler incorporating safety devices and combustion control equipments – incinerators – Sewage plants – Bilge oil separators.

Module 4:

Propulsion and Steering Systems: 10 Hours

Propulsion Systems: Auxiliary propulsion systems – Layout and Optimizing storage space – Electrical Propulsion – Advantages & Disadvantages DC constant current systems – DC motor supplied from alternators – Turbo – electric propulsion – AC single speed and Induction motor drives – Fixed speed alternators – Cyclo converter device-Diesel Electric propulsion – Thruster and Water jet propulsion. Steering Systems & Gyrocompasses: Fundamentals – Auto Navy steering Systems – Type P – Electro hydraulic Steering – Control systems-Typical system configuration- Components-Auto Steer-Types, Structure – Gyroscopes – Compass Considerations. Deck Machinery & Cargo Equipment: Anchor Windlass – Cargo winches – Hydra lift Marine cranes-Maritime GMC A.S.-Hagglunds Drives & H.W. Carlsen AB-Magnetic disc brakes. Automation of Air Compressors: Selection – Choice of a correct machine-Oil-free and non-oil free air – Instrument air – Air Vs Water cooled-Reciprocating Compressors-Starting & control-Safety protection Equipment – Automatic Operation.

Module 5:

Auxillaries and Maintenance: 10 hours

Batteries & Battery charging: Battery supplies – Lead-acid batteries – Electrical Characteristics – Nickel – Cadmium batteries – Sealed Ni-Cd batteries – Battery charging – Charging from AC and DC mains – Standby Emergency batteries – Voltage Regulators – Battery insulation & safety measures – First Aid treatment – Rotary generators. Gas analysers - Combustible gas indicator – Portable oxygen analyzer – CO2 Analysis – Tank scope – Fixed oxygen Analyser. Miscellaneous Systems: Cathodic protection system-Crankcase oil mist detector – Air drier – Dynic Water purity meter – Salinometer – Electric Tachometer – Rudder position Indicator – Ship‟s roll stabilizer – Galley Equipment – Laundry Equipment – Refrigerating Machinery – Temperature monitoring for R & AC systems. Maintenance & Troubleshooting: Introduction – Planned Preventive Maintenance – Life, Breakdown and Condition maintenance, Troubleshooting, Maintenance of specific equipments – Recommended list of spares, tools & Accessories.

TEXT BOOKS:

1. BOWIC C.T., Marine Electrical Practice, 5th Edition, “Butter Worth”, London, 1981.
2. LAW S.W., “Electricity applied to Marine Engineering”, 4th Edition, “The Institute of Marine Engineers”, London, 1998.

REFERENCE:

1. Elstan.A. Fernandez., “Marine Electrical Technology”, 1st Edition, “Sterling Book House”, Mumbai, 2002.
2. Elstan.A. Fernandez., “Marine Electrical Technology”, 4th Edition, “Shroff Publishers & Distributors Pvt. Ltd.,Mumbai, 2007.
3. Surinder Pal Bali,” Electrical Technology Machines and Measurements”, Vol II, 1st Ed. Pearson, 2013
4. Surinder Pal Bali,” Electrical Technology Machines and Measurements”, Vol.I, 1st Ed. Pearson, 2013

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

MARINE INTERNAL COMBUSTION ENGINE-II

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 62	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:
The students should be able to have:

- A theoretical Knowledge of the Manoeuvring Systems.
- A knowledge of the automation in diesel engine plants
- A knowledge of the Trouble shooting in Diesel Engines.
- A knowledge of fuel and lubricating systems.

COURSE OUTCOMES:
At the end of this course, student will be able to:

- Have an understanding of Various types of forces and stresses acting on Marine Diesel Engines.
- Have knowledge of Manoeuvring Systems used in Marine Diesel Engine plants.
- Have knowledge of the lubricating system and Trouble shooting in Diesel Engines.

MODULE: 1

Forces and stresses: Balancing, overloading, Different types of moments & couples, Different type of vibration & its effects, A/F vibration, methods of vibration damping

Fuel pumps and Metering Devices: Jerk and Common rail systems: Fuel injection systems helical groove and Spill valve type fuel pumps. System for burning heavy fuel oil in slow and medium speed marine engine, V.I.T &Electronic injection system

MODULE: 2

Manoeuvring Systems: Starting and reversing system of different Marine Diesel Engines with safety provisions and Actions in Emergency situation.

