

KALASALINGAM UNIVERSITY

Anand Nagar, Krishnankoil - 626 190
Srivilliputhur Taluk, Virudhunagar District, Tamil Nadu, India



CURRICULUM AND SYLLABUS 2007-2008

M. TECH
(AUTOMOTIVE SYSTEMS ENGINEERING)

Courses Offered by

**CENTRE FOR AUTOMOTIVE SYSTEMS AND INDUSTRIAL ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
KALASALINGAM UNIVERSITY**

&

**RWTH, AACHEN UNIVERSITY OF TECHNOLOGY
GERMANY**

KALASALINGAM UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM FOR M.TECH AUTOMOTIVE SYSTEMS ENGINEERING

SEMESTER I

Code	Name of the Subject	L	T	P	C
MAT5909	Applied Mathematics	3	0	0	3
MEC5201	Automatic Control Engineering	3	0	0	3
MEC5202	Automotive Materials and Metallurgy	3	0	0	3
MEC5203	Automotive Engineering I	3	0	0	3
MEC5204	Automotive Engineering II	3	0	0	3
MEC5205	Internal Combustion Engineering Fundamentals	3	0	0	3
MEC5281	Computer Aided Vehicle Design and Analysis Laboratory	0	0	3	2
TOTAL		18	0	3	20

SEMESTER II

Code	Name of the Subject	L	T	P	C
MEC5206	Automotive Electrical and Electronic Systems	3	0	0	3
MEC5207	Automotive Transmission System	3	0	0	3
MEC5208	Welding Technology	3	0	0	3
MEC5209	Tribology	3	0	0	3
MECxxx	Elective I	3	0	0	3
MECxxx	Elective II	3	0	0	3
MEC5282	Automotive and Autotronics Laboratory	0	0	3	2
TOTAL		18	0	3	20

SEMESTER III

Code	Name of the Subject	L	T	P	C
MEC6201	Vehicle Maintenance	3	0	0	3
MECxxx	Elective III	3	0	0	3
MECxxx	Elective IV	3	0	0	3
MEC6298	*Project Work Phase I	0	0	18	6
TOTAL		9	0	9	15

*Project work Phase I contains two laboratory courses and a project preliminary work

Code	Name of the Subject	L	T	P	C
MEC6281	Advanced Automotive Laboratory	0	0	3	2
MEC6282	Automotive Components and Testing Laboratory	0	0	3	2
MEC6283	Project Work	0	0	12	2

SEMESTER IV

Code	Name of the Subject	L	T	P	C
MEC6299	Project Work Phase II	0	0	36	12

Total Credits: 67

LIST OF ELECTIVES**M.TECH AUTOMOTIVE SYSTEMS ENGINEERING**

Code	Name of the Subject	L	T	P	C
MEC5211	Automotive Systems Safety, Quality and Reliability	3	0	0	3
MEC5212	Finite Element Analysis for Automotive Systems	3	0	0	3
MEC5213	Modeling and Simulation of Automotive Systems	3	0	0	3
MEC5214	Artificial Intelligence Applications in Automotive Engineering	3	0	0	3
MEC5215	Advanced Heat Transfer	3	0	0	3
MEC5216	Manufacturing of Automotive Components	3	0	0	3
MEC6202	Computational Fluid Dynamics	3	0	0	3
MEC6203	Combustion in Engines	3	0	0	3
MEC6204	Manufacturing and Testing of IC Engines and Components	3	0	0	3
MEC6205	Supercharging and Scavenging	3	0	0	3
MEC6206	Alternative Fuels and Specialty Engines	3	0	0	3
MEC6207	Vehicle Acoustics	3	0	0	3

SEMESTER I

MAT5009	APPLIED MATHEMATICS	L	T	P	C
		3	0	0	3

[(Common for M.Tech (CAD/CAM), M.Tech (Energy) and M.Tech (ASE)]

ONE-DIMENSIONAL WAVE EQUATION

Laplace transform methods for one dimensional wave equation - displacements in a string - longitudinal vibration of an elastic bar - Fourier transformation methods for one - dimensional heat conduction problems in infinite and semi-infinite rod.

LAPLACE EQUATION

Laplace equation - properties of harmonic functions - Fourier transformation methods for Laplace equation - solutions for Poisson equation by Fourier transform method.

VARIATION AND ITS DERIVATIVES

Variation and its properties - Euler's equation - functional dependent on first and higher order derivatives -Functionals dependent on functions of several independent variables - some applications - direct methods - Ritz and Kantorovich methods.

SOLUTION OF LAPLACE EQUATION

Solution of Laplace's and Poisson equation on a rectangular region by Liebmann's method - diffusion equation by the explicit and Crank Nicolson - implicit methods - stability and convergence criterion - solution of wave equation by explicit scheme.

SCHWARZ - CHRISTOFFEL TRANSFORMATION

The Schwarz - Christoffel transformation - transformation of boundaries in parametric form - physical applications - application to fluid flow - application to heat flow.

Text Book

1. Sneddon, I. N., Elements of partial differential equations, McGraw-Hill, 1986.

References

1. Spiegel, M. R., Theory and problems of complex variables with an introduction to conformal mapping and its applications, Schaum's outline series, McGraw-Hill Book Co., 1987.
2. Sankara Rao, k., Introduction to partial differential equations, Prentice-Hall of India, New Delhi, 1995.
3. Elsgolts, L., Differential equation and calculus of variations, Mir Publishers, Moscow, 1966.

MEC5201	AUTOMATIC CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

BASIC CONCEPTS AND SYSTEM REPRESENTATION

Terminology and basic structure-feedback control theory - multivariable systems - dynamic models - state variable models-impulse response models and transfer function models-application to mechanical, thermal, hydraulic, pneumatic and electromechanical systems - block diagram representation and signal flow graphs-control system components.

TIME RESPONSE ANALYSIS AND DESIGN

First and second order systems - performance specifications-feedback analysis - P, PI and PID controllers design – effect of pole, zero addition-desired closed loop location-root locus plot and applications-steady state and dynamic error coefficients - robust control

FREQUENCY RESPONSE ANALYSIS AND DESIGN

Performance specifications-correlation to time domain specifications - bode plots and polar plots - gain and phase margin - constant M and N circles and Nichols chart – non-minimum phase systems.

STABILITY

BIBO stability, Routh-Hurwitz criterion, stability ranges for a parameter - Nyquist stability criterion - relative stability assessment using Routh and Nyquist criterion and bode plots.

COMPENSATION DESIGN

Design concepts-realisation of basic compensation-cascade compensation in time domain and frequency domain, simple MATLAB applications to analysis and compensators design problems

Text Book

1. Gopal, M., Control System Principles and Design, Tata McGraw Hill, New Delhi 1998.

References

1. Ogatta, Modern Control Engineering, Tata McGraw Hill, New Delhi, 1997.
2. Nagarath I.J.and Gopal M., Control System Engineering, Wiley Eastern Ltd., Reprint, 1995.
3. Dorf, R.C. and Bishop R.H., Modern Control Systems, Addison Wesley, Boston, 1995.
4. Leonard N.E. and William Levine, Using MATLAB to Analysis and Design Control Systems, Addison Wesley, Boston, 1995.

