MAHATMA GANDHI UNIVERSITY

B.TECH. DEGREE COURSE

5TH SEMESTER

SCHEME
&
SYLLABUS

2002

MECHANICAL ENGINEERING BRANCH

MECHANICAL ENGINEEING

SCHEME

5TH SEMESTER

Course Code	Course No.	Subject	Teaching Periods			Duration of Uty. Exam. (Hrs.)	Marks			
			Lect.	Tut.	Prac.		Sessional	Theory	Practical	Total
A	CMEL PA 501	Engineering Mathematics - IV	3	1	-	3	50	100	-	150
B	M 502	Manufacturing Processes	3	1	-	3	50	100	-	150
C	M 503	Computer Programming	2	2	-	3	50	100	-	150
D	M 504	Theory of Machines II	2	2	-	3	50	100	-	150
E	M 505	Mechatronics and Control systems	2	2	-	3	50	100	-	150
F	M 506	Thermal Engineering - I	2	2	-	3	50	100	-	150
G	M 507	Computer Laboratory	-	-	3	3	50	-	100	150
H	M 508	Machine Tool Laboratory	-	-	3	3	50	-	100	150
		Total	14	10	6	-	400	600	200	1200

SYLLABUS

ENGINEERING MATHEMATICS - IV

CMELPA501 **3+1+0**

Module 1

Complex Integration: Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities-Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

Module 2

Numerical solution of algebraic and transcendental equations: Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

Module 3

Numerical solution of ordinary differential equation: Taylor's series method-Euler's method –Modified Euler's method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

Module 4

Z – Transforms: Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property-inverse transform – solution of 1^{st} & 2^{nd} order difference equations with constant coefficients using Z transforms.

Module 5

Linear programming: graphical solution – solution using simplex method (non – degenerate case only) – Big-M method, two phase method- Duality in L.P.P.-Balanced T.P. – Vogels approximation method – Modi method.

References

1. Advanced Engineering Mathematics – Ervin Kreyszig, Wiley Eastern limited.
2. Numerical methods in Engineering & Science – Dr. B.S.Grewal, Kanna Publishers.
3. Higher Engineering Mathematics – Dr. B.S.Grewal, Kanna Publishers.
4. Numerical methods in Science & Engineering – Dr. M.K.Venkitaraman, National Publishing Company.
5. Quantitative techniques Theory & Problems – P.C.Tulsian, Vishal Pandey, Pearson Education Asia.
6. Complex variables and applications – Churchill and Brown, McGraw-Hill.
7. Operations research – Panneer Selvam, PHI
8. Engineering Mathematics vol III – S.Arumugam, A.T.Isaac, Somasundaram, Scitech publications
9. Advanced Mathematics for Engg.students vol III –S.Narayanan, T.K.M.Pillay, G.Ramanaigh, S.Vishwananthan printers & publishers.

MANUFACTURING PROCESSES

M 502 **3+1+0**

Module 1

Patterns: - pattern allowances and materials-moulding-core and core prints-types of cores- pattern construction-layout and colour coding-tools-processes-moulding sand constituents, types and testing-moulding machines-moulding procedure-sand conditioning-gating system-cupola operation-pouring and cleaning of castings-defects in castings-inspection and quality control-casting machines-design of dies-centrifugal, continuous, investment, squeeze casting and shell- mould casting- - comparison of casting with other production processes.(include necessary figures)

Module 2

Welding: - definition-metallurgy of welding-applications – classification - mechanism-processes-gas welding - details, equipment, fluxes and filler rods - design effect of weld parameters on weld quality-flame cutting-ISI specification for welding. Arc welding applications-equipment –polarity-governing factor in fusion welding-electrodes and types-ISI specification for electrodes –Welding design-butt joint-TIG-GMA-CO_2 process. Submerged arc, electroslag plasma arc and flux cored arc welding-resistance, thermit solid state, electron beam and laser welding.Brazing: soldering-explosive welding-inspection and defects in welding-welding of plastics.(include necessary figures)

Module 3

Rolling: - principles-types of rolls and rolling mills-semifinished and rolled products- rolling of tubes, wheels, axles, I-beam-thread and gear rolling-friction and lubrication in metal forming-hot and cold rolling-rolling machines-heating and cooling in rolling-strip velocity and roll velocity-roll and roll pass design - Theories of rolling and effect of parameters-load calculation-High velocity forming - energysources - material behaviour - pneumatic, mechanical, electrohydraulic, electromagnetic, and explosive forming.

