THEORY OF MACHINES

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

SEMESTER – IV

Subject Code	15 MR42	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:

This course provides

1. To identify and enumerate different link based mechanisms with basic understanding of motion
2. To interpret and analyse various velocity and acceleration diagrams for various mechanisms
3. To understand and illustrate various power transmission mechanisms using suitable method
4. To design and evaluate the performance of different cams and followers.

COURSE OUTCOMES:

The student shall be able to

1. To identify and enumerate different link based mechanisms with basic understanding of motion
2. To understand and illustrate various power transmission mechanisms using suitable methods
3. To understand and illustrate various power transmission mechanisms using suitable methods
4. To design and evaluate the performance of different cams and followers.

MODULE 1

Links and Mechanisms:

Definitions Link or Element, Kinematic Pairs, Degrees of Freedom, Grubler's Criterion (without derivation), Kinematic Chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. Kinematic Chains and Inversions: Inversions of Four Bar Chain; Single Slider Crank Chain and Double Slider Crank Chain.

Static force analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, free body diagrams, principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction. **10 Hours**

MODULE 2

Force principle:

Alembert's principle, Inertia force, inertia torque, Dynamic force analysis of four-bar mechanism and slider crank mechanism.

Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot bearings. Belt drives: Flat belt drives, ratio of belt tensions, centrifugal tension, and power transmitted. **10 Hours**

MODULE 3

Balancing of Rotating Masses:

Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine **10 Hours**

MODULE 4

Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronism, effort and power.

Gyroscope: Vectorial representation of angular motion, gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aero plane, stability of two wheelers **10 Hours**

MODULE 5

Cams: Types of Cams, Types of Followers. Displacement, Velocity & Acceleration Time Curves for Cam Profiles. Disc Cam with Reciprocating Follower Having Knife- Edge, Roller & Flat-Face Follower, Disc Cam With Oscillating Roller Follower. Follower Motions including, SHM, Uniform Velocity, Uniform Acceleration & Retardation and Cycloidal Motion.

10 Hours

Analysis of CAMS: Analysis of Tangent cam with roller follower**10 Hours**

TEXT BOOKS:

1. "Theory of Machines", Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd Ed-2009
2. "Theory of Machines", Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Ed 2006/

REFERENCE BOOKS

1. "Theory of Machines & Mechanisms", J.J. Uicker, , G.R. Pennock, J.E. Shigley, OXFORD 3rd Ed. 2009.
2. "Theory of Machines"by Thomas Bevan, CBS Publication 1984.
3. "Design of Machinery" by Robert L. Norton, McGraw Hill, 2001.
4."Mechanisms and Dynamics"of Machinery by J. Srinivas, Scitech Publications,Chennai,2002.
5. "Dynamics of machinery" by J. B. K. Das & P. L. S. Murthy.

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.

APPLIED THERMODYNAMICS

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

SEMESTER – IV

Subject Code	15 MR43	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:

1. Understand combustion thermodynamics, stoichiometric and actual air/fuel ratios and analyze fuel and flue gas.
2. Apply the basic knowledge of thermodynamics to Gas power cycles, Gas Turbines, Vapour power cycles, Air compressors, Refrigeration and hence find the performance parameters of the devices which work on these cycles.
3. Find the performance parameters of I.C engines and draw the heat balance sheet.
4. Understand the property of air, device air conditioning system based on the given requirements.

COURSE OUTCOMES:

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

1	Analyze the combustion process, calculate the stoichiometric and actual A/F ratio, analyze the fuel and flue gases.
2	Understand the theoretical working cycle of I.C engines, Gas Turbines, Thermal power plants, Compressors and refrigeration.
3	Calculate the performance parameters and draw the heat balance sheet for I. C. Engines.
4	Refrigeration system and apply theory to solve numerical on working of these devices.
5	Understand the properties of air and design air conditioning system for the requirement given.

Module-1

Combustion thermodynamics: Theoretical air and excess air for combustion of fuels. Mass balance actual combustion. Exhaust gas analysis. A/F ratio energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, combustion efficiency, and adiabatic flow temperature.

10 Hours

Module-2

I.C Engines: Testing of two stroke and four stroke SI and CI engines for performance related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

Reciprocating compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effects of clearance and volumetric efficiency. Adiabatic, isothermal, and mechanical efficiencies. Multistage compressor, saving in work, optimum intermediate pressure, inter-cooling minimum work for compression.

10 Hours

Module-3

Vapour power cycles: Carnot vapor power cycles, drawbacks as a reference cycle, simple Rankine cycle, description, T-S diagram analysis for performance, comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapor power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters. Reheat Rankine cycle.

Gas Power cycles: Air standard cycles: Carnot, Otto, Diesel, Dual combustion cycles P-V and T-s diagrams, description,

efficiencies, and comparison of Otto, Diesel and Dual cycles. **10 Hours**

Module-4

Gas turbines and jet propulsion: classification of gas turbines, analysis of open and closed cycle gas turbine. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency. Jet propulsion and rocket propulsion.

10 Hours

Module-5

Refrigeration: Vapor compression refrigeration system, description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP, refrigerants and their desirable properties. Air cycle refrigeration's, reversed Carnot cycle, reversed Brayton cycle, Vapor absorption refrigeration system, steam jet refrigeration.
Psychometry: atmospheric air and psychometric properties, Dry bulb temperature, wet bulb temperature, dew point temperature, partial pressures, specific and relative humidities and the relation between the two, enthalpy and adiabatic saturation temperature. Construction and use of psychometric chart. Analysis of various processes: heating, cooling, dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and Winter air conditioning. **10 Hours**

TEXT BOOKS:

1. **Basic and Applied thermodynamics:** P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co, 2002.
2. **Applied Thermodynamics:** Rajput, Laxmi publication.

REFERENCE:

1. **Thermodynamics, An Engineering approach:**Yunus, A. Cenegal and Michael A. Boies, 6th Ed., Tata McGraw Hill Pub.Co,2002.
2. **VTU-EDUSAT Course Material.**

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.

SHIP STRUCTURE AND CONSTRUCTION

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

SEMESTER – IV

Subject Code	15 MR44	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:

1. Conceptual understanding of ship terms, section and materials use.
2. Understanding of bottom and side framing and for-end and after- end arrangements.
3. Basic knowledge of shell and decks.
4. Understanding of loadline and tonnage
5. Understanding Ship Types and miscellaneous outfits

COURSE OUTCOMES:

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

1	Understand ship terms, section and materials use
2	Describe those parts of the ship's structure that facilitate the stowage and handling of cargo operations
3	Develop basic knowledge of Shell and decks
4	define ship design terminology to facilitate comprehension of construction principles
5	have a basic knowledge of shipyard practice

Module-1

Ships Terms: Various terms used in ship Construction with reference to Ship's parameter e.g. L.B.P., LOA, Moulded Depth, Moulded draught, and other similar terms, General Classification of Ships. Stresses in ship's structure: Bending, Shear, Hogging, Sagging, Racking, Pounding, Painting, etc., and Strength members to counteract the same.

Sections and materials use : Type of section like Angles, Bulb Plates, Flanged beams used in ship construction. process of welding, testing of welds, weld faults **10 Hours**

Module-2

Bottom & Side Framing : Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tankside brackets, Beam Knee, Web frame, etc,

Fore-End Arrangements: Stem construction, arrangements to resist panting, panting stringers, Forepeak — Collision bulk heads, Bulbous bows. Anchor and cable arrangements.

After-End-Arrangements: Types of Sterns, Stem frame and rudder. Types of rudder. Supporting of rudder, Shaft tunnel, Tunnel bearings. **10 Hours**

Module-3

Shell & Decks: Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, mid-ship Section of ships.

Bulk heads & Deep Tanks: Water tight bulkheads, Arrangements of plating and stiffeners. Water tight sliding doors, Water tight openin[g]s through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads. **10 Hours**

Module-4

Loadline and Tonnage

Definition of freeboard and various assigning conditions, plimsol, Load line Mark, Tonnage regulations, calculation as per latest convention. Shipyard Practice: Layout of a Shipyard, loftwork, fabrication of assembly, subassembly, units in construction, role of Surveyors in construction of Ship; Keel laying, Launching, Sea trial. Use of computers in ship design with cost implication. **10 Hours**

Module-5

Ship Types and miscellaneous outfits

Tankers, bulk carriers, container ships, car carriers, LNG, LPG and chemical carriers, Lash ships; Passenger ships, Dredger, Tugs, etc. – constructional details and requirements. Offshore Technology: Drilling Ships and Platforms, Supply/Support Vessels-types and constructions, Dynamic Positioning,

Ship insulation, corrosion control and antifouling system, surface preparation and painting shipboard cranes

10 Hours

TEXT BOOKS:

1. Ship Construction – REEDS Vol – 5
2. D. J. Eyres "Ship Construction", 4' Edition, Butter Worth – Heinemann, Oxford, 1994.