Indicator diagrams and power calculations: Construction details of indicator instrument. Study of different types of indicator cards, Significance of diagram power calculation, fault detection, simple draw cards and out of phase diagram Power balancing, Performance Characteristic Curves, Test bed and Sea trials of diesel engines.

MODULE: 3

Lubrication systems: Lubrication arrangement in diesel engines including Coolers and Filters, Cylinder Lubrication, Liner wear and protective measures, Combinations of lubricating oil its effect and preventive measures.

Gas Turbines: General Construction and design features for marine plants, Materials of construction, Heat Exchangers and Reheat arrangements, Comparison of Free piston engine and conventional air-steam combustion chambers.

MODULE: 4

Automation in Modern Diesel Engine Plants: Remote operation, Alarm and fail safe system; Governor and their basic functions Constant speed and Over speed governors. Constructional details and hunting of governor; Concept of intelligent engine: U.M.S Operation of ships, minimum requirement of automation for UMS operation

Maintenance of Diesel Engines: Electronic Governor, Inspection and replacement of various Component members such as Piston, Piston ring-head bearings, Cylinder Head, Liner, Bearings, Driving chain and gears etc. Crankshaft deflection and alignment, Engine holding down arrangements, Tightening of Tie bolts

MODULE: 5

Trouble shooting in Diesel Engines: Hot and Cold corrosion, Crankshaft web slip-head bearing problems, microbial degradation in fuel & lube oil.

Modern trends in Development: Current Engines (Sulzer, B&W CMC & SMC, SEMI Pill stick), Intelligent Engine (Camels concept), Improvement in design for increased TBO, Nox-Control of Marine Diesel Engines. All latest Technology incorporated in a modern propulsion machinery ships

TEXT BOOKS:

1. Wood yard, Goug,"Pounder's Marine Diesel Engines" (8th edition), Batter worth Heinemann Publishing, London, 2001
2. S H Henshell,"Medium and High speed Diesel Engines for Marine Use" (1st edition), Institute of Marine Engineers, Mumbai, 1996

REFERENCE BOOKS:

3."Slow speed Diesel Engine", Institute of Marine Engineer
4. D K Sanyal,"Principal & Practice of Marine Diesel Engines", 2nd edition
5."Marine Low Speed Diesel Engine", Denis Griffiths.
6."Lamb's Question and Answer Marine Diesel Engine"
7."Diesel Engine",A.J.Wharton

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

MARINE AUXILIARY MACHINES-II

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 63	IA Marks	20
Number of Lecture Hrs / Week	04	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:
The students should be able to have:

- Theoretical Knowledge of the auxiliary equipments on ships.
- Knowledge of oily water separator, sewage, incenerator and MARPOL equipment on ships.
- Knowledge of the refrigeration systems on ships.
- Knowledge of the air compressors and their working
- Knowledge of the maintenance procedures on board ships.

COURSE OUTCOMES:
At the end of this course, student will be able to:

1 Have an understanding of the Construction, operation, maintenance of incinerator and sewage plant.
2 Have a knowledge of the Construction, operation, maintenance of Oily water Separator and Purifiers
3 Have knowledge of the maintenance operation and maintenance of refrigeration and air conditioning systems.
4. Have knowledge of the Maintenance and repair of Equipments, Machinery fitted in ships.

Module 1:

MARPOL EQUIPMENT **10 Hours**

Prevention of oil, garbage, sewage, air pollution and IMO requirement as per MARPOL act. Operation, construction, maintenance of oil water separator both manual and automatic versions. Construction, operation, maintenance of incinerator and the of sewage plant.

Module 2:

THEORY OF OIL PURIFICATION /AIR COMPRESSAOR AND DECK EQUIPMENT: **10 Hours**

Construction, operation, maintenance of fuel oil and lub oil purifiers, clarifiers together with self de- sludge operation. Theory of air compression and uses of compressed air on board.Construction, operation, maintenance of main air compress and emergency air compressors.Types of bow thrusters, operation, maintenance of the same and Deck machinery, operation, maintenance of cargo winches, windless mooring winches.

