# DEPARTMENT OF INSTRUMENTATION ENGINEERING

## BE (E & I) PART TIME CURRICULUM

### I - SEMESTER

<table>
<thead>
<tr>
<th>SL No</th>
<th>Course code</th>
<th>Course Title</th>
<th>L</th>
<th>P</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PTMA 172</td>
<td>Mathematics - I</td>
<td>3</td>
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<tr>
<td>2.</td>
<td>PTPH 173</td>
<td>Physics</td>
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<td>3.</td>
<td>PTCH 173</td>
<td>Chemistry</td>
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<tr>
<td>4.</td>
<td>PTGE 172</td>
<td>Fundamentals of Computing</td>
<td>3</td>
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<tr>
<td>5.</td>
<td>PTEI 182</td>
<td>Electron Devices</td>
<td>3</td>
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### II - SEMESTER

<table>
<thead>
<tr>
<th>SL No</th>
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<tbody>
<tr>
<td>1.</td>
<td>PTMA 182</td>
<td>Mathematics - II</td>
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<tr>
<td>2.</td>
<td>PTEI 271</td>
<td>Digital Logic Theory</td>
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<td>3.</td>
<td>PTEI 273</td>
<td>Electronic Circuits</td>
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<td>4.</td>
<td>PTEI 274</td>
<td>Object Oriented Programming</td>
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<td>5.</td>
<td>PTEI 282</td>
<td>Electrical Measurements</td>
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### III - SEMESTER

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<thead>
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<tbody>
<tr>
<td>1.</td>
<td>PTEI 281</td>
<td>Data structures and Algorithms</td>
<td>3</td>
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<tr>
<td>2.</td>
<td>PTEI 283</td>
<td>Transducer Engineering</td>
<td>3</td>
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<td>3.</td>
<td>PTEI 284</td>
<td>Communication Engineering</td>
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<td>4.</td>
<td>PTEI 376</td>
<td>Electronic Instrumentation</td>
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<td>5.</td>
<td>PTEI 386</td>
<td>Transducer Engineering Lab</td>
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### IV - SEMESTER

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<tbody>
<tr>
<td>1.</td>
<td>PTEI 371</td>
<td>Control Engineering</td>
<td>3</td>
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<td>2.</td>
<td>PTEI 372</td>
<td>Industrial Instrumentation 1</td>
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<td>3.</td>
<td>PTEI 374</td>
<td>Linear and Digital ICs</td>
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<td>4.</td>
<td>PTEI 375</td>
<td>Microprocessors and Microcontrollers</td>
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<td>5.</td>
<td>PTEI 378</td>
<td>Microprocessor and Microcontroller Lab</td>
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## V - SEMESTER

<table>
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<th>Sl. No</th>
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<tbody>
<tr>
<td>1.</td>
<td>PTEI 372</td>
<td>Digital Signal Processing</td>
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<td>2.</td>
<td>PTEI 381</td>
<td>Analytical Instrumentation</td>
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<td>3.</td>
<td>PTEI 382</td>
<td>Industrial Instrumentation II</td>
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<td>Process Control</td>
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<td>5.</td>
<td>PTEI 386</td>
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## VI - SEMESTER

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<thead>
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<th>Sl. No</th>
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<tr>
<td>1.</td>
<td>PTEI 385</td>
<td>Digital System and VLSI Design</td>
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<td>Computer Control of Processes</td>
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<td>3.</td>
<td>PTEI 472</td>
<td>Computer Networks and DCS</td>
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<td>Design Project</td>
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## VII - SEMESTER

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<tr>
<td>1.</td>
<td>PTGE 381</td>
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<td>Elective IV</td>
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<td>Project work</td>
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## ELECTIVES

<table>
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<tr>
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<tbody>
<tr>
<td>1.</td>
<td>PTEI 071</td>
<td>Fibre Optics and Laser Instrumentation</td>
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<td>PTEI 072</td>
<td>Bio Medical Instrumentation</td>
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<td>3.</td>
<td>PTEI 073</td>
<td>Power Plant Instrumentation</td>
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<td>4.</td>
<td>PTEI 074</td>
<td>Instrumentation in Petrochemical Industry</td>
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<td>5.</td>
<td>PTEI 075</td>
<td>Operating Systems</td>
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<td>Computer Architecture</td>
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<td>PTEI 077</td>
<td>Artificial Intelligence and expert systems</td>
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<td>Data Base Management Systems</td>
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<td>PTEI083</td>
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<td>Microcontroller based system Design</td>
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<td>Real Time and Embedded System</td>
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<td>PTEI 473</td>
<td>Neural and Fuzzy Logic Control</td>
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<td>PTEI088</td>
<td>Management Sciences</td>
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</tbody>
</table>
1. MATRICES


2. FUNCTIONS OF SEVERAL VARIABLES


3. ANALYTIC FUNCTIONS

Analytic functions – Cauchy’s Riemann equations – Properties – Harmonic conjugates – Conformal Mapping – Mapping by functions

$$W = \frac{1}{z} + z^2$$ – Bilinear transformation

4. COMPLEX INTEGRATION


5. LAPLACE TRANSFORM

Application to solution of linear ordinary differential equations with constant coefficients.