MEC5202	AUTOMOTIVE MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS

Elastic forms - stress and strain relationship in engineering materials-iron carbon diagram - deformation mechanism - plastic stress strain relations - slip line field theory – dislocation theory - strengthening mechanisms - strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion hardening, fiber and texture strengthening-preferred orientation.

FAILURE OF MATERIALS

Fracture, classification and types, Griffith's theory - notch effects, stress concentration - concept of fracture toughness-metallographic aspects of fracture-fractography, ductile brittle transition – fatigue - mechanism of crack initiation and growth - fatigue under combined stresses, factors affecting fatigue – creep - creep curve, creep mechanism, metallurgical variables of creep- super plasticity.

CHARACTERISTICS OF MATERIALS

Castability, machinability, formability and welding of engineering materials such as steel, cast iron, alloy steels, brass, bronze and aluminum alloy - behaviour of materials for high temperature – wear and corrosion resistance application- residual stress analysis by diffraction methods - metallurgical characterization of automotive materials.

SELECTION OF MATERIALS

Criteria of selecting materials for automotive components viz cylinder block, cylinder head, piston, piston ring, gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gearwheel, clutch plate, axle, bearings, chassis, spring, radiator, brake lining etc - application of non-metallic materials such as composite, ceramic and polymers in automobile components.

HEAT TREATMENT AND SURFACE TREATMENT

Heat treatment of steel - annealing, normalizing, hardening and tempering with specific relevance to automotive components, surface hardening techniques, induction and flame hardening - coating for wear and corrosion resistance, electroplating, electroless plating, phosphating, anodizing, thermal spraying, hard facing and thin film coatings.

Text Book

1. Dieter, G.E., Mechanical metallurgy, McGraw-Hill, 3rd Edition, New York, 1996.

References

1. Avner, S. H., Introduction to physical metallurgy McGraw-Hill, New York, 1982.
2. Raghavan, V., Physical Metallurgy, Principle and practice, Prentice Hall, 1995.
3. Bawa, H. S. Materials Metallurgy ,McGraw-Hill, New York,1996.
4. William D. Callister. Jr., Material Science and Engineering, John Wiley and Sons, 6th Edition, Singapore, 2005.

MEC5203	AUTOMOTIVE ENGINEERING I	L	T	P	C
		3	0	0	3

CHASSIS STRUCTURAL DESIGN

Chassis structural design, various types of frames, constructional details, materials, properties, weight reduction, structural efficiency loading, torsional, bending, stiffness, load input points, static/dynamic loads – crash worthiness, roller protection, driver protection.

VEHICLE BODY ENGINEERING

Body details – car, bus, commercial vehicles – selection and properties of body materials, trim and mechanisms.

VEHICLE AERODYNAMICS

Generation of aerodynamic loads on vehicles – road loads due to aerodynamic forces – aerodynamic design of vehicles – load transfer due to cornering – roll over stability – vehicle drag and various body optimization techniques for minimum drag – types of forces, moments and effects – wind tunnel testing, scaling, measuring techniques – component balance to measure forces and moments.

DESIGN OF SUSPENSION SYSTEM

Types and applications – material for spring - stress – deflection equation for helical spring, Wahl correction factor – design of helical springs – tension springs – buckling of spring – springs in parallel and in series – design consideration of Belleville springs, electrometric spring and air (pneumatic) spring – design of leaf spring for automobile suspension system – design of coil spring for front independent suspension system.

ANALYSIS OF SUSPENSION SYSTEM

Kinematic analysis – compliances, non-linear effects – effect of spring and dampers on steady state and transient handling – forces in members.

Text Book

1. Heldt, P. M., Automotive chassis, Chilton Co., New York, 1990.

References

1. Crouse, W.H., Automotive Chassis and body, McGraw Hill, New York, 1971.
2. Pouloski, J, Vehicle Body Engineering, Business Books Ltd., 1989.
3. Hocho, E. H. (Ed), Aerodynamics of road vehicles, SAE, (4th Edition), 1998
4. Adams, H., Chassis Engineering, H.P. Berks, 1993.

MEC5204	AUTOMOTIVE ENGINEERING II	L	T	P	C
		3	0	0	3

AUTOMOTIVE ENGINES

Ideal gas cycles - petrol engine combustion - diesel engine combustion - delay angle - rate of heat release - valve timing - volumetric efficiency - pumping losses - scavenging - engine friction-ways of increasing output power - engine configuration, no of cylinders, stroke to bore ratio, engine external dimensions-turbo charging - performance characteristics of petrol and diesel engines-combustion chamber design - continuously variable transmission.

DESIGN OF BRAKES

Overview of brake system - design consideration in brakes – band - internal expanding shoe - external contracting, long and short - energy equation - thermal consideration and rating of brakes.

DESIGN OF FRONT AXLE, REAR AXLE AND STEERING SYSTEM

Types of front axle - construction details-materials-front wheel geometry - construction of rear axles - types of loads acting on rear axles, rear axles housing, construction of different types of rear axle housing, design consideration - multi-axled vehicles - construction details of multi-axled vehicle - construction details of multi drive axled vehicles-construction details of multi drive axle vehicles – steering - steering geometry, steering system, steering linkages, steering gear boxes, design considerations, power and power assisted steering, steering of crawler tractors

VEHICLE PERFORMANCE ANALYSIS

Tractive resistance and types – properties - engine characteristics – transmission characteristics - clutch, gearbox, driveline, differential and transfer box - traction and power limited calculation-fuel economy calculation - kinematics analysis of a braking vehicle - vehicle braking model - brake pre-positioning – efficiency and adhesion utilization.

VEHICLE RIDE BEHAVIOUR

Road roughness characteristics - performance criteria, drive comfort, suspension, working space, handling implication, body attitude control - mathematical modeling, generation, predicted results, interpretation of results - practical suspension design, and guidelines-advanced suspension-cost/benefits of various active suspension designs.

Text Book

1. Sethi H.M, “Automobile Technology”, Tata McGraw-Hill, New York, 2003.
2. Newton steeds Garret, Motor vehicles, Butter worth, London, 1998.

References

1. Obert, E. F., I.C. Engines air pollution, Harper Row Publisher, New York, 1973.
2. Gillespie, T.D., Fundamentals of vehicle dynamics, SAE, 1992.
3. Lucas, G.G., Road vehicle performance, Gordon and Breach, 1986.
4. Giles, J.G., Steering, Suspension and tyres, Illife books ltd., London, 1998.
5. Corolle, D.A., Fifth, G.R., Hertton, D.N.L.,An Introduction to vehicle Dynamics, University of Leeds, 1992.

MEC5205	INTERNAL COMBUSTION ENGINEERING FUNDAMENTALS	L	T	P	C
		3	0	0	3

INTRODUCTION TO IC ENGINES

Basic engine nomenclature – classification - cycles, comparisons - SI and CI engine operations - stratified charge engine characteristics, torque, IP, BP and efficiency - SFC -Air/fuel ratio.