Module 3:

Refrigeration and air-conditioning: **10 Hours**

Basic principles of refrigeration and refrigeration cycles. Typical marine refrigerating plants with multiple compression and evaporator system, Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant oil, purging of air, defrosting methods, trouble shooting, refrigerants used in marine practice and their justification. Cryogenic technology — definition Operation, maintenance and Troubleshooting of refrigeration plants, Montreal protocol, new refrigerants. Different air conditioning systems used on board ships. Construction of ducts, fans and **ventilation systems** in accommodation, engine room, cargo spaces CO2 and Battery rooms.

Module 4: **10 hours**

Fuels and Lubricants: Source of supply, Study of Primary Fuels, Coal, Petroleum, Natural Gas, Classification of Fuels. Treatment of Fuels for combustion in Marine I.C.E. Residual fuels, Emulsified Fuels, Merits and demerits of such fuel in marine engines. Theories of Lubrication, Types of Lubricants and their Properties Suitability of Lubricants for various uses, solid and fluid lubricants. Additive Oils and their specific use. Terminology used in Lubrication systems.

Module 5:

MAINTAINENCE AND REPAIR **10 Hours**

Inspection and routine overhauling of underwater fittings and hull. Measurement of clearances and drops. Engine room crane, chain blocks, tackles, its testing and survey requirements. **Noise Sources on Ships** and noise suppression techniques, Noise level measurement. Various modes of **vibration in a ship** (i.e. free, forced, transverse, axial, torsional — their sources and effects), **Planned maintenance**, preventive maintenance, condition monitoring, risk assessment, trials and safe working practices.

TEXT BOOKS:

1. D.W. Smith, "Marine Auxillary Machinery", 6th Edition, Butter worths, London, 1987.
2. H.D. McGeorge, "Marine Auxillary Machinery", 7th Edition, Butter worth, London,2001.

REFERENCES:

1. D.K. Sanyal, " Principle and practices of Marine Diesel Engine" 2nd Edition, Bhandarkar Publication, Mumbai, 1998
2. MARPOL 73/78, IMO Publications , 2001.
3. Wood Yard , Doug, "Pounder"s Marine Diesel Engine" 7thedition, Butter Worths Heinemann Publications ,London 2001
4. " Pumping and Piping Diagram", IME publication
5. Heinz P. Bloch, Fred K. Geitner, "Machinery Component Maintenance and Repair" 3rd Ed. An imprint of Elsevier, 2010

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

HEAT TRANSFER

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 64	IA Marks	20
Number of Lecture Hrs / Week	03+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES:

This course is designed to introduce a basic study of the phenomena of heat transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes. A knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation progressively elucidated in different modules will be assigned and studied in detail. As well, to gain experience in designing experiments for thermal systems.

COURSE OUTCOMES:

The student shall be able to

1. Understand the basic laws of heat transfer and consequence of heat transfer in thermal analyses of engineering systems
2. Analyze problems involving steady state heat conduction and unsteady heat conduction.
3. Understand the fundamentals of convective heat transfer and evaluate heat transfer coefficients for natural and forced convection.
4. Analyze heat exchanger performance by using the method of log mean temperature difference and method of heat exchanger effectiveness.
5. Calculate radiation heat transfer between black body surfaces and gray body surfaces.

Module -1 **10 hours**

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; Combined heat transfer mechanism.

Conduction: Boundary conditions of 1^{st} , 2^{nd} and 3^{rd} kind, Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in slab, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance. Critical thickness of insulation-cylinder and sphere.

Module -2 **10 hours**

Finned surfaces: eat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems. Variable Thermal Conductivity**-**Derivation for heat flow and temperature distribution in plane wall.

One dimensional Transient(unsteady) conduction and use of temperature charts: Lumped system analysis, mixed Boundary condition, Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

Module -3 **10 hours**

Convection Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numerical based on empirical relation given in data handbook

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems. **Free convection:** Application of dimensional analysis for free convection- physical significance of Grashoff number, Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Numerical Problems

Module -4 **10 hours**

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems.

Module -5 **10 hours**

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces configuration factor or view factor. Numerical problems.