Module 4

Press working: - types of presses and pressworking operations involving shearing, bending, drawing, squeezing-Extrusion: - methods, machines-analysis of rod extrusion-Wire and wire drawing operations-analysis-die angles-simple, progressive and compound dies-plastic and rubber processing-Calendering-transfer, injection and compression moulding.

Module 5

Forging: -classification-process-equipments-drawing, deep drawing, punching, blanking- tube piercing-spinning and coining-elastic and plastic deformation-hot forging, die forging- machinery for forging-operation-heating in forging-manufacture of drop forging dies, presses-design of forgings and dies-upsetting-

forging defects-forging analysis-quality assurance for forging-non destructive testing.

References

1. Workshop Technology - Raghuvanshi
2. Manufacturing Engineering & Technology - S.Kalpakjian and S.A.Schmidt
3. Manufacturing Processes - Begeman
4. Manufacturing Science & Technology; Vol. I - Suresh Daleela
5. Processes and Materials of Manufacture - Roy A.Lindberg

COMPUTER PROGRAMMING

M503 **2+2+0**

Module 1

Introduction to C language – character set – operators – constants and variables – data types – use of built in I/O functions - use of control statements if, if – else, for, while, do-while and switch – use of logical AND, OR and NOT – pre-processor directive - writing summation of various mathematical series like e^x, sin(x), cos(x) etc.

Module 2

Arrays – declaration of one dimensional array and its handling – bubble sorting – quick sorting – searching – string handling functions – multidimensional arrays and its handling – structure and union – array of structures – sorting of strings – programs

Module 3

Functions – declaration – global and local variables - call by value method – writing different string handling functions – storage classes – passing an array to a function – passing a structure to a function – recursion - macros – programs

Module 4

Declaration and use of pointers – call by reference method – pointer to an array – pointer to a structure – array of pointers – pointer to an array – self-referential structure – dynamic memory allocation – linked lists – programs

Module 5

Different types of files – reading writing and appending of text and binary files – other various file handling functions - transfer of data in blocks - command line arguments – use of bit-wise AND, OR and NOT.

References

1. Programming with C – Schaum's series
2. Programming in C – Balaguruswamy
3. The C Programming Language – Kerningham & Ritchie
4. Let us C – Yaswant Kanetkar
5. Programming with ANSI and Turbo C – Kamthane, Pearson

THEORY OF MACHINES - II

M 504 **2+2+0**

Module 1

Static force analysis: - force couples-condititons for equilibrium-free body diagram- analysis of four bar chain-force analysis of slider-crank mechanism-Coulomb friction.

Dynamic force analysis: - D'Alemberts principle-inertia forces-dynamic force analysis of four bar chain, and slider crank mechanism.

Module 2

Governors: - terminology; Watt, Porter, Proel, Hartnell, Hartung, Wilson-Hartnell, and Pickering governors-spring controlled governors of gravity type-effort and power-controlling force diagram-quality of governors-effect of friction-insensitiveness-stability-inertia governors- governor speed, torque characteristics of an engine-governor and flywheel.

Module 3

Turning moment diagram and Flywheel: - coefficient of fluctuation of energy and speed- energy saved in a flywheel-punching press-dynamically equivalent two mass system-centre of percussion-kinetic equivalence-reversed effective force analysis-piston effort-crankpin effort- crank effort-turning moment diagrams for steam and I.C. engines.

Module 4

Gyroscope: - principle-angular acceleration-effect of gyroscopic couple on bearings, airplanes, and ships-stability of automobile and two wheel vehicles-gyroscopic stabilization of sea vessels and grinding mills.

Gear trains: -simple, compound-epicyclic trains with coaxial shafts.

Module 5

Cams and Followers: - types-follower motion-SHM-uniform velocity and acceleration- cycloidal - displacement, velocity and acceleration curves-cam profile-reciprocating and oscillating followers-tangent cams-convex and concave cams with footed followers.