THERMODYNAMICS OF FUEL -AIR MIXTURES

Composition of air and fuels combustion stoichiometry - first law applied to combustion - energy and enthalpy balances - enthalpies of formation - heating values - combustion efficiency of IC engine - second law applied to combustion - maximum work and efficiency.

COMBUSTION IN SI AND CI ENGINES

Thermodynamic analysis of SI engine combustion - flame structure and speed - cyclic variations in combustion, partial burning and misfire - abnormal combustion - types of diesel combustion systems - fuel spray behavior - ignition delay - ignition quality - auto ignition - factors affecting delay fuel properties – mixing, combustion (uncontrolled and controlled).

SUPERCHARGING

Objectives - effects of engine performance – required engine modification - thermodynamics of mechanical supercharging and turbo - charging – turbo-charging methods - engine exhaust modifications.

POLLUTANT FORMATION AND CONTROL

Nature and extent of problem - Nitrogen oxides - formation of NO_x in SI and CI engines - hydrocarbon emission from SI and CI engines - particulate emission - Exhaust gas treatment.

Text Book

1. Paul, W. Gill, James, H. Smith, JR. Eugene, J. Ziurys, Fundamentals of internal combustion engines, Oxford and IBH Publishing Co. Pvt. Ltd, 1962.

References

1. John, B. Heywood, Internal Combustion Engine, McGraw Hill Book Company, 1988.
2. Ganesan, V., Internal Combustion Engine, Tata McGraw Hill Book Company.
3. Edward, F., Obert, Internal Combustion Engine and Air Pollution, Harper and Row International Edition, 1973.

MEC5281	COMPUTER AIDED VEHICLE DESIGN LABORATORY	L	T	P	C
		0	0	3	2

- Design of piston, piston pin and piston rings and drawing of these components.
- Designing of connecting rod, small end and big end shank design, design of big end crank arms, and drawing of the connecting rod assembly.
- Design of crank shaft, balancing weight calculations, development of short and long crank arms, front end and rear end details, drawing crankshaft assembly.
- Design and drawing of flywheel, ring gear design, drawing of the flywheel including of ring gear teeth.
- Design and drawing of inlet and exhaust valves.
- Design and drawing of Cam and Cam Shaft.
- Design of Combustion Chamber.
- Design and drawing of Engine Complete assembly involved with cylinder block, cylinder head, crank case, valve ports, water jackets, front and rear end details.
- Complete design of clutch components. Components and assembly drawing.
- Gear train calculations, Layout of Gear box. Calculation of bearing loads and selection of bearings. Complete assembly drawing using drafting software.

SEMESTER II

MEC5206	AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS	L	T	P	C
		3	0	0	3

FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL SYSTEMS

Battery - principle, construction and characteristics – battery rating capacity - efficiency of batteries - various tests on battery condition –electric power steering.

CHARGING AND STARTING SYSTEMS

Charging principles, circuits – generation of direct current, shunt generator characteristics, voltage and current regulator, compensated voltage regulator - alternators, behaviour of starter during starting, working of different starter drive units, care and maintenance of starter motor, new development requirements of starter system.

FUNDAMENTALS OF AUTOMOTIVE ELECTRONIC SYSTEMS

Electronic management of chassis system – vehicle motion control – automotive microprocessor uses – electronic dash board instruments – onboard diagnosis system –electronic control of braking and traction - automatic transmission, electronic clutch.

IGNITION SYSTEMS

Types of solid state ignition systems and their principle of operation, advantages of electronic ignition systems, contactless electronic ignition system, distributorless ignition, electronic sparks timing and control, spark arrester, throttle body injection and multi port or point fuel injection.

SENSORS AND ACTUATORS

Introduction, basic sensors arrangement, types of sensors – oxygen sensors, crank angle position sensors – fuel metering and vehicle speed sensors and detonation sensors, altitude sensors, flow sensor, throttle position sensors, solenoids, stepper motors, relays.

Text Book

1. Judge, A., W., Modern Electrical Equipment of Automobiles, Chapman and Hall, London, 1992.

References

1. Young, A. P. and Griffiths, L., Automobile Electrical Equipment, English Languages Book Society and New Press, 1990.
2. Vinal, G. W., Storage batteries, John Wiley and Sons Inc. New York, 1985
3. Crouse, W. H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc. New York, 1980.
4. Spread Bury, F. G., Electrical Ignition Equipment, Constable and Co. Ltd., London, 1962.
5. Kholi, P. L., Automotive Electrical Equipment, Tata McGraw-Hill Co Ltd, New Delhi, 1975.

MEC5207	AUTOMOTIVE TRANSMISSION SYSTEM	L	T	P	C
		3	0	0	3

CLUTCHES AND GEAR BOX

Design requirements of friction clutches - selection criteria-torque transmission capacity - single plate clutch-multiple plate clutch-lining material - design consideration of gear box-selection of proper gear ratio for an automobile gear box - design of shafts - splines and gears, design of gear and shaft for gear box - different types of gear boxes - conventional gear boxes - performance characteristics.

AXLES, PROPELLOR SHAFTS, FINAL DRIVE AND DIFFERENTIAL

Design of front and rear axles for automobiles - design of propellor shafts for bending torsion and rigidity, universal joints and slip joints - different types of drives - worm and worm wheel - bevel and hypoid gear final drives - double reduction and twin speed final drives - differential principles - construction details of differential units - non slip differential - differential locks - differential housings.

HYDROSTATIC DRIVES AND ELECTRICAL DRIVES

Hydrostatic drives - various types of hydrostatic systems - principles of hydrostatic drive systems - advantages and limitations - comparison of hydrostatic with hydrodynamic drives - construction and working of typical hydrostatic drives - electrical drives - principles and design-advantages and limitations - performance characteristics.

AUTOMATIC TRANSMISSION

Semi automatic transmission for cars and heavy vehicles-layout and operation - automatic transmission - advantages, basic construction and operation - automatic transmission for passenger cars - hydraulic operation - continuous variable transmission - operating principle - basic layout and operation-advantages and limitations.

VEHICLE HANDLING DYNAMICS

Tyre behaviour, generation of forces and moment-simple vehicle handling model - under steer/over steer, steady turning behaviour - stability during straight high speed running, forced responses to drivers steering inputs - vehicle design guidelines, vehicle layout, suspensions, tyre choices - extensions of model including all degrees of freedom, handling measurements-handling of vehicle combinations - load distributions - calculation of tractive effort for different drives - stability of vehicles on a slope, curve, banked road.

Text Book

1. Crouse, W. H., Anglin, D. L., Automotive Transmission and Power train consideration, McGraw Hill, 1976.

References

1. Hydrostatic transmission for vehicle applications, I Mech E Conference, 1981-88.
2. Grouse, W. H., Automotive Chassis and body, McGraw Hill, New York, 1971.
3. Johnsen, R. C., Optimum design of mechanical elements, John Wiley and Sons, 1980.
4. Arora, J. S., Introduction to optimum design, McGraw Hill Book Company Ltd, 1997.
5. Ellis, J. R., Vehicle handling dynamic, Mechanical engineering publications, 1994.
6. Gillespie, T. D., Fundamental of vehicle dynamics, SAE, 1992.
7. Steed W., Mechanics of road vehicles, Iliffe Books Ltd., London, 1960.
8. Giri, N. K., Automobile Mechanics. Khanna Publishers, 2002.