BOOKS FOR STUDY


BOOKS FOR REFERENCE


PTPH 17§

PHYSICS

1. ACOUSTICS


– Applications in industry and engineering.

2. CRYSTALLOGRAPHY


3. LIGHT


4. LASERS AND FIBRE OPTICS


5. NON-DESTRUCTIVE TESTING

Steps involved in non-destructive testing – principles of radiography – X ray and gamma ray radiography – Liquid penetrant
REFERENCES:
1. Arumugam, M., engineering Physics, Anuradha Agencies, Kumbakonam, 2002

PTCY 17A
CHEMISTRY
3 0 100
(Common to all branches of Engineering and Technology)

1. WATER TREATMENT AND POLLUTION CONTROL


2. FUELS


3. THERMODYNAMICS AND KINETICS


4. ELECTROCHEMISTRY AND CORROSION


5. POLYMER AND COMPOSITES

3. PROBLEM SOLVING AND OFFICE AUTOMATION


4. INTRODUCTION TO C


5. FUNCTIONS AND POINTERS


TOTAL: 45

TEXT BOOKS:


REFERENCES:


1. ELECTRON DYNAMICS
Motion of Electrons in Electrostatic field, Magneto static field, combined Electric and magnetic field-Deflection of Electrons in Electrostatic field, Magneto static field-practical applications of electron deflection system, CRO.

2. SOLID STATE ELECTRONICS

3. BIPOLAR JUNCTION TRANSISTOR
Transistor Structure – Basic Transistor operation – Transistor characteristics and parameters – The transistor as a switch, an amplifier – Transistor bias circuits – Voltage divider bias circuits, base bias circuits an emitter bias circuits, collector feedback bias circuits – Q point stability over temperature. DC load line – AC load line.

4. FET, UJT, SCR
JFET characteristics and parameters – JFET biasing, self bias, voltage divider bias – Q point, stability over temperature – MOSFET D-MOSFET, E-MOSFET – MOSFET characteristics & parameters – MOSFET biasing, zero bias, voltage divider bias method, drain feedback bias – Characteristics and applications of UJT, SCR, DIAC, TRIAC – GTO, IGBT.

5. ELECTRO OPTIC AND OPTO ELECTRONIC DEVICES
LED, Injection laser diode, LCD, photoconductive cells, PIN photodiode, Avalanche photodiode, phototransistor, photo thyristors, photo voltaic cells, Optocoupler, Photo multiplier diodes.

TEXT BOOK

REFERENCE

MATHEMATICS II
1. MULTIPLE INTEGRALS
Double integration – Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates – Change of variables between Cartesian and polar coordinates and
between Cartesian and cylindrical / spherical polar coordinates.

2. VECTOR CALCULUS  9 + 3

Gradient, divergence and curl - Line, surface and volume integrals - Green's, Gauss divergence and Stoke's theorems (without proof) - Verification of the above theorems and evaluation of integrals using them.

3. ANALYTIC FUNCTIONS  9 + 3

Function of a complex variable - Analytic function - Necessary conditions - Cauchy - Riemann equations in Cartesian coordinates - Sufficient conditions (Proof 25 not included) - Properties of analytic function - Determination of harmonic conjugate by Milne - Thomson method - Conformal mapping - \( z \) and \( z = azw + b \) bilinear transformation.

4. COMPLEX INTEGRATION  9 + 3

Statement and application of Cauchy's theorem and Cauchy's integral formula - Taylor and Laurent expansion - Singularities - Classification - Residues - Cauchy's residue theorem - Contour integration - Unit circle and semi-circular contours (excluding poles on real axis).

5. LAPLACE TRANSFORM  9 + 3

Laplace Transform - Sufficient conditions - Transforms of elementary functions - Basic properties - Inverse transforms - Derivatives and integrals of transforms - Transforms of derivatives and integrals - Convolution theorem - Transform of periodic functions - Application to solution of linear ordinary differential equations up to second order with constant coefficients.

\[ L + T : 45 + 15 = 60 \]

TEXT BOOKS


REFERENCE


PTEI 271 DIGITAL LOGIC THEORY  3 0 100

1. BOOLEAN ALGEBRA  10

Review of number systems and computer codes - Boolean Algebra-Demorgan's theorem-Canonical forms - Representation of combinational circuits by switching functions - Graphical representation of switching functions - Simplification using K-maps and Quine Mcclusky methods.

2. IMPLEMENTATION OF COMBINATIONAL SYSTEMS  10

3. ARITHMETIC CIRCUITS AND FLIP-FLOPS

Adder-Carry look ahead adder-Number complements-Subtraction using adders-Signed number addition and subtraction-BCD adders - Basic latch circuit - Debouncing of a switch-Flipflop truth table-excitation table-Latch timing conditions-Analysis of sequential circuits with latches-Transition table-Transition diagram - Race in sequential circuits-Hazards and techniques for controlling hazards.