References

1. Mechanism and Machine Theory - Ambedkar
2. Theory of Mechanism and Machines - A.Ghosh & A.K.Mallick
3. Theory of Machines - V.P.Singh
4. Theory of Machines - P.L.Ballaney
5. Theory of Mechanism and Machines - Joseph Shigley
6. Dynamics of Machinery - Holovanco

MECHATRONICS AND CONTROL SYSTEMS

M 505 **2+2+0**

Module 1

Introduction: - Scope of Mechatronics-systems-microprocessor based controllers-mechatronic approach-sensors – transducers - force-velocity – displacement - temperature-inputting data by switches-signal coditioning - operational amplifiers-filtering-multiplexers-data acquisition- modulation. Data presentation systems: - displays-measurement systems-calibration-pneumatic and hydraulic systems-control valves-actuators-mechanical and electrical actyation systems-relays and solenoid switches and proximity pickups.

Module 2

Input/Output systems: - ports, interface requirements-adaptors-programmable logic controllers-data-handling- digital communications-system, networks, protocols, interfaces, fault finding-design and mechatronics-design solutions.
Electromechanical systems: CD, DVD ROMs, OCR, Printers-Medical devices: Artificial internal organs-Diagnostic and Therapeutic EMDs.

Module 3

Introduction to Control systems Engineering:- concept of automatic control-open loop and closed loop systems-servomechanisms-block diagrams-transfer functions. Representation of control components and systems-Translational and rotational mechanical components-series and parallel combinations-comparators, integrating devices, hydraulic servomotors, temperature control systems, and speed control systems.

Module 4

System response: - First and Second order system response to step, pulse, ramp, and sinusoidal input-systems with distance, velocity lag. Control system analysis: - Transient response of simple control systems-Stability of control systems-Routh stability criteria- error analysis.

Module 5

Frequency response analysis: - polar, rectangular and logarithmic plots-experimental determination of frequency response-Bode, and Nyquist stability criteria-Gain and phase margin. Root locus of simple transfer functions-transient response from root locus.

References

1. Mechatronics - W.Bolton, Pearson
2. Understanding Electromechanical Engineering - Lawrence J.Kamm
3. Mechatronics - Dan S. Necsuleseu, Pearson
4. Control System Engineering - T.J.Nagrath and M.Gopal
5. Automatic Control Theory - Ravan
6. Modern Control Engineering - Katsuhiko Ogata
7. Control Systems - A.Nagoor Kani
8. Modern Control Engineering - Dorf, Pearson

THERMAL ENGINEERING - I

M 506 **2+2+0**

Module 1

Steam Engineering: Properties of steam - wet, dry and superheated steam - dryness fraction - enthalpy and internal energy - entropy of steam - temperature entropy diagram - process - Mollier chart - Rankine cycle for wet, dry and superheated steam. Steam Generators - classification - modern steam generators - boiler mountings and accessories.

Module 2

Steam nozzles - Mass flow rate - throat pressure for maximum discharge - throat area - effect of friction - super saturated flow.

Steam turbines: velocity triangles, work done, governing, and efficiencies.

Module 3

Gas turbine Plants - Open and closed cycles - thermodynamics cycles - regeneration, re heating - inter cooling - efficiency and performance of gas turbines. Rotary Compressors - Analysis of rotary compressors - centrifugal and axial compressors. Combustion - combustion chambers of gas turbines - cylindrical, annular and industrial type combustion chamber - combustion intensity - combustion chambers efficiency - pressure loss combustion process and stability loop.

Module 4

Introduction to solar energy - solar collectors - Liquid flat plate collectors - principle - thermal losses and efficiency - characteristics - overall loss coefficient - thermal analysis - useful heat gained by fluid - mean plate temperature -

performance - focussing type solar collectors - solar concentrators and receivers - sun tracking system - characteristics - optical losses - thermal performance - solar pond - solar water heating - solar thermal power generation (Description Only)

Module 5

Thermal power plants: layout and operation of steam and diesel power plants - coal burners - stockers - cooling ponds & towers - chimneys - draught - dust collectors - precipitators - feed water heaters - evaporators - steam condensers - coal handling - ash handling.