MEC5208	WELDING TECHNOLOGY	L	T	P	C
		3	0	0	3

CLASSIFICATION OF WELDING PROCESS

Gas welding – gases - setup of equipments - flame characteristics, different kinds of flame and their areas of applications, weld quality – applications - variants of oxy - gas welding - manual metal arc welding - process, different types of electrodes and their applications, electrode designations - defects.

CHARACTERISTICS OF WELDING ARC

Physical phenomena occurring in the arc potential distribution, static and dynamic arc characteristics, brief ideas on heat generation, types of forces and metal transfer in the arc - arc blow power source characteristics – volt - ampere relationship and its measurements, operating point of the arc, variation of current and voltage with arc length - arc length control.

SOLID STATE WELDING PROCESS

Fundamental principles, survey of the various pressure welding process and their applications - friction, explosives, diffusion and ultrasonic welding - principles of operation, characteristic and application.

HIGH ENERGY BEAM WELDING

Heat generation and regulation - equipment details, electron beam welding in different degrees of vacuum, advantages and disadvantages, applications - laser welding, principles of operation, advantages and limitations, applications.

ELECTRON SLAG WELDING

Heat generation, principles of operations, wire and consumable guide techniques, selection of current - voltage and other processes, variables, nature of fluxes and their choice - electro-gas welding, principles and applications, narrow gap welding, under water welding.

Text Book

1. A.W.S., Welding Technology Handbook, Vol - 1 and 2, 8th edition 1992.

References

1. Nadkarni, S. V. Modern Arc welding Technology. Oxford IBH Publishing Co., 1996.
2. Parmer, R. S., Welding Process and technology, Hanna Publishers, 1992.
3. Lancaster, J. F., Welding Processes and Technology, Pergamon Press, 1984.
4. Houlderft, P. T. Submerged arc welding, Abington, 1989.
5. Metals Handbook (Welding and brazing) Vol.6.10th edition ASM.1995.
6. Richardson, D. V., Rotating electrical machinery and transformer technology, Prentice Hall of India 1978.
7. Schwartz M. M., Metals joining Manual, McGraw Hill Book.1979.
8. Tylecote, R. F., The solid phase welding of metals, Edward Arnold Publishers Ltd., London, 1968.
9. Christopher Davis., Laser welding Practical guide, Jaico Publishing House, 1994.

MEC5209	TRIBOLOGY	L	T	P	C
		3	0	0	3

TRIBOLOGY

Introduction, tribology in design, tribology in industry, tribological problems in design - economic consideration, laws of friction, kinds of friction, cause of friction, friction measurements, theory of friction, types of wear, various factors affecting wear, measurements of wear, wear between solid and liquids, theory of wear.

LUBRICANTS AND LUBRICATION

Lubrication properties - physical and chemical - lubrication - basic modes of lubrication - flow of viscous fluid through rectangular slots - seal - mechanical and dynamic seals - forging, wire drawing extrusion, rolling - lubrication used for wire ropes - design aspects of gear lubrication.

ELEMENTS OF CONTACT MECHANICS

Concentrated and distributed forces on plate surfaces - contact between two elastic bodies in the form of spheres - failures of contact surfaces - thermal effects in surface contact - contact between rough surfaces, representation of machine element contact.

HYDROSTATIC BEARINGS

Basic concepts, operations, advantages and limitations - hydrostatic conical and spherical bearings, load carrying and flow of lubricants - bearing power and film thickness, bearing temperature and power - compensator and their action - hydrostatic squeeze film, circular and rectangular plates, impact conditions between lubricated solids - application to journal bearing.

HYDRODYNAMIC BEARING

Theory of hydrodynamic lubrication - mechanism of pressure development in oil film- two dimensional Reynolds equations - infinite tapered shoe slider bearings and infinite long journal bearing - short bearing theory applied to journal bearing - friction and power losses in journal bearings, ratio of heat conducted, temperature rise approximate and rapid methods, design considerations - hydrodynamic thrust bearings - flat plate thrust bearing, pressure equation, load, centre of pressure - tapered land thrust bearing, step thrust bearing, tilting pad thrust bearing - friction in tilting pad thrust bearing.

Text Book

1. Willams, J.A., Engineering tribology, Oxford University Press, 1994.

References

1. Halling J., Principles of tribology, MacMillan Press Ltd, 1978.
2. Neale M.J., Tribology hand book, Butterworth-Heinemann Ltd; 2 Rev.Ed edition, 2004.
3. Bharat Bhushan, Modern Tribology Handbook, Vol. 1 and 2, CRC Publishers, 2000.

MEC5282	AUTOMOTIVE AND AUTOTRONICS LABORATORY	L	T	P	C
		0	0	3	2

Automobile Laboratory:

- Performance test on a 4 stroke engine.
- Viscosity determination of a given fluid.
- Moment of inertia for connecting rod.
- Determination of effectiveness of a parallel and counter flow heat exchangers.
- Valve timing of 4 stroke and port timing of 2 stroke engine.
- Performance test on 2 stroke engine.
- Study of axles.
- Study of clutch.
- Study of gear box.
- Study of transfer case.
- Study of steering system.
- Study of casing system.
- Study of differential mechanism.
- Study of power steering mechanism.
- Study of chassis.

Autotronics Laboratory:

- Study of NDIR gas analyzer and FID.
- Study of chemiluminescent NOx analyzer.
- Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer.
- Diesel smoke measurements.
- Study of rectifier and filters.
- Characteristics of amplifiers.
- Study of logic gates, address and flip-flops.
- Study of SCR and IC timer.
- D/A and A/D converter.
- Assembly language programming exercise.
- Interfacing A/D converter and simple data acquisition.
- Interfacing stepper motor control and CRT terminal.
- Micro controller programming and inter facing

SEMESTER III

MEC6201	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

MAINTENANCE RECORDS AND SCHEDULE

Importance of maintenance - scheduled and unscheduled maintenance - preparation of check list - chassis lubrication - cost effectiveness - pre-trip, inspection form - log books, trip sheets - other maintenance record form.

MAINTENANCE OF ENGINE

Dismantling of engine components - cleaning methods - visual inspection and dimensional check of various engine components - minor and major tune up, reconditioning, repairing methods of engine components - assembly procedure - special tools used for maintenance, repair and overhauling.

MAINTENANCE OF CHASSIS DRIVELINE COMPONENTS

Clutch-mechanical, automatic types - gear box-mechanical, automatic types - final reduction - propeller shaft - front and rear suspension system - rigid and independent types - brakes systems - hydraulic, servo, air - air bleeding - steering system - wheel alignment - tyres.

MAINTENANCE OF ELECTRICAL SYSTEMS

Battery - testing methods - starter motor - charging system-dc generator, ac alternator, ignition system - coil ignition, transistor assisted ignition, capacitor discharge ignition - electric horn, wiper, flasher, electric fuel pumps, gauges, lighting system, head light focusing, wiring system.

MAINTENANCE OF COOLING SYSTEM, LUBRICATION SYSTEM, FUEL SYSTEM AND BODY

Cooling system - types, water pumps, radiator, thermostat valve - anti corrosion and anti freezing solutions - lubricating system-oil analysis, oil topping up, oil change, oil filters, oil relief valve - fuel system-petrol, diesel fuel feed system components - body repair tools, minor body panel beating, tinkering, soldering, polishing, painting - door locks mechanism - window glass actuating mechanism.

Text Book

1. Derek Newbold, Allan Bonnick, A Practical Approach to Motor Vehicle Engineering, Butterworth-Heinemann, 2000

References

1. John Doke, Fleet management, Mc-Graw Hill Co, 1984.
2. Maleev, V. L., Diesel engine operation and maintenance, Mc-Graw Hill Book Co, New York, 1984.
3. Leslie F Going , Automotive maintenance and trouble shooting, American Technical Society, 1972.

MEC6281	ADVANCED AUTOMOTIVE LABORATORY	L	T	P	C
		0	0	3	2

METROLOGY LABORATORY

- Calibration of automotive parameters
- Measurement of automotive Gears
- Non destructive material inspection
- Thickness measurements.
- Measurement of surface roughness

MATERIALS BEHAVIOUR ANALYSIS

- Physical and mechanical properties testing
- Testing of fuels, oils and brakes fluids
- Testing of engine coolants
- Wear analysis through pin on disk type
- Friction analysis
- Corrosion analysis

NOISE, VIBRATION AND HARSHNESS (NVH) MEASUREMENTS

- Measurement of Sound intensity
- Evaluation of silencer characteristics
- Evaluation of acoustic properties
- Noise and vibration mapping studies.

ADVANCED METALLOGRAPHY LABORATORY

- Crystallographic analysis of plain carbon steel, CI, alloy steel etc.
- Micro structure of important non ferrous metals and alloys
- Electrolytic polishing and advanced etching techniques
- Phase identification through diffraction techniques
- Micro strain and grain size determination
- Photomicrography techniques.

WELDING METALLURGY LABORATORY

- Arc striking practice
- Fabrication of simple joints
- Micro hardness survey for weldments
- Metallography of weldments
- Microscopic analysis of HAZ.

MEC6282	AUTOMOTIVE COMPONENTS AND TESTING LABORATORY	L	T	P	C
		0	0	03	2

- Load test on automotive engine
- Deflection test on chassis
- Heat balance test on automotive diesel engine
- Performance study on petrol engine at full throttle and part throttle condition
- Engine tuning for performance test
- Measurement of emission
- Measurement of vibration of engine and body
- Wheel geometry test by using optical method
- Engine combustion analysis
- Calibration of fuel jet
- Design and analysis of automotive system by using software packages
- Calibration of diesel fuel injection pump
- Testing of automotive electrical system
- Testing of automotive electronic system

LIST OF ELECTIVES

MEC5211	AUTOMOTIVE SYSTEMS SAFETY, QUALITY AND RELIABILITY	L	T	P	C
		3	0	0	3

SAFETY MANAGEMENT PRACTICES IN AUTOMOTIVE INDUSTRIES

Need for safety - safety concepts – safety management functions – safety committee - safety audit and survey- safety inspection – safety sampling -job safety analysis - damage control - disaster control – emergency preparedness plan - accident types – causes and cost of accidents - house keeping – safety education and training - accident reporting - accident investigation – accident prevention programs - first aid - fire fighting - personal protective equipments.

SAFETY SYSTEM ANALYSIS

Introduction – definitions - safety systems - safety control systems - organisations and management of safety - safety information system, basic concepts, information sources, coding sources, documentation, processing of information - safety budget allocation - cost benefit analysis - allocating the budget - total loss control – benefits.

HAZARDS AND RISKS IN AUTOMOTIVE INDUSTRIES

Introduction – hazard - risk – safety analysis - risk assessment - Techniques and methodologies for risk analysis – checklist - what if analysis - Hazard and Operability Studies (HAZOP) - Fault Tree Analysis (FTA) - Even Tree Analysis (ETA) - Failure Mode Effect Analysis (FMEA) – Material Safety Data Sheet (MSDS) - computer aided hazard analysis - expert system and artificial intelligence application - fault detection and diagnosis.

TRANSPORT SAFETY

introduction - factors for improving safety on roads - causes of accidents due to drivers and pedestrians – safety in design, selection, operation and maintenance of transport vehicles - preventive maintenance – servicing - check list - insurance - Transport emergency card (TREM) - warning symbols- responsibility of driver - transport precaution- safe driving - history of legislations related to safety - safety provisions in the factory act - indian motor vehicles act and rules - workmen compensation act - ESI act - OSHA standards.

RELIABILITY AND QUALITY

Reliability – reliability function – MTBF - MTTF - mortality curve - availability – maintainability- failure data analysis – repair time distributions - graphical evaluation - reliability prediction - failure rate estimates - effect of environment and stress - series and parallel systems - RDB analysis – standby systems - complex systems - total quality management – QC Tools – quality circles – quality function deployment – 5S – Kaizen – Six sigma – quality management system – ISO – implementation steps.

Text Books

1. Brown D.B., System Analysis and Design for Safety, Prentice Hall Inc., New Jersey, 1976.
2. Dale H. Besterfield, et al., Total Quality Management, Person Education, 2002.
3. Ebeling, An Introduction to Reliability and Maintainability Engineering, Tata McGraw Hill, 2004.
4. John.V.Grimaldi and Rollin H.Simonds , Safety management , All India Travelers book seller, 1989.

References

1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
2. Babkov.V.F, Road conditions and traffic safety, MIR Publications, Moscow, 1986.
3. Dhillon.B.S. and Singh.C, Engineering Reliability- New Techniques and Applications , John Wiley andsons,1981.
4. Ernest J.Henley and Hiromitsu Kumamoto, Designing for reliability and safety control, Prentice Hall,1985.
5. Ernest J.Henly and Hiromitsu Kumamoto, Reliability Engineering and Risk Assessment, Prentice Hall,1981.
6. ILO-Major Hazard Control- A Practical Manual, ILO, Geneva,1988.
7. John Bank, The Essence of TQM, PHI, 1993.
8. Lees, F.P., Loss Prevention in Process Industries, Butterworths, New Delhi, 1986.
9. Motor vehicles act, 1988, Government of India.
10. Occupational Safety manual, BHEL
11. Popkes. C.A Traffic Control and Road Accident Prevention, Chapman and Hall Limited, 1986.
12. Richard A. Stephans and Warner W.Talso, System safety analysis handbook, The system safety society , 1993.
13. David S. Gloss., Introduction to safety Engineering, Wiley-Interscience,1984.
14. Rose, J.E., Total Quality Management, Kogan page limited, 1993.