Text Books:

1. **Heat transfer-A basic approach**, Ozisik, Tata McGraw Hill 2002
2. **Heat & Mass transfer,** Tirumaleshwar, Pearson education 2006
3. **Fundamentals of heat and mass transfer,** Frenk P. Incropera and David P. Dewitt, John Wiley and son's

Reference Books:

1. **Heat transfer,** P.K. Nag, Tata McGraw Hill 2002.
2. **Heat transfer, a practical approach,** Yunus A- Cengel Tata McGraw Hill
3. **Principles of heat transfer,** Kreith Thomas Learning 2001

E-learning

- **NPTEL**

Scheme of Examination:
Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

HEAT TRANSFER LAB

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	**15MRL67**	IA Marks	20
Number of Lecture Hrs / Week	01	Exam Marks	80
No of Practical Hours / Week	02	Exam Hours	03
CREDITS – 02			

COURSE OBJECTIVES

Students are expected-

- To demonstrate the concepts discussed in the Heat & Mass Transfer course.
- To experimentally determine thermal conductivity and heat transfer coefficient through various materials.
- To experimentally measure effectiveness of heat exchangers.
- To conduct performance tests on refrigeration & air conditioning systems.

COURSE OUTCOMES

At the end of the course, the students will be able to:

- To practically relate to concepts discussed in the Heat & Mass Transfer course.
- To conduct various experiments to determine thermal conductivity and heat transfer coefficient in various materials.
- To select appropriate materials & designs for improving effectiveness of heat transfer.
- To conduct performance tests and thereby improve effectiveness of heat exchangers.
- To conduct performance tests and thereby improve effectiveness of refrigeration and air conditioning systems.

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
6. Determination of Emissivity of a Surface

PART – B

1. Determination of Steffan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour
4. Performance Test on a Vapor Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner
6. Experiment on Transient Conduction Heat Transfer

Students should make observations on nature of failure and manifestations of failure in each of the experiments apart from reporting values of mechanical properties determined after conducting the tests.

Scheme of Examination:

ONE question from part -A:	**30 Marks (10 write up+20)**
ONE question from part -B:	**30 Marks (10 write up+20)**
Viva -Voice:	**20 Marks**
Total :	**80 Marks**

MARINE ELECTRICAL LAB

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15MRL68	IA Marks	20
Number of Lecture Hrs / Week	01	Exam Marks	80
No of Practical Hours / Week	02	Exam Hours	03
CREDITS – 02			

COURSE OBJECTIVES:

- Information to supplement to the Electric Machines (15MR61) course.
- The ability to conduct testing and experimental procedures on different types of electrical machines
- A chance to practice different types of wiring and devices connections.
- The capability to analyze the operation of electric machines under different loading conditions

COURSE OUTCOMES

Students will be able to

- Understand the concept of efficiency and the short circuit impedance of a three-phase transformer from no-load test, winding resistance, short circuit test, and load test.
- Understand the effect of unbalanced loading on a three-phase transformer with different connections, and the effects and limitations of each connection.
- Study series and parallel connections of three-phase transformers.
- Experimentally obtain the load characteristics of various dc motors and generators.
- Experimentally obtain the load characteristics, starting current and starting torque of a squirrel-cage induction motor and to derive circuit parameters from no-load and blocked-rotor tests.

PART A

1. Load characteristics of a D.C. shunt and compound generator. Compound generator
   i) Short shunt-Cumulative and Differential
   (ii) Long shunt-Cumulative and Differential.
2. Load test on a DC motor- determination of speed-torque and HP-efficiency characteristics.
3. Swinburne's Test.
4. Hopkinson's Test.
5. Fields test on series motors.

PART B

1. Retardation test- electrical braking method.
2. Speed control of DC motor by armature voltage control and flux control.
3. Ward Leonard method of speed control of D.C. motor.
4. Voltage regulation of an alternator by EMF and MMF method

Question paper pattern:

One question is to be set from Part-A	30 Marks
One question is to be set from either Part-B	30 Marks
Viva – Voce	20 Marks
Total	**80 Marks**

Professional electives-2

SHIP FIRE PREVENTION AND CONTROL

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 651	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

The students should be able to have:

- Conceptual knowledge of basics of the chemistry of fire.
- Knowledge of rules and regulations governing passive and active fire fighting on board ships.
- Knowledge of fixed and portable firefighting equipment and their operation.
- Understanding of the dangers to human life because of fire.
- Knowledge of emergency procedures for fire fighting on ships.
- Human behavior affecting fire fighting and team management during fire fighting.

COURSE OUTCOMES:

At the end of this course, student will be able to:

1	Understand the chemistry and the physics of fire and its propagation.
2	Understand the various fire fighting systems onboard ships.
3	Understand the structural rules governing fire fighting.
4	Understand the working, testing and maintenance of fire fighting systems.
5	Understand the fire fighting procedure and safety systems on board ships.

