

Semester 4

Theory

S.no	Subject name	L	P	M
01	Control Systems	4	0	100
02	Dynamics of machine	4	0	100
03	Machine Tools and Process	4	0	100
04	Microprocessor and Interfacing	4	0	100
05	Numerical methods	4	0	100
06	Power Electronics	4	0	100

Practical

S.no	Subject name	L	P	M
07	Microprocessor Lab	0	3	100
08	Power Electronics Laboratory	0	3	100

Semester IV

Control Systems

4 0 100

1. BASIC CONCEPTS AND SYSTEM REPRESENTATION (9)

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.

2. 2.TIME RESPONSE ANALYSIS AND DESIGN (9)

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

3. 3.FREQUENCY RESPONSE ANALYSIS AND DESIGN (9)

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

4. 4.STABILITY (9)

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

5. 5.COMPENSATION DESIGN (9)

Design concepts - realization of basic compensation - cascade compensation in time domain and frequency domain (Simple MATLAB applications to analysis and compensators design problems.)

TOTAL HOURS:45

Text Books:

1. Gopal M. " Control System Principles and Design ", Tata McGraw Hill, 1998.
- References:
 1. Ogatta, " Modern Control Engineering ", Tata McGraw-Hill, 1997.[MATLAB reference]
 2. Chesmond C.J., " Basic Control System Technology ", Viva Low Priced Student Edition, 1998.
 3. Nagarath I.J. and Gopal M., " Control System Engineering ", Wiley Eastern Ltd., Reprint, 1995.
 4. Dutton K., Banaclough W. and Thompson S., " The Art of Control Engineering ", Addison Wesley.
 5. Dorf R.C. and Bishop R.H., " Modern Control systems ", Addison-Wesley,

1995 (MATLAB reference)

6. Leonard N.E. and William Levine, " Using MATLAB to Analyse and Design Control Systems ", Addison Wesley, 1995.

Semester IV

Microprocessor and Interfacing

4 0 100

1. UNIT I (9)

Introduction to Microprocessors: Organisation of a microprocessor based system comparison of microprocessors with mini and large computers typical applications microprocessors of different makes: Intel :Motorola and Zilog. Architecture and Organization: Intel 8085: Pin configuration √ internal register organization √ addressing methods √ instruction set

6. 2.UNIT II (9)

Memory and I/O interfacing: Logic devices for interfacing Memory interfacing I/O interfacing interrupt structure Programmable interrupt controllers DMA structure programmable DMA controller.

7. 3.UNIT III (9)

Interface Design: System design using programmable peripheral interface keyboard/ Display controller programmable interval timer programmable communication interface.

8. 4.UNIT IV (9)

Input/Output Switches keypads displays stepper motors DC motors analog to digital converters digital to analog converters.

9. 5.UNIT V (9)

Advanced Microprocessors: Architecture of inter 8085 microprocessor - pin configuration minimum mode maximum mode internal register organization interrupt structure addressing modes multiprocessor architecture support

TOTAL HOURS:45

TEXT BOOKS:

1. RAMESH GAONKAR," Microprocessor Architecture, Programming and Applications with the 8085 ", Pentech press, 1997.
2. KENT STIFLER A." Design with Microprocessors for Mechanical Engineers " Mc. Graw Hill Book co., Singapore.

REFERENCES:

1. DOUGLAS V HALL. Microprocessors and interfacing Programming and Hardware, McGraw Hill Inc., 1992.
2. Microcontroller Hand Book, INTEL 1984.

Semester IV

Power Electronics

4 0 100

1. POWER SEMICONDUCTOR DEVICES (9)

Principle of operation - Characteristics and modeling of power diodes, SCR, TRIAC, GTO, power BJT, powerMOSFET and IGBT.

2.PHASE CONTROLLED CONVERTERS (9)

2 pulse , 3 pulse and 6 - pulse converters - inverter operation - input power factor - effect of source inductanceand firing circuits.

3.DC TO DC CHOPPERS (9)

Voltage, current and load - commutated choppers - step up chopper and firing circuits.

4.INVERTERS (9)

Series inverter - Voltage source inverters - current source inverters - PWM inverters.

5.AC VOLTAGE CONTROLLERS (9)

Single phase AC voltage controller - multi stage sequence control - step up and step down cycloconverters -three phase to single phase and three phase cycloconverters.

TOTAL HOURS:45

Text Books:

1. Rashid, M.H., " Power Electronics - Circuits Devices and Applications ", Prentice Hall International, 1995.

References:

1. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., " Thyristorised Power Controllers ", Wiley Eastern Limited, 1986.
2. Lander, W., " Power Electronics ", McGraw Hill and Company, Third Edition, 1993.

Semester IV

NUMERICAL METHODS

4 0 100

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS (9)

Iterative method, Newton – Raphson method for single variable and For Simultaneous equations with two variables. Solutions of a linear system By Gaussian, Gauss-Jordan, Jacobi and Gauss – Seidel methods. Inverse of a Matrix by Gauss – Jordan method. Eigen value of a matrix by Power and Jacobimethods

2. INTERPOLATION (9)

Newton's divided difference formulae, Lagrange's and Hermite's polynomials. Newton forward and backward difference formulae. Stirling's and Bessel's Central difference formulae.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION (9)

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both 1/3rd and 3/8th) rules. Two and Three point Gaussian quadrature formula Double integrals using Trapezoidal and Simpson's rule.

1. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (9)

Single step Methods – Taylor Series, Euler and Modified Euler, Runge – Kutta method of order four for first and second order differential equations. Multistep Methods- Milne and Adam's Bashforth predictor and corrector methods.

2. BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (9)

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation both implicit and explicit), One-dimensional wave equation and two-dimensional Laplace and Poisson equations.

TOTAL HOURS:45

TEXT BOOKS:

1. Sastry, S.S., “Introductory Methods of Numerical Analysis(Third Edition)”, Prentice Hall of India, New Delhi, 1998.

REFERENCES

1. Kandasamy, P., Thilakavthy, K. and Gunavathy, K. “Numerical Methods”, S.Chand and Co., New Delhi, 1999.
2. Grewal B.S., Grewal J.S., “Numerical Methods in Engineering and Science”, Khanna Publishers, New Delhi, 1999.
3. Jain M.K., Iyengar S.R.K and Jain R.K., “Numerical Methods for Engineering And Scientific Computation (Third Edition)”, New Age International (P) Ltd., New Delhi, 1995.
4. Gerald C.F., Wheatley P.O., Applied Numerical Analysis (Fifth Edition), Addison – Wesley, Singapore, 1998.
5. Narayanan S., Manickavachakam Pillai K. and Ramanaiah G., “Advanced Mathematics for Engineering Students-Vol.-III”, S.Viswanathan Pvt. Ltd., Chennai, 1993.

Semester IV

Dynamics of Machines

4 0 100

1.FORCE ANALYSIS

(9)

Applied and Constraint Forces - Free body diagrams - Static Equilibrium conditions - two, three and four force members - Static force analysis in simple mechanisms - Dynamic force analysis - Inertia force and Inertia torque - D'Alembert's principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines - Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels - Engine shaking Forces - Cam dynamics - Analysis of Rigid and Elastic body cam system - Unbalance, Spring, Surge and Windup.

2.BALANCING

(9)

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines

3.FREE VIBRATION

(9)

Basic features of vibratory systems - idealized models Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems.

4.FORCED VIBRATION

(9)

Response to periodic forcing - Harmonic Forcing - Forcing caused by unbalance - Support motion - Force transmissibility and amplitude transmissibility Vibration isolation.

5.MECHANISM FOR CONTROL

(9)

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling Force other Governor mechanisms. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes - Introduction to Automatic Controls.

TOTAL HOURS:45

Text Books:

1. Shigley J.E. and Uicker J.J., " Theory of Machines and Mechanisms ", McGraw Hill, Inc., 1995.

References:

1. Thomas Bevan, " Theory of Machines ", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., " Theory of Mechanisms and Machines ", Affiliated

- East-West Press Pvt.Ltd., New Delhi, 1988.
3. Rattan S.S., " Theory of Machines ", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
 4. Rao J.S. and Duggipati R.V., " Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi, 1992.
 5. John Hannah and Stephens R.C., " Mechanics of Machines ", Viva low-Priced Student Edition, 1999.

Semester IV

Machine Tools and Processes

4 0 100

1. FUNDAMENTALS OF CUTTING (9)

Mechanics of chip formation-Types of chips produced in cutting - Mechanics of orthogonal and oblique cutting-Cutting forces and power- Temperature in cutting- Tool life: Wear and failure-Surface finish and integrity-Machinability.

2.MACHINING PROCESSES FOR PRODUCING ROUND SHAPES (9)

Turning parameters-lathes and Lathe operations-High speed machining-Ultraprecision Machining and Hand turning - Cutting screw threads - Boring and bring machines- Drilling and drills-Drilling machines-reaming and reamers-tapping and taps-Design considerations for drilling, reaming and tapping.

3.MACHINING PROCESSES FOR PRODUCING VARIOUS SHAPES (9)

Milling operations-Milling machines-Planing and shaping-Broaching and broaching machines-Sawing-filling and finishing-gear manufactured by machining.

4.ABRASIVE MACHINING AND FINISHING OPERATIONS (9)

Abrasives-bounded abrasives-grinding-process-wheel gear-grinding operations and machines-fluids-Design Consideration for grinding-Ultrasonic machining-finishing operations-deburring-economics of grinding and finishing operation.

5.MACHINE TOOL STRUCTURES AND CUTTING TOOLS (9)

Machine tool structures-Vibration and chatters in machining-Machining economics-Cutting tool steels, cobalt alloys, coated tools. Nitride tools and Diamond-Cutting tool reconditioning-Cutting fluids.

TOTAL HOURS:45

TEXT BOOK:

KALPAKJIAN, Manufacturing Engineering and Technology, Addison Wesley, 1995.

REFERENCES:

1. P.C.SHARMA, A Text book of Production Technology, S.Chand and Co., Ltd., 1999.
2. KRAR, OSWARD, Technology of Machine Tools, McGraw Hill International Editions, 1991.

3. ROY A LINDBERG, Fourth Edition, Process and Materlas of Manufacture, Prentice-Hall of India, 1994.
4. E.PAUL DeGARMA, J.T.BLACK and RONALD A.KOSHER, Eighth Edition, Materials and Processes in Manufacturing Prentice-Hall of India, 1997.

Semester IV

Microprocessor Lab

0 3 100

I. PROGRAMMING

1. Addition of Two 8-bit numbers, Sum of 8-bits and 16bits.
2. Decimal addition of two 8-bit numbers Sum: 16 bits.
3. 8-bit subtraction.
4. 8-bit Decimal subtraction
5. Additional of Two 16-bit numbers, Sum: 16 bits or more.
6. Multibyte Subtraction.
7. Multibyte Subtraction.
8. To arrange a series of numbers in ascending order.
9. To arrange a series of numbers in descending order.
10. 8-bit Multiplication.
11. 8-bit Division.
12. Decimal to hexadecimal conversion and Hexadecimal number to Decimal number conversion.

TOTAL HOURS: 45