4. COUNTERS AND SHIFT REGISTERS

Asynchronous and synchronous counter design- Up/down counter-General BCD counter -Ring counter-Digital clock-Serial input and serial /parallel output-Parallel in right/left serial shift registers-Shift counters - Application of shift register in keyboard entry of decimal data.

5. LOGIC FAMILIES

Introduction to various logic families-TTL circuits-TTL parameters-AND-OR-INVERT gates-Open collector gates-Tristatedevices-CMOScircuits-CMOS characteristics-TIL to CMOS to-TIL interfaces.

TEXT BOOKS


REFERENCES

2. CLASSES AND OBJECTS

Specifying a class – Defining member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects.


3. OPERATOR OVERLOADING, INHERITANCE & POLYMORPHISM


4. JAVA EVOLUTION, CONSTANTS, VARIABLES, DATA TYPES, OPERATORS, CLASSES, OBJECTS, METHODS, ARRAYS AND STRINGS


5. PROGRAMMING USING INTERFACES, PACKAGES, MULTITHREADING, MANAGING ERRORS AND EXCEPTIONS AND APPLETS


L = 45 Total = 45

TEXT BOOKS


REFERENCE BOOKS


PTEI 282 ELECTRICAL MEASUREMENTS

1. DIFFERENT TYPES OF AMMETERS AND VOLTMETERS


2. WATTMETERS AND ENERGYMETERS


L = 45 Total = 45
3. POTENTIOMETERS AND INSTRUMENT TRANSFORMERS


4. RESISTANCE MEASUREMENT


5. INDUCTANCE AND CAPACITANCE MEASUREMENT


L = 45 Total = 45

REFERENCES


PTEI 281 DATA STRUCTURES AND ALGORITHMS

1. INTRODUCTION TO DATA STRUCTURES

Abstract data types - Sequences as value definitions - Data types in C - Pointers in C - Data structures and C - Arrays in C - Array as ADT - One dimensional array - Implementing one dimensional array - Array as parameters - Two dimensional array - Structures in C - Implementing structures - Unions in C - Implementation of unions - Structure parameters - Allocation of storage and scope of variables.

Recursive definition and processes: Factorial function - Fibonacci sequence - Recursion in C - Efficiency of recursion.

2. STACK, QUEUE AND LINKED LIST

Stack definition and examples – Primitive operations – Example - Representing stacks in C - Push and pop operation implementation.

Queue as ADT - C Implementation of queues - Insert operation - Priority queue - Array implementation of priority queue.
Inserting and removing nodes from a list-linked implementation of stack - Queue and priority queue - Other list structures - Circular lists: Stack and queue as circular list - Primitive operations on circular lists - Header nodes - Doubly linked lists - Addition of long positive integers on circular and doubly linked list.

3. TREES


Trees and their applications: C representation of trees - Tree traversals - Evaluating an expression tree - Constructing a tree.

4. SORTING AND SEARCHING


Sequential search: Indexed sequential search - Binary search - Interpolation search.

5. GRAPHS

Application of graph - C representation of graphs - Transitive closure - Warshall's algorithm - Shortest path algorithm - Linked representation of graphs - Dijkstra's algorithm - Graph traversal - Traversal methods for graphs

- Spanning forests - Undirected graph and their traversals - Depth first traversal - Application of depth first traversal - Efficiency of depth first traversal - Breadth first traversal - Minimum spanning tree - Kruskal's algorithm - Round robin algorithm.

L = 45 Total = 45

TEXT BOOKS


REFERENCE BOOKS


PTEI 283 TRANSDECER ENGINEERING

1. SCIENCE OF MEASUREMENT AND TRANSDUCTION

Units and standards - Calibration methods - Classification of errors - Error analysis - Limiting error - Probable error - Propagation of errors - Odds and uncertainty - Principle of transduction - Classification.

2. CHARACTERISTICS OF TRANSDUCERS

Static characteristics - Accuracy - Precision - Sensitivity - Linearity etc. - Mathematical model of transducers - Zero - First order and second order transducers - Response to impulse - Step - Ramp and sinusoidal inputs.
3. VARIABLE RESISTANCE TRANSDUCERS
Principle of operation - Construction details - Characteristics and applications of resistance potentiometers - Strain gauges - Resistance thermometers - Thermistors - Hotwire anemometer - Piezoresistive sensors and humidity sensors.

4. VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS
Induction potentiometer - Variable reluctance transducers - EI pick up - LVDT - Capacitive transducers - Variable air gap type - Variable area type - Variable permittivity type - Capacitor microphone.

5. OTHER TRANSDUCERS
Piezoelectric transducer - Magnetostrictive transducer - IC sensor - Digital transducers - Smart sensor - Fiber optic transducers - Hall effect transducers - Feedback transducers - Introduction to MEMS.

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES

PTEI 284 COMMUNICATION ENGINEERING

1. RADIO COMMUNICATION SYSTEMS
Basic principle of AM - FