COURSE STRUCTURE AND SYLLABUS
FOR M.TECH PROGRAMME IN
MAINTENANCE ENGINEERING AND TRIBOLOGY
(Approved by Acad. Council in 74th meeting dt.07.03.06)

Semester – I

Sl. No.	Course No.	Subject	L	T	P	Cr. hrs.
1.	AMC51101	Advanced Numerical Methods & Applied Statistics#	4	0	2	10
2.	MMC51103	Friction and Wear	3	1	0	7
3.	MSC51105	Management Principles and Practices	4	0	0	8
4.	EIR13101	Digital Electronics**	3	0	0	6
5.		Elective(Any one)	3	0	0	6
a.	MME51105	Lubrication and Bearing Design				
b.	MME51104	Vibration and Noise Engg.				
c.	MME51102	Maintenance Engineering. Systems				
d.	MME51103	Fluid Flow Machines				
Practicals and/or others						
6.	MMC51601	Industry/ Laboratory Visit	0	0	2	2
7.	MMC51001	Term Paper	0	0	2	2
		Total	17	1	6	41

Semester – II

Sl. No.	Course No.	Subject	L	T	P	Cr. Hrs.
1.	MMC52103	Tribological Materials	3	1	0	7
2.	ACC52137	Corrosion and Corrosion protection	3	0	0	6
3.	MSC52105	Advanced Decision Modeling	4	1	0	9
4.	ACC52136	Chemistry of Lubricants and Additives	3	1	0	7
5.		Elective (any one)	3	0	0	6
a.	MME52103	Reliability, Availability & Maintainability (RAM) Engg.				
b.	MME52102	Computer Aided Maintenance				
c	CME52107	Environmental Engineering				
e.	MME52104	Automation and Robotics				
Practicals and others						
6.	ACC52266	Chemistry of Lubricants and Additives Practical	0	0	2	2
7.	MMC52001	Grand Viva-voce	0	0	2	2
8.		Industrial Training (to be credited in IIIrd Sem.)				
		Total	16	3	6	39

Semester – III

Sl. No.	Course No.	Subject	L	T	P	Cr. Hrs.
1.	MMC53901	Industrial Training (credited from Iind. Sem.)	0	0	4	4
2.	MMC53401	Seminar on Industrial Training	0	0	2	2
3.	MMC53501	Comprehensive Viva-voce	0	0	4	4
4.	MMC53902*	Interim Dissertation	0	0	15	15
5.	MMC53402	Seminar and Viva-voce on Dissertation	0	0	10	10
6.	MMC53001	Teaching Assignment/Lab. Development Evaluation	0	0	5	5
		Total	0	0	40	40

Semester – IV

Sl. No.	Course No.	Subject	L	T	P	Cr. Hrs.
1.	MMC54901	Dissertation	0	0	20	20
2.	MMC54401	Seminar on Dissertation	0	0	5	5
3.	MMC54501	Viva-voce on Dissertation	0	0	10	10
4.	MMC54001	Teaching Assignment/Lab. Development Evaluation	0	0	5	5
		Total	0	0	40	40

*Changed vide notice no. 614001/Acad/M.Tech/2010 dated 09.09.2010 (earlier the course no. was MMC53901. Since the course in Sl. No. 1 has the same course no., hence this change was made.

Changed as approved by chairman (AC) on 03.11.2010 from Cr. Hrs. 4-0-0 to Cr. Hrs.4-0-2

** Changed vide notification no. 616010/ME&MME/Acad/2011 dated 4th April,2011.

SEMESTER I

AMC511 **Advanced Numerical Methods & Applied Statistics** 4 0 0

Section A: Adv. Num. Methods – Review of solution of system of linear simultaneous equation. Solution of tridiagonal system, III conditioned system and iterative method to improve accuracy of an ill conditioned system. Evaluation of double and triple integrals by numerical methods and its application, solution of non-linear simultaneous equations, numerical solutions of integral equations, advanced method of interpolation, spline interpolation, numerical solution of simultaneous first order ordinary differential equations and higher order O.D.E. Initial and boundary value problems; Numerical solution of partial differential equations; Laplace and Poisson equation; heat conductive and wave equations; Writing computer program in the above methods.

Section B: Applied Statistics – Review of binomial, negative binomial, Poisson, normal and log normal distribution. Test of significance of mean, variance, correlation and regression coefficients; χ^2 test of goodness of fit; attributes and contingency table; F tests, tests of proportions, tests of significance under large sample approximation. Non-parametric tests: Wald-Wolfowitz run tests, tests of randomness, median tests, sign tests, Mann-Whitney Wilcoxon U-tests. Time series analysis, introduction to reliability and life testing experiments in engineering problems. One way and two-way analysis of variance, Completely Randomized Design (CRD), Randomized block Design (RBD), Latin Square Design (LSD).

MMC51101 **Friction and Wear** 3 1 0

Surface phenomena, nature of surface and contact, surface interaction and friction. Effect of lubricants and surface films. Theory of friction.

Mechanism of wear, types of wear – adhesive, abrasive, fatigue, corrosive etc. with reference to machine elements and subcomponents like bearings, clutches, brakes etc. Minimization of wear. Wear tests and testing machines.

MSC51105 **Management Principles and Practices** 4 0 0

Essentials of management functions. Human behavior at work – motivation, leadership, training and development. Essentials of communications – types, barriers, presentation skill. Financial management – sources of capital (long term and short term), financial statement analysis, working capital management. Engineering economics – concept of time value of money, capital budgeting techniques, replacement analysis, cost concepts, cost volume profit analysis, characteristics and life cycle of a project. Project cost estimates, job costing. Introduction to marketing management – concept and practice.

EIR513101 **Digital Electronics** 3 0 0

Boolean algebra, logic gates and switching functions, truth tables and switching expressions; Minimization of completely and incompletely specified functions-Karnaugh map and Quine-McClustey method. Decoders, Multiplexers, clocks, Flip-flops, Latches, Counters, and shift registers, synthesis of synchronous sequential circuits, minimization and state assignment; Timing circuits. (*Changed from" instrumentation and Microprocessor control" vide Notification no.616010/ME&MME/Acad/2011 dated 4th April 2011)*

MMC51102 **Vibration and noise Engg.** 3 1 0

Vibration: Single and multi-degree system, undamped and damped vibration, free and forced vibration, torsional vibration and critical speed. Application to machine foundation and condition monitoring. Vibration isolation and absorption. Balancing: on-line and off-line techniques.

Noise Engg.: Concept and scope, measurement of sound level, power level, directivity pattern, directivity index and directivity factor of noise source. Sound measurement in free field, reverberant field and semi-reverberant field. Sound propagation, attenuation due to various factors. Noise pollution, noise limits and legislation. Acoustic materials, noise control Engg..

MME51103 **Lubrication and bearing Design** 3 0 0

Basic principles of lubrication, lubrication theories; Hydrostatic, boundary, hydrodynamic and elasto-hydrodynamic lubrication. Generalized Reynolds equation, flow and shear stress. Mechanism of hydrodynamic instability. Dynamic characteristics of hydrodynamic journal bearings.

Plain bearing lubrication and performance. Design, application and selection of various types of bearings – sliding and rolling element bearings. Concept of air and magnetic bearings.

MME51104 **Maintenance Engg. Systems** 3 0 0

Maintenance techniques – break down, preventive and condition based maintenance. RCM Analysis of frequency and distribution of failure. Principles and application of fault analysis. Condition monitoring techniques by vibration and lube-oil analysis, Temperature etc.. Trouble shooting for various types of equipment. Non-destructive testing techniques and their application in maintenance. Use of soft computing for maintenance.

MME51103 **Fluid Flow Machines** 3 0 0

Classification, application, calculation of capacity, head, power, energy and efficiency of fluid flow machines like centrifugal pumps, reciprocating and rotary positive displacement pumps, fans and compressors.

SEMESTER II

MMC52101 **Tribological materials** 3 1 0

Tribologically relevant properties of materials, friction materials and their application in clutch and brake linings. Antifriction/plain bearing materials, wear resistant materials. Surface modification techniques. Materials for specific applications e.g. seals, hydraulic components etc. Lubricants: types and properties, additives and their role; Grease, solid lubricants. Standards, evaluation, testing and selection of lubricants. Salvaging and re-use of lubricants. Critical environmental problems related to use of lubricants and possible control measures.