MEC5212	FINITE ELEMENT ANALYSIS FOR AUTOMOTIVE SYSTEMS	L	T	P	C
		3	0	0	3

FINITE ELEMENT ANALYSIS

Historical background - weighted residual methods-basic concept of fem - variational formulation of B.V.P.- Ritz method-finite element modeling - element equations - linear and quadratic shape functions - bar, beam elements - applications to heat transfer.

FINITE ELEMENT ANALYSIS OF 2 D PROBLEMS

Basic boundary value problems in 2 dimensions-triangular, quadrilateral, higher order elements - poissons and laplace equation - weak formulation - element matrices and vectors-application to solid mechanics, heat transfer, fluid mechanics.

ISO-PARAMETRIC FORMULATION

Natural co-ordinate systems - lagrangian interpolation polynomials - isoparametric elements – formulation - numerical integration - 1D, 2D, triangular elements - rectangular elements - illustrative examples.

SOLUTION TO PLANE ELASTICITY PROBLEMS

Introduction to theory of elasticity-plane stress-plane strain and axisymmetric formulation principles of virtual work, consistent and lumped formulation-use of local co-ordinates, element matrices using energy approach.

SPECIAL TOPICS

Dynamic analysis – equation of motion - mass matrices - free vibration analysis - natural frequencies of longitudinal - transverse and torsional vibration - introduction to transient field problem - non linear analysis - use of softwares - h and p elements - special element formulation.

Text Book

1. Reddy, J.N., An introduction to the Finite Element Method, McGraw Hill, 1993.

References

1. Segerlind, L. J., Applied finite element analysis, John Wiley, 1984.
2. Rao, S. S., Finite element method in engineering, Pergamon Press, 1989.
3. Chandragupta and Belagundu, Finite elements in Engineering, Prentice Hall of India private limited, 1997.
4. Cook, Rober Davis et. al., Concepts and applications of finite elements analysis, John Wiley and sons, 1999.
5. Buchaman, G. R., Schaum's outline of finite element analysis, McGraw-Hill Company, 1994.

MEC5213	MODELING AND SIMULATION OF AUTOMOTIVE SYSTEMS	L	T	P	C
		3	0	0	3

GENERAL CONSIDERATIONS OF MODELING

Governing equations - conservation of mass, conservation of energy, second law analysis - numerical methodology - computing mesh – Discretisation - grid formation.

SPRAY MODELING

Spray equation models - thin spray models, thick spray models - droplet turbulence interactions, droplet impingement on walls - full field model, K-e Model,

IN-CYLINDER FLOW MODELING

Laminar flow modeling - probability density functions - Ekman layers roll-up vortex, vortex structures - compression generated turbulence, effective viscosity, and turbulent diffusivity.

INRODUCTION TO COMBUSTION MODELING

Classification – zero dimensional modeling, quasi-dimensional modeling, multidimensional modeling - comparison of different combustion systems, combustion efficiency, applications, classification - multi zone models - heat transfer Cp-relations - Weibe's function analysis - white house-way model - two zone models - mathematical modeling of catalytic converters - one dimensional model – 2D axi-symmetric model of monolithic reactor- computation of chemical reactions.

ENGINE SIMIUATION

Combustion in diesel engines – heat transfer in engines – heat transfer correlations - simulation of Otto cycle at full throttle, part throttle and supercharged conditions - progressive combustion - exhaust and intake process analysis - engine and porting geometry - gas flow, scavenging.

Text Book

1. J. I. Ramos, Internal Combustion Engine Modeling, Hemispherical Publishing Corporation, 1989.

References

1. Ashley, S, Campbell, Thermodynamic analysis of combustion engines , John Wiley and sons, 1980.
2. Gordon, P, Blair, The basic design of two stroke engines, SAE Publication, 1990.
3. Horlock and Winterbone, The Thermodynamic and Gas Dynamic of Internal Combustion engines, Vol 1 and 2, Clarendon press, 1986.
4. J. N. Mattavi and C. A. Amann, Combustion Modeling in Reciprocating engines, Plenum press 1980
5. John B Heywood, Internal Combustion Engine Fundamentals, McGraw-Hill International editions, Automotive Technology Series, 1988.
6. Sandeep Maju, Robert, I. Sagar Jr, and Benny J. sridar, predicting durability, Mechanical engineering, vol.64, March 1999.

MEC5214	ARTIFICIAL INTELLIGENCE APPLICATIONS IN AUTOMOTIVE ENGINEERING	L	T	P	C
		3	0	0	3

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Introduction to artificial intelligence – definition – A.I applications – A.I representation - properties of internal representation - heuristic search techniques - best first search, mean and end analysis - A* and AO* algorithm – game playing – minimize search procedure – alpha beta cutoffs – waiting for quiescence – secondary search.

AI IN MANUFACTURING

Design and manufacturing – AI integration through quality – intelligent software system for intelligent manufacturing – architecture for integrating enterprise automation - application of AI in industries - utilization and functionality - architecture of expert system, knowledge representation, and two case studies on expert systems – knowledge based expert system – product and process design – relations between manufacturing and AI researchers.

AI IN ROBOTICS

Programme control and subroutines - communication and data processing - monitor mode commands - representing and recognizing scenes, waltz algorithm, constraint determination - trihedral figures labeling knowledge representation using predicate logic - predicate calculus - predicate and arguments - ISA hierarchy - frame rotation, resolution - natural deduction – symbolic representation and planning for robot control system in manufacturing.

KNOWLEDGE REPRESENTATION USING NON MONOTONIC LOGIC

TMS (truth maintenance system), statistical and probabilistic reasoning - fuzzy logic, structure knowledge representation - semantic net - frames, script - conceptual dependency planning - block world, strips - implementation using goal stack - non linear planning with goal stacks - hierarchical planning - list commitment strategy.

NEURAL NETWORKS

Introduction to neural networks and perception – qualitative analysis only, neural net architecture and application - natural language processing and understanding and pragmatic, syntactic, semantic, analysis, RTN, ATN, understanding sentences.

Text Book

1. Eugene, Charniak, Drew Mcdermott, Introduction to artificial intelligence, Wesley series in Computer Science, 1985.

References

1. Elaine Rich and Kerin Knight, Artificial Intelligence, McGraw Hill, 1990.
2. Kishen Mehrotra, Sanjay Rawika, K. Mohan, Elements of Artificial Neural Network, MIT Press, 1996.
3. A. Fazel, Famili, Dana S. Nau and Steven H. Kim. Artificial Intelligence Application in Manufacturing., AAAI Press, 1992.
4. M. W. Firebaugh, Artificial Intelligence, Artificial knowledge based approach, Boyd and Frasher Publishing Co, 1988.
5. Charniac, E and M. C. Dermott, Introduction to AI, Addison Wesley, 1986.

MEC5215	ADVANCED HEAT TRANSFER	L	T	P	C
		3	0	0	3

CONDUCTION AND RADIATION HEAT TRANSFER

One dimensional energy equations and boundary condition - three dimensional heat conduction equations - conduction with heat generation - extended surface heat transfer - transient and periodic heat conduction.