Module 1:

Basics of fire fighting. 9 hours

Chemistry of fire , fire triangle and fire tetrahedron, aspects of combustion-types of combustion including spontaneous combustion, flash point , fire point, limits of flammability, UEL, LEL, classification of fire and the properties of materials in each class of fire, fire fighting mediums and their properties, combustion products and their effect on human life and safety .

Module 2:

Fire Protection Built In Ships 8 Hours.

SOLAS convention, requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire detection and extinction systems, fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements for firefighting systems and equipments on different vessels, fire doors & fire zones.

Module 3:

Fire Fighting Equipment and Detection Systems 9 Hours

Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships, water-mist fire suppression system.

Module 4:

Fire Control and Safety Systems on Ships 8 Hours

Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds, galley, etc. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, fire organization on ships, shipboard organization for fire and emergencies. Fire signal and muster. Fire drill. Fire control plan, Leadership and duties, human behavior

Module 5:

Safety Measures and First Aid 8 hours

Special safety measures for preventing, fighting fire in tankers, chemical carriers, oil rigs, supply vessels, and fire fighting ships - Safe working practice with respect to fire on board ships. First aid, Rescue operations from affected compartments.

TEXT BOOKS:

1. Frank Rush Brook, "Fire Aboard", 3rd Edition, Brown, son & Ferguson Ltd.,
2. Dr James Cowley , "Fire safety at sea", Marine Engineering Practice, Vol 1, Part 05, IMarEST,
3. Fire safety code book

REFERENCES:

1. D.G. Shipping, Fire Fighting Appliances Rules (1969/1990), 3rd edition published by Bhandarkar Publications, Mumbai, 1996

2. IMO, SOLAS (Safety of Life at Sea) 3rd Edition, International Maritime Organization, London, UK, 2001.

3. Leslie Jackson, Reed‟s General Engineering Knowledge for Marine Engineers Vol.8, 4th Edition, Thomas Reed publication, Great Britain, 1986.

4. Gupta, R.S.,"A Hand Book of Fire Technology", 2nd Ed., University Press, 2011

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

MECHANICS OF COMPOSITE MATERIALS

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR 652	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

The course objectives are to train students to be able to design composite structures, select composite materials, conduct stress analyses of selected practical applications using laminated plate theories and appropriate strength criteria, and be familiar with the properties and response of composite structures subjected to mechanical loading under static and cyclic conditions.

COURSE OUTCOMES:

The student shall be able to

1. Understand the concept of composite materials.
2. Analyze macro and micro mechanical behavior of lamina.
3. Develop governing equations for bending, buckling and vibrations in laminated plates.
4. Analyze and design composite structures used in aerospace, marine, automobile and other applications
5. Know about composite materials and their processing.

Module -1 **8 hours**

Introduction to composite materials: Introduction, What is a composite material, Current and potential advantages of fiber reinforced composites, Applications of composite materials, Military, civil, space, automotive and commercial applications

Module -2 **8 hours**

Macro and micro mechanical behavior of a lamina: Stress strain relations for anisotropic materials, Restrictions on engineering constants, Strengths of an orthotropic lamina, biaxial strength criteria for orthotropic lamina

Module -3 **9 hours**

Micro mechanical behavior of lamina and laminates: Mechanical of material approach to stiffness, Elasticity approach to stiffness, Classification lamination theory, Special cases, strength of laminates

Module -4 **8 hours**

Buckling and Vibration of laminated plates: Governing equations for bending buckling and vibration of laminated plates, Deflection of simply supported laminated plates, Vibration of simply supported laminated plates

Module -5 **9 hours**

Design of composite structures: Introduction, design philosophy, anisotropic analysis, Bending extension coupling, Micromechanics, Non linear behavior, Interlaminar stresses, transverse shearing, Laminate optimization

Text Books:

1. **Composite Science and Engineering,** K. K. Chawla Springer Verlag 1998.
2. **Mechanics of composite materials,** Autar K. Kaw CRC Press New York.
3. **Principles of composite material mechanics**, Ronald F. Gibson, CRC Press, 2011.
4. **Mechanics of Composite Materials**, Robert M Jones, Taylor & Francis, 2000

Reference Books:

1. **Composite materials hand book,** Meing Schwaitz," McGraw Hill book company.1984
2. **Mechanics of Composite Materials and Structures**, Madhujit Mukhopadhyay , Universities Press 2009
3. **Fiber Reinforced Composites,** P. K. Mallick, Marcel Dekker,Inc

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

SPECIAL DUTY VESSELS AND TYPE OF OPERATION

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR653	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

The students should be able to have:

- Basic knowledge of various special duty vessels.
- Understanding of associated pipelines for cargo operations.
- Thorough knowledge of IG system and Tank Washing.
- Understanding of all types of dangerous cargo.
- Understanding of requirements laid by classification society.

COURSE OUTCOMES:

At the end of this course, student will be able to:

- History of trade of special duty vessel.
- Cargo operation of oil tankers.
- About inert gas system and tank washing operations of tankers.
- Dangerous cargo operation of chemical tankers, LNG/LPG vessels
- About rules of classification societies for cargo ships and tankers.

MODULE 1

INTRODUCTION: **8 Hours**

Need for special duty vessels with reference to development of trade and necessities of the trade. Operation of Bulk carriers –Bulk Grain and ore etc., -Banana carriers –Coal Carriers –Forest Products carriers –Timber carriers –Container vessels.

MODULE 2 **9 Hours**

OIL TANKER CARGO OPERATIONS:

Pipeline systems –Ring main –Direct Line –Combined–Free flow system –Stripping lines.Lining up pipe lines and cargo operations –loading more than one grade –discharging –ballasting –precautions –ship / shore check list safety goods –Sources of ignition on –static electricity –precautions to prevent ignition due to static electricity cargo operations when not secured alongside –procedure if oil spill occurs –oil record books.

OIL TANKERS ROUTINE OPERATIONS: **8 Hours**

Inert Gas system: Principle –components of system, plant and distribution system –uses of inert gas during tanker operating cycle.

Tank washing:Procedure –portable and fixed machines –tank washing with water –washing atmospheres –crude oil washing (COW) –advantages and disadvantages of COW –operating and safety procedures –gas freeing –pressure vacuum values –"Load on Top" system (LOT) regulations and operation –Segregated Ballast Tanks (SBT).

MODULE 4 **9 Hours**

INTRINSICALLY DANGEROUS CARGOS:

Dangerous goods –loaded in bulk –Packaging–IMDG code –emergency procedures –„MS & M" notices –general fire precautions, during loading / discharging, -fire fighting and detection system. Liquefied gas cargoes –regulations types of cargo and carriers –LPG and LNG –cargo handling equipments tank monitors and controls –operational procedures loading and discharging of LPG/LNG cargoes –chemical cargoes regulations, operations –bulk chemical carriers –tank material and coatings –tank washing –cargo record book –equipment items precautions to be observed during cargo operations in port –fire protection –personnel protection

MODULE 5 **8 Hours**

RULES AND REGULATIONS:

Classification societies for hull, equipment and machineries of Cargo ships and oil tankers –requirements of various types of surveys and certification of Merchant ships

Text Books:

1. Lavery, "Ship board operation", 2nd Edition, Butter Worth- Heinemann, London, 1990.
2. V.K. Bhandarkar, "MS & M Notices to Mariners", 1st Edition, Bhandarkar Publications, Mumbai, 1998.
3. D.J. Eyres, "Ship Construction", 4th Edition, Butter worth – Heinemann, Oxford, 1994.

Reference Books:

1. Indian Register of Shipping Part1 to Part7, "Rules and Regulations for the construction and classification of steel hips", 1st Edition, Indian Register of Shipping, Mumbai, 1999.
2. International of Maritime Organization, "SOLAS consolidated Edition 1997", 2nd Edition, Sterling Book House, Mumbai, 1997.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

CONTROL ENGINEERING

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15MR654	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

This course provides

1. To Identify the basic elements and structures of feedback control systems
2. To Construct Bode and polar plots for rational transfer functions
3. To recognize the properties of root-locus for feedback control systems with a single variable parameter.
4. To design and evaluate the performance of different Mechanical correction system.

COURSE OUTCOMES:

The student shall be able to

1. To identify and enumerate different Bode and polar plots for rational transfer functions
2. To Verify automation / control systems using good design practice
3. To Understand the purpose, functions, and operations of a PLC
4. To design and evaluate the performance of different Mechanical correction system.