REFERENCE:

1. Ship Construction – Munro & Smith
2. Merchant Ship Construction – H.J. Pursey

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 HEAT ENGINE AND AIR CONDITIONING

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

SEMESTER – IV

Subject Code	15 MR45	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:

- To develop the knowledge of students in Marine refrigeration and Air conditioning.

COURSE OUTCOMES:

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

1	The performance reciprocating compressors
2	The theoretical aspects of marine refrigeration and air conditioning
3	The method of economical and efficient design of heat exchangers for air conditioning and refrigeration plants

Module-1:

RECIPROCATING COMPRESSORS: Ideal cycles for compressors work transfer in a single stage compressors-mass flow-volume flow-free air delivery-effect of clearance and volumetric efficiency in single stage compressors. Multi stage compression neglecting clearance volume. Condition for minimum work input and perfect inter cooling. Tandem in line arrangements in compressors. Air motors.

10 Hours

Module-2:

BASIC REFRIGERATION AND AIR CONDITIONING : Reversed Carnot cycle-vapour compression cycle-refrigerating effect-co-efficient of performance-cooling capacity-refrigerants used in marine practice and their justification-rating of refrigeration plant-methods for improving C.O.P –use of vapour tables-applied problems.

10 Hours

Module-3:

MARINE REFRIGERATING PLANTS: Typical marine refrigerating plants with multiple compression and evaporator systemrefrigerated cargo T.E.V: H.P cutout, L.P cutout, shaft seal, lubrication and maintenance of refrigerant plant, transfer and storage of refrigerant, refrigerant charging, Troubleshooting in refrigeration systemrefrigeration in liquefied gas carries reffer vessels –applied problems

10 Hours

Module-4:

MARINE AIR CONDITIONING: Principle of air conditioning-Psychometric properties of air comfort conditions-control of humidity-air flow and air conditioning capacity-cylinder and loading mechanism-air circulation system- container cooling system-air cooler fans-air conditioning system in cargo ship-types of air conditioning system-air flow and air conditioning capacity -trouble shooting and maintenance. **10 Hours**

Module-5

BASIC DESIGN OF HEAT EXCHANGERS: Introduction-types-LMTD and NTU method-double pipe, shell and tube type, condenser and evaporator, air distribution and duct insulation, detail of ship side and deck insulation, cooling and heating load and maintenance –applied problems **10 Hours**

TEXT BOOKS:

1. Arora C P "refrigeration and Air conditioning" 1st edition, srieswar enterprises Chennai
2. McGeorge
3. Kuppan thulukkanam, heat exchanger design hand book 1st edition CRC Press 2000

REFERENCE:

1. D A Taylor introduction to marine engineering 2nd edition Butter Worth London 1993

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.

FLUID MECHANICS

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

SEMESTER – IV

Subject Code	15 MR46	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:

1. Conceptual understanding of fluid properties and fluid statistics.
2. Understanding of fluid kinematics and fluid dynamics.
3. Basic knowledge of dimensional analysis and similitude.
4. Understanding of laminar and turbulent flows in closed conduits
5. Understanding flow measurement.

COURSE OUTCOMES:

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

1	Understand properties of fluids and hydrostatics.
2	Formulate and solve equations of the control volume for fluid flow systems.
3	Develop basic knowledge of dimensional analysis and similitude.
4	Calculate resistance to flow of incompressible fluids through closed conduits.
5	Solve field problems in flow measurement

MODULE 1

Properties of Fluids:

Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation.

Fluid Statistics:

Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid. **10 Hours**

MODULE 2

Buoyancy and Fluid Kinematics:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically. Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity potential function and stream function.