FREE AND FORCED CONVECTIVE HEAT TRANSFER

Dimensional analysis - boundary layer concept - basic governing equations - free and forced convection - momentum and energy equations - turbulent boundary layer heat transfer - mixing length concept - turbulence model - K-E model - analogy between Heat and momentum transfer- Reynolds, Colburn, Von Karman, Turbulent flow in a tube - high speed flows.

PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGER

Condensation with shear edge on bank of tubes, boiling – pool and flow boiling - heat exchanger - E-NTU approach and design procedure - compact heat exchangers.

RADIATION

Basic laws of radiation - radiation in ideal and real surfaces - view factor algebra - radiation shields - electrical analogy using radiosity and irradiation - radiation in gaseous and vapours.

MASS TRANSFER AND ENGINE HEAT TRANSFER CORRELATION

Mass transfer - vaporization of droplets - combined heat and mass transfer problems - heat transfer correlations in I.C. engines.

Text Book

1. Incropera, F. P. and DeWitt, D. P., Fundamentals of Heat and Mass Transfer, John Wiley and Sons, 1996.

References

1. Eckert, E. R. G. and Drake, R. M., Analysis of Heat and Mass Transfer, McGraw Hill Co., 1980.
2. Ozisik, M. N., Heat Transfer, Basic approach, McGraw Hill Co., 1985.
3. Bejan, A., Convection Heat Transfer, John Wiley and Sons, 1984.
4. Rohswnow, W. M., Harnett, J. P., and Ganic, E. N., Handbook of Heat Transfer Applications, McGraw Hill, New York 1985.
5. Patankar. S.V., Numerical heat transfer and Fluid flow, Hemisphere Publishing Corporation, 1980.
6. Carnahan, B., Luther. H. A., and Wilkes, J. O., Applied Numerical Methods, Wiley and Sons, 1976.

MEC5216	MANUFACTURING OF AUTOMOTIVE COMPONENTS	L	T	P	C
		3	0	0	3

INTRODUCTION TO AUTOMOTIVE COMPONENTS

Cylinder blocks - production methods, dry and wet liners, cylinder heads – types - production methods - production of oil pan - piston –types – functions manufacturing methods-production of actuators - use of robots in assembly line.

VALVES AND ACCESSORIES

Valves - types – mechanisms - production methods - production of push rod, rocker arm and tappets – cam shafts - manufacturing methods – production of carburetors – king pins and propellers shafts.

TRANSMISSION SYSTEMS

Clutch - universal joint – differentials - main axle - stub axle - wheels.

BRAKES, SUSPENSION AND ENGINE MANAGEMENT SYSTEMS

Precision and micro machining - diamond turning of parts to nanometer accuracy – stereo microlithography machining of micro sized components.

SURFACE TREATMENT AND FABRICATION

Thermal spraying - vapour deposition-ion implantation - diffusion coating – electroforming – anodizing - conversion coating - hot dipping - ceramic coating – diamond coating - explosive welding and diffusion bonding.

Text Book

1. Heldt, P. M., High speed Combustion engines, Oxford and IBM publisher's co., 1985.

References

1. Kirpal Singh, Automobile engineering, Vol. I &II, Standard publisher's distributors, New Delhi, 1997.
2. Newton and steels, The motor vehicle, ELBS, 1980.
3. Narang, G. B. S., Automobile engineering, Khanna publishers, 1990.
4. Serope kalpakjian, Manufacturing Engineering and Technology, Third Edition- Addison-Wesley publication Co., 1995.
5. Brahem, T. Smith, Advanced machining I.F.S., U.K, 1989.
6. Amstead, B. H., Ostwald Philips and Bageman, R. L., Manufacturing Process John Wiley's Sons, 1987.
7. Muccic, E. A., Plastic processing technology, Materials park, Ohio, ASM int., 1994.
8. Jarger, R. C., Introduction to microelectronic Fabrication, Addison-Wesley, 1988.

MEC6202	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3

GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD

Classification - initial and boundary conditions - initial and boundary value problems - finite difference method - central, forward, backward difference - uniform and non-uniform grids - numerical errors - grid independence test.

CONDUCTION HEAT TRANSFER

Steady one - dimensional conduction, two and three dimensional steady state problems, transient one dimensional problem, two-dimensional transient problems - steady one dimensional transient problems.

INCOMPRESSIBLE FLUID FLOW

Governing equations, stream function – Vorticity method - determination of pressure for viscous flow - Simple procedure of Patankar and spalding - computation of boundary layer flow, finite difference approach.

CONVECTION HEAT TRANSFER AND FEM

Steady one-dimensional and two-dimensional convection – diffusion, unsteady one-dimensional convection – diffusion - introduction to finite element method – solution of steady heat conduction by FEM – incompressible flow – simulation by FEM.

TURBULENCE MODELS

Algebraic Models – one equation model, K-E Models, standard and high and low Reynolds number models - prediction of fluid flow and heat transfer using standard codes.

Text Book

1. Muralidhar, K., and Sundararajan, T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi, 1995.

References

1. Subas, V. Patankar, Numerical heat transfer fluid flow, Hemisphere Publishing Corporation, 1980.
2. Taylor, C., and Hughes, J. B., Finite Element Programming of the Navier Stock Equation, Pineridge Press Ltd., U.K, 1981.
3. Anderson, D. A., Tannehill, I. I., and Pletcher, R. H., Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, New York, USA, 1984.
4. Fletcher, C. A. J., Computational Techniques for Fluid Dynamics 1, Fundamental and General Techniques, Springer, Verlag, 1987.
5. Fletcher, C. A. J., Computational Techniques for Different Flow Categories, Springer-Verlag, 1987.
6. Bose, T.K., Numerical Fluid Dynamics, Narosa Publishing House, 1997.
7. Ghoshdasdar, P. S., Computer Simulation of flow and heat transfer, Tata McGraw-Hill Publishing Company Ltd., 1998.

MEC6203	COMBUSTION IN ENGINES	L	T	P	C
		3	0	0	3

COMBUSTION PRINCIPLES

Thermodynamics - concepts of combustion – combustion equations - heat of combustion theoretical flame temperature - chemical equilibrium and dissociation.

CHEMICAL KINETICS

Theories of combustion - pre-flame velocities - reaction rates - laminar and turbulent flame propagation in engines.

COMBUSTION IN S.I. ENGINES

Initiation of combustion - flame velocities - normal and abnormal combustion - knocking combustion - pre-ignition - knock and engine variables - features and design consideration of combustion chambers - stratified charge combustion - concepts of lean burn engines - heat release correlations.

COMBUSTION IN C.I. ENGINES

Various stages of combustion - vaporization of fuel droplets and spray formation - air motion - swirl measurement - delay period correlations - diesel knock and engine variables - features and design considerations of combustion chambers.

COMBUSTION IN GAS TURBINE

Flame stability, re-circulation zone and requirements - combustion chamber configuration.