References

1. Power plant technology - E. L. Wahid
2. Thermodynamic and heat power engineering - Mathur and Mehta
3. Thermal Engineering - P. L. Ballaney
4. Gas Turbine Theory - Cohen & Rogers
5. Solar Energy Utilization - G. D. Rai
6. Thermal engineering - R.K. Rajput.

COMPUTER LABORATORY

M 507 **0+0+3**

a) Familiarization of operating systems. Use of file directories, editors, compilers and file managers etc.
b) Familiarization of Word processing packages – editing, formatting and printing
c) Familiarization with spread sheet packages for graphical representation of data
d) Introduction to computer aided drafting – drawing simple objects
e) Programming experiments in C to cover control structures functions, arrays, structures, pointers and files

Examples: -

i. Counting characters, lines and words
ii. Checking leap year
iii. Finding sum of digits and reversing a number
iv. Generating Prime numbers, Fibonacci numbers and Angstrom numbers
v. Sine and Cosine series
vi. Sorting of numbers, strings and records
vii. Matrix addition and multiplication
viii. Implementation of dynamic memory allocation
ix. Implementation of linked lists

x. File handling
xi. Problems using Command line arguments

MACHINE TOOL LABORATORY

M 508 **0+0+3**

Study of Centre Lathe: Origin of the name lath and lathe- specification of lathe- head stock, tail stock, carriage, cross slide, compound rest, guide ways, feed gar box, apron box, micro structural requirement of bed material. Accessories: Chuck, two and three jaws, and faceplate, follow rest, tool post grinder, and centres.

Study of Machining technology: Study of metal cutting – tool terminology as per ASA, ISO, DIN standards –merchant's circle, Lee & Shaffer theory, thick & thin zone models - tool materials, coated HSS, ceramic, CBN, diamond etc, inserts, chip breakers -- Tool wear mechanisms, VB determination - Use of Taylor's equation at shop floor - Machineabilty index - Role of specific heat in cutting fluids. – Cutter types and selection – Abrasive machining (Ra values) – Diamond turning of parts (Ra values) - Production of axi – symmetric parts – Production of prismatic components – Hole machining – Gear machining.

Study of Basic measurement and devices: accuracy, precision, sensitivity, and standards of measurements, metrology lab; standard and calibration, linear measurements, limit gauges (types and design), Taylor's principle, comparators (optical, mechanical, electrical, pneumatic), slip gauges, optical projector with digital measuring. – Geometrical measurements: angular measurements, vernier and optical protractors, sine bar. - Measurement of light wave interference, flatness and parallelism and round measurement, checking the dimensional accuracy of slip gauges with interference microscope. - *Surface characterization*: measurement of surface finishes RMS and CLA values, waviness, cut off, skid, instruments for measurement of roughens of a sand cast surface, slip gauge surface, ground bore of an engine cylinder, importance of surface finish on crack initiation. – *Screw thread terminology*, best wire size, two and three wire methods pitch measurement – Gear metrology (spur gear): run out checking, composite errors, base pitch measurement, profile measurement, checking backlash, alignment errors. – *Advanced measuring devices:* CMM, machine vision, toolmakers microscope, limitations, SEM, & TEM, laser measuring instruments, laser micrometer and alignment test using laser interferometry.

Experiments

Measurement of cutting forces in machine tools using dynamometers –process capability study of Machines –grinding of tool angle using tool and cutter grinding machine in a tool room –Turning & taper turning, turning & thread cutting, - Indexing & Gear cutting, pocket milling— Study of tool and machine monitoring systems.- Angular measurements use of sine bar and slip gauges, measurement of angle using clinometer, bevel protractor – calibration of plug and snap gauges using slip gauges – Roundness measurement : cylindricity, concentricity, perpendicularity using dial stand and measuring bench – Surface

finish measurement.- Optical profile projector: study of profile of gear tooth, screw threads, other tools – Tool makers microscope: to study tool geometry, screw threads, measurement of turning tool wear of VB & KT values –Flatness measurement of surface table using auto collimator – Lathe alignment test using laser interferometer – gear concentricity tester, gear roll tester and gear tooth measurement.

Student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and university examination shall be done by Faculty members.

References

1. Acharkan. N. -Machine Tool Design Vol. 1 to 4, MIR Publication.
2. HMT- Production Technology, TMH.