Fluid Dynamics

Introduction to equation of motion, Introduction to Navier- Stokes equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation. **10 Hours**

MODULE 3

Fluid Flow Measurements

Venturimeter, orifice meter, pitot-tube, vertical orifice, V-Notch and rectangular notches

Dimensional AnalysisScheme 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.

Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitudes **10 Hours**

MODULE 4

Flow through pipes

Minor losses through pipes. Darcey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

Laminar flow and viscous effects

Reyonold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates. **10 Hours**

MODULE 5

Flow past immersed bodies Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness. Introduction to compressible flow: Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid. **10 Hours**

Text Books:

1. Fluid Mechanics (SI Units), Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006
2. Fluid Mechanics, Dr. Bansal, R.K. Lakshmi Publications, 2004.

Reference Books:

1. Fluid Mechanics, Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. Fluid Mechanics and hydraulics, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
3. Fluid Mechanics, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons, 2004
5. Fluid Mechanics -. Merle C. Potter, Elaine P.Scott. Cengage learning

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.

MECHANICAL MEASUREMENTS AND METROLOGY LAB

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

SEMESTER – IV

Subject Code	**15MRL 47**	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:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

COURSE OUTCOMES

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

	Description	CL	POs
CO1	To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer.	U	PO1, PO6
CO2	To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.	U	PO1, PO6
CO3	To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.	U	PO1, PO6
CO4	To measure cutting tool forces using Lathe/Drill tool dynamometer.	U	PO1, PO6
CO5	To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.	U	PO1, PO6
CO6	To measure surface roughness using Tally Surf/ Mechanical Comparator.	U	PO1, PO6

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
   a) Lathe tool Dynamometer OR
   b) Drill tool Dynamometer.
5. Measurements of Screw thread Parameters using two wire or Three-wire methods.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A:	**25 Marks**
ONE question from part -B:	**40 Marks**
Viva -Voice:	**15 Marks**
Total :	**80 Marks**

COMPUTER AIDED MACHINE DRAWING

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

SEMESTER – IV

Subject Code	15MRL48	IA Marks	20
Number of Lecture Hrs / Week	01 L+ 02 P	Exam Marks	80
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

COURSE OBJECTIVES

- To acquire the knowledge of CAD software and its features.
- To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages.
- To acquire the knowledge of limits fits and tolerance pertaining to machine drawings.

COURSE OUTCOMES

Having successfully completed this course, the student will be able to draw and use modeling software's to generate

	Course Outcome	**Cognitive Level**	**POs**
CO1	Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D	U	PO1, PO5,
CO2	Orthographic views of machine parts with and without sectioning in 2D.	U	PO1, PO5,
CO3	Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.	U	PO1, PO5,
CO4	Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D	U	PO1, PO5,
CO5	Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D	U	PO1, PO5,
CO6	single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D	U	PO1, PO5,
CO7	Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D	U	PO1, PO5,
CO8	assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D	U	PO1, PO5, PO12
Total Hours of instruction		**50**	

INTRODUCTION TO COMPUTER AIDED SKETCHING

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. 02 Hours

PART A

UNIT I

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids), True shape of section. 04 Hours **Orthographic views:** Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines. 04 Hours

UNIT II

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw. 08Hours

PART B

UNIT III

Keys and Joints: Parallel, Taper, Feather Key, Gib head key and Woodruff key

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods. 08 Hours

UNIT IV

Couplings: Split muff coupling, protected type flange coupling, Pin (bush) type flexible coupling, Oldham's coupling and Universal coupling (Hook's Joint). 06 Hours

PART C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry. 03 Hours

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Cylinder relief valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Boiler blow down valve
6. Gear pump

15 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal, Published by Charotar Publishing House, 1999.
3. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006.

REFERENCE BOOK:

1. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007.
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

Note:

Internal Assessment: 20 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (20 Marks)

(a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 10Marks.

(b) Internal Assessment test in the same pattern as that of the main examination (Better of the two Tests): 10 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.

Student has to answer one question each from Part A , Part B for 15 marks each and one question from Part C for 50 marks.

Part A 1 x 15	= 15 Marks
Part B 1 x 15	= 15 Marks
Part C 1 x 50	= 50 Marks
Total	= 80 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15MRL47) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.