ASE52137 **Corrosion and corrosion Protection** 3 0 0

Basic concepts of corrosion: Importance, corrosion theories, kinetics and mechanism of corrosion processes. Metallurgical factors and forms of corrosion: Crystal structure and metallic bond, crystal defects, effects of casting procedures, heat treatment, mechanical working and composition, corrosion resistant alloys. Different forms of corrosion and their control methods. Environmental aspects: Atmospheric corrosion, underground corrosion, biological corrosion – mechanisms and control measures. Corrosion testing and monitoring: Laboratory corrosion tests, corrosion monitoring methods. Chemical and electro-chemical removal of corrosion products. Cathodic and anodic protection: Principles, applications, advantages and disadvantages. Chemical methods of corrosion control: Use of inhibitors and coatings. Corrosion in industries and specific corrosion control methods.

MSC52105 **Advanced decision modeling** 4 1 0

Review of linear programming and its solution methodology. Integer programming and its application in managerial decision making, solution methodologies, zero-one programming. Dynamic programming: Principle of optimality, concept of state and stage, solution of discrete problem through backward dynamic programming, continuous and multi-stage dynamic programming problems, concept of stochastic dynamic programming problems. Introduction to Markov Decision Process, Markov decision problems. Queuing theory: Definition and classification, birth and death process, single and multiple server queues, application of queuing analysis in decision making. Discrete-event simulation: Random number and random deviate generation, simulation of queuing, inventory and maintenance systems, validation of simulation models, sampling of simulation outputs and statistical inferences, variance reduction techniques. Concept of multi criteria decision-making. Stochastic decision making models: Decision tree, introduction to stochastic programming models.

ASC52136 **Chemistry for Lubricants and Additives** 3 1 2

Physical and mechanical properties, performance and production of solid, semi-solid, liquid and synthetic lubricants. Lubricant formulation and its importance in effective machinery lubrication. Chemistry of Lubricating oils, Hydraulic fluids, Greases and Additives (used to enhance lubricant performance). Chemistry of lube oil oxidation, effect of oxidation on lubricant properties. Indications of oil oxidation. Machine fault detection through lubricant analysis. Tools used in analysis of lubricants.

ACC 52266 **Chemistry for Lubricants and Additives Practical** 0 0 2

Determination of Viscosity, TAN, TBN and Flash point of lubricants. Analysis of lubricants based on FTIR and DSC.

MME52103 **Reliability, Availability & Maintainability (RAM) Engg** 3 0 0

Introduction, Definition of reliability, maintainability and availability; Failure data analysis, MTIF, MTBR, MTTR.. Reliability improvement and apportionment; Concept of terrotechnology. Statistical distribution associated with reliability engg.; Quantitative measures of reliability, Bath tub curve; Quantitative measures of maintainability and measures to assure maintainability; Concept of comprehensive maintainability program; Methods to assure reliability; Concepts of assurance engg.; Fault tree analysis(FTA), Failure mode and effect analysis (FMEA), Failure mode, effect and criticality analysis (FMECA).Reliability estimation of mechanical components, reliability optimization, software reliability and human reliability,

MMC52102 **Computer Aided Maintenance** 3 0 0

Computer application for maintenance planning and failure analysis, system design and implementation, case studies. Computer application for spare parts control and maintenance costing. Computer simulation for planning of maintenance manpower and other facilities. Information system for effective maintenance. Computer application for condition monitoring. Application of soft computing techniques..

CME52107 **Environmental Engineering** 3 0 0

Environmental issues, policies, laws; Structure and functions of ecology and ecosystem; Water pollution, water quality parameters, their characteristics and standards, water quality monitoring, heavy metal pollution, eutrophication, deoxygenation, disinfection, water quality indices, water quality management and treatment; Air pollution – primary and secondary pollutants, air quality monitoring, standards and indices, meteorology and natural purification processes, engineered system for air pollution control, control devices for gaseous contaminants, vehicular pollution and control; Euro standards; Industrial noise abatement and control; Solid waste management – solid waste disposal design and operation of landfills; , Environmental management system; !SO 14000; Environmental auditing; Environmental impact assessment and preparation of EMP.

MME52105 **Automation and Robotics** 3 0 0

Basic concepts of automation; Automation in material handling; Mechanisms of automation. Definition, specification and classification of robots; Application of robots in mining and allied industries; Robots for different industrial purpose; Type of sensors – tactile; Tele-operated robots; Multi-robot systems and applications; Robo-vision system.