MODULE 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current. **9 Hours**

MODULE 2

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, blocks representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

9 Hours

MODULE 3

Frequency Response Analysis: Polar plots, NYQUIST stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin.

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams. **8 Hours**

MODULE 4

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

Programmable logical controllers: Integrated automation control and monitoring (ICAMS), Computer programmable controller, Relay circuit unit, Digital sequential control devices, Control mechanism of PLC

8 Hours

MODULE 5

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test. 8 **Hours**

Text Book:

1. Modern Control Engineering, Katsuhiko Ogatta, Pearson Education,2004.

2. Control Systems Principles and Design, M.Gopal, 3rd Ed., TMH,2000.

Reference books:

1. Modern Control Systems, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. System dynamics & control, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. Feedback Control System, Schaum's series. 2001.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Open Elective-2

AUTOMATION AND INDUSTRIAL ROBOTICS

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR661	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

This course provides

- To identify potential areas for automation and justify need for automation.
- To select suitable major control components required to automate a process or an activity
- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the control of robots for some specific applications.

COURSE OUTCOMES:

The student shall be able to

- To translate and simulate a real time activity using modern tools and discuss the benefits of automation.
- To identify suitable automation hardware for the given application.
- To recommend appropriate modelling and simulation tool for the given manufacturing application.
- To explain the basic principles of Robotic technology, configurations, control and programming of Robots.
- To explain the basic principles of programming and apply it for typical Pick & place, loading & unloading and palletizing applications.

Module 1

Introduction to automation

Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control, sensors ,actuators, analog to digital converters, digital to analog converters, input/output devices for discrete data **9 hours**

Module 2

Automated production lines

Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, automated assembly systems, fundamentals of automated assembly systems, quantitative analysis of assembly systems, automatic identification methods, barcode technology, radio frequency identification, other AIDC technologies **8 hours**

Module 3

Industrial Robotics

Robotic configuration robot anatomy and related attributes robot control systems, end effectors sensors in robotics, industrial robot application robot accuracy and repeatability, different types of robotics, various generations of robots, degrees of freedom – Asimov's laws of robotics dynamic stabilization of robots. **8 hours**

Module 4

Spatial descriptions and transformations

Positions, orientations, and frames. Mappings: Changing descriptions from frame to frame. Operators: translations, rotations and transformations, transformation arithmetic transform equations, transformation of free vectors computational considerations, manipulator Kinematics, link description, link-connection description, actuator space joint space and Cartesian space **8 hours**

Module 5

Robot programming

Introduction, levels of robot programming, requirements of robot programming language, problems pertaining to robot programming languages, offline programming systems, central issues in OLP systems, automating subtasks in OLP systems, simple programs on robot applications **9 hours**

TEXT BOOKS:

(1) Automation, Production systems, and computer integrated manufacturing-Mikell P.Groover 3rd edition, Pearson 2009

(2) Introduction to robotics mechanics and control- John J.Craig 3rd edition, Pearson 2009

REFERENCE BOOKS:

(1) Robotics for Engineers –Yoram Koren, McGraw Hill International, 1st edition, 1985.

(2) Industrial Robotics-Groover, Weiss, Nagel, McGraw Hill International, 2nd edition, 2012.

(3) Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 2009.

(4) Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010.

(5) An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

PROJECT MANAGEMENT

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR662	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

This course provides

- Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.
- Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
- Demonstrate effective project execution and control techniques that result in successful projects.
- Conduct project closure activities and obtain formal project acceptance.
- Demonstrate a strong working knowledge of ethics and professional responsibility.
- Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.

COURSE OUTCOMES:

The student shall be able to

- Describe a project life cycle, and can skillfully map each stage in the cycle
- Students will identify the resources needed for each stage, including involved stakeholders, tools and supplementary materials
- Students will describe the time needed to successfully complete a project, considering factors such as task dependencies and task lengths
- Students will be able to provide internal stakeholders with information regarding project costs by considering factors such as estimated cost, variances and profits
- Students will be able to develop a project scope while considering factors such as customer requirements and internal/external goals

Module 1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles

Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects. **8 hours**

Module 2

Planning Projects: Introduction, developing the project management plan, understanding stake holders, communication planning, project meeting management, communication needs of global and virtual project teams, communication technologies, Constructing Work Breakdown Structures –scope planning, scope definition, work breakdown structures (WBS), Using Microsoft project for work breakdown structures. **8 hours**

Module 3

Scheduling Projects: purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt Chart, Using Microsoft Project for critical path schedules

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project ream composition issues, assign resource to each activity, resource overloads, critical chain project management (CCPM), compress the project schedule, Using Microsoft Project for resource allocation. **9 hours**

Module 4

Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control, using Microsoft Project for Project Budgets,

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan, using Microsoft Project for project baselines. **8hours**

Module 5

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management, Leading and Managing Project Teams – Acquiring, developing, managing and leading the project team, managing stakeholders, managing project conflicts.