Text Book

1. Samir Sarkar, Fuel and Combustion, 2nd Edition, Orient Longman, 1990.

References

1. Ganesan, V., Internal Combustion Engines, Tata McGraw Hill Book Cop., 1995.
2. John, B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Book, 1998.
3. Mathur M. L., and Sharma, R. P., A Course in Internal Combustion Engines, Dhanpat Rai Publications Pvt. New Delhi-2, 1993.
4. Obert, E. F., Internal Combustion Engine and Air Pollution, International Text Books Publishers, 1983.
5. Cohen, H. Rogers, G, E. C. and Saravanamutto, H. I. H., Gas Turbine Theory, Longman Group Ltd, 1980.

MEC6204	MANUFACTURING AND TESTING OF IC ENGINES AND COMPONENTS	L	T	P	C
		3	0	0	3

CYLINDER BLOCK AND CYLINDER HEAD

Casting practice and special requirement, materials, machining, methods of testing.

PISTON ASSEMBLY

Types, requirement, casting, forging, squeeze casting, materials, machining, testing, manufacture and testing of fuel and ignition, bimetallic pistons, articulated pistons.

CONNECTING ROD, CRANKSHAFT AND CAMSHAFT

Requirements, materials, forging practice, machining, balancing of crankshaft, testing, manufacturing of fuel system parts such as carburetor, gasoline injection system and diesel injection system and diesel injection parts.

COMPUTER INTEGRATED MANUFACTURING

Integration of CAD, CAM and business function CIM – networking, CNC programming for machining of I.C. Engines components.

QUALITY AND TESTING

Introduction to ISO 9000, ISO 14000, QS9000, its importance, BIS codes for testing various types of engines, equipments, required, instrumentation, and computer aided engine testing, metrology for manufacturing I.C. engine components.

Text Book

1. Heldt, P. M. High Speed internal combustion engines, Oxford and IBH Publishing Co., 1960.

References

1. Grover, M.P., CAD/CAM, Prentice Hall of India Ltd., 1985.
2. Heldt, P. M. High Speed internal combustion engines, Oxford and IBH Publishing Co., 1960.
3. Judge, A. W., Testing of high Speed internal combustion engines, Chapman and Hall, 1960.
4. Richard, W., Heine Carl R.Loper Jr. and Philip, C., Rosenthal, Principles of Metal Casting, McGraw Hill Book Co., 1980.
5. IS: 1602 – 1960 Code for testing of variable speed internal combustion engines for Automobile Purposes, 1966.
6. SAE Handbook, 1994.
7. P. Radhakrishnan and S. Subramaniyan, CAD/CAM/CIM, New Age International (P) Limited Publishers, 1997.
8. Mikett, P. Groover, Automation, production systems and computer, Integrated Manufacturing, Prentice Hall of India Private Limited, 1999.

MEC6205	SUPERCHARGING AND SCAVENGING	L	T	P	C
		3	0	0	3

SUPERCHARGING

Objectives - effects on engine performance - engine modification required - thermodynamics of mechanical supercharging and turbo charging - turbo charging methods - engine exhaust manifolds arrangements.

SUPERCHARGERS

Types of compressors - positive displacements blowers - centrifugal compressors - performance characteristic curves - suitability for engine application – surging - matching of compressors, turbine engine.

SCAVENGING OF TWO STROKE ENGINES

Peculiarities of two stroke cycle engines - classification of scavenging systems - mixture control through reed valve induction - charging process in two stroke cycle engine – terminologies - Shankey diagram - relation between scavenging terms - scavenging modeling - perfect displacement, perfect mixing - complex scavenging models.

PORTS AND MUFFLER DESIGN

Porting - design considerations - design of intake and exhaust systems -tuning.

EXPERIMENTAL METHODS

Experimental techniques for evaluating scavenging - firing engine tests - non firing engine tests - port flow characteristics - Kadenacy system - orbital engine combustion system - sonic system.

Text Book

1. Obert, E. F., Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

References

1. Richard Stone, Internal Combustion Engines, SAE, 1992.
2. Vincent, E. T., Super charging the I.C. Engines, McGraw-Hill.
3. Watson and Janota, M.S., Turbo Charging the I.C. Engines, Macmillan Co.,
4. Schweitxer, P. H., Scavenging of two Stroke Cycle Diesel Engine, Macmillan Co., 1984.
5. John, B., Heywood, Two stroke cycle engine, SAE publications, 1997.

MEC6206	ALTERNATIVE FUELS AND SPECIALTY ENGINES	L	T	P	C
		3	0	0	3

FUELS

Availability and suitability to piston engines, concept of conventional fuels, potential alternative fuels - ethanol, methanol, DEE/MEE - hydrogen, LPG, natural gas, producer gas, bio gas and vegetable oils - use in I.C. engines - merits and demerits of various fuels.

UNCONVENTIONAL FUELS

Solar energy, introduction, extra terrestrial solar radiation-radiation at ground level, collectors, photovoltaic solar cells-p-n junction-Scotty junction, electrolyte - semiconductor characteristics of solar cells - solar chargeable battery - biomass energy - introduction-biomass conversion-biogas production - ethanol production - direct combustion - applications.

S.I. ENGINE SYSTEMS

Spark ignition engine system variants - stoichiometric, lean-burn, port injected/direct injected, carbureted - air assisted fuel injection engines, HEV Engines; dedicated alternative fuelled engine systems-CNG, LPG, H₂, Alcohols.

C.I. ENGINE SYSTEMS

Compression ignition engine systems variants-low, medium and high speed systems characteristics, high pressure fuel injection systems, coal and producer gas fueled engine systems.

SPECIAL PURPOSE ENGINE SYSTEMS

Engines for special applications - mining, defense, off-highway - tractor, bulldozer etc - submarines, race car engine systems, flexible fuelled systems.

Text Book

1. Osamu Hirao and Richard, K. Pefley, Present and future Automotive fuels, John Wiley and sons, 1998.

References

1. Keith Owen and Trevor Eoley, Automotive Fuels hand book, SAE publications, 1990.
2. Richard, L. Betchold, Automotive fuels Guide book, SAE Publications, 1997.
3. Jan P.Norbye, The Wankel Engine-Design, Development Application, Chilton Book Company, USA, 1971.
4. Introduction to Internal combustion engines, Richard Stone, Third Edition, Society of Auto motive engineers Inc, USA, 1999.
5. Diesel Engine Reference Book, Bernard Challen and Rodica baranescu (Editors) 2nd edition, R-183, SAE International, 1999.
6. Ansadle, R.F., The Wankel RC Engine, A. S. Barnes and Co., USA, 1969.
7. Bosch Technical Instruction Booklets, Robert Bosch Gnph, Germany, 1985.
8. Vezhigolu, T.N., Alternative Energy Sources, Vol. 5 and 6, McGraw-Hill, 1978.

MEC6207	VEHICLE ACOUSTICS	L	T	P	C
		3	0	0	3

Physical and audio logical basis of automotive acoustics.

Noise emission standards - measurement and regulations and procedures.

Noise generation and technical reduction potentials

Specific vehicle noise sources like power train, brakes, tyres etc. and the reduction methods.

Influences of manufacture, customer and legislation on the reduction of traffic noise – use of anechoic chamber in the sound level measurement.

Note: Course offered by German professors - reference to be quoted by that professor.