Determining Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Using Microsoft Project to monitor and control projects. Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure, celebrate success and reward participant, provide ongoing support. **9 hours**

TEXT BOOKS:

1. **Project Management**, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2. **Project Management**, A systems approach to planning schuduing and controlling by Harold kerzner, CBS publication.

REFERENCE BOOKS:

1. **Project Management Refer,** Pennington Lawrence, Mc Graw hill
2. **Project Management,** A Moder Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. **Project Management,** Bhavesh M. Patal, Vikas publishing House

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosingat least one full question from each module.

NON TRADITIONAL MACHINING

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR663	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

This course provides

- Identifying the classification of unconventional machining processes.
- To understand the principle, mechanism of metal removal of various unconventional machining processes.
- To study the various process parameters and their effect on the component machined on various unconventional machining processes.
- To understand the applications of different processes.

COURSE OUTCOMES:

The student shall be able to

- Discuss the principle of working of NTM process
- Explain the need for NTM processes
- Describe the various equipment used for NTM processes
- Describe in detail the methods of Laser beam ,plasma arc, electro chemical, ultrasonic, abrasive jet and water jet Machining
- Distinguish between the various NTM processes
- Discuss applications of NTM methods
- Explain the advantages and disadvantages of NTM

Module 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.
Ultrasonic Machining (Usm):Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM. **9 hours**

Module 2

Abrasive Jet Machining (AJM): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. Abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design and shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery. **8 hours**

Module 3

Electrochemical Machining (ECM): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.
Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of

chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

9 hours

Module 4

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM. **8 hours**

Module 5

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

Laser Beam Machining (Lbm) Electron Beam Machining (Ebm): Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations. Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

8 hours

TEXT BOOKS:

1. Modern machining process, Pandey and Shan, Tata McGraw Hill 2000
2. New Technology, Bhattacharya 2000

REFERENCE BOOKS:

1. Production Technology, HMT Tata McGraw Hill. 2001
2. Modern Machining Process, Aditya. 2002
3. Non-Conventional Machining, P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. Metals Handbook: Machining Volume 16, Joseph R. Davis (Editor), American Society of Metals (ASM)

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosingat least one full question from each module.

MANAGEMENT AND ENTREPRENEURSHIP

[AS PER CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME]

SEMESTER – VI

Subject Code	15 MR664	IA Marks	20
Number of Lecture Hrs / Week	02+02Tutorial	Exam Marks	80
Total Number of Lecture Hrs	42	Exam Hours	03
CREDITS – 03			

COURSE OBJECTIVES:

This course provides

- The basic principles, concepts of management and list steps in planning.
- The concepts of organizing, staffing, directing and controlling.
- The meaning, functions, types and roles of an entrepreneur and describe various institutional support.
- The study in detail about the small scale industries and prepare the project report.

COURSE OUTCOMES:

The student shall be able to

- Describe the basic principles and concepts of management.
- Distinguish different plans and list steps in planning.
- Discuss the concepts of organizing and staffing.
- Interpret the concepts of directing and controlling.
- Demonstrate the meaning, functions, types and roles of an entrepreneur and describe various institutional support.
- Explain in detail about the small scale industries and prepare the project report.

Module 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches – Modern management approaches **8 hours**

Module 2

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

Organizing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) **9 hours**

Module 3

Staffing: Nature and importance of staffing, Process of Selection & Recruitment (in brief)

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance -coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system -Methods of establishing control (in brief) **8 hours**

Module 4

Entrepreneur: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur – an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

Small Scale Industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government

Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only) **9 hours**

Module 5

Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC;KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.
Preparation Of Project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification f business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study. **8 hours**

TEXT BOOKS:

1 **Principles of Management –** P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2 **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3 **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1 **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2 **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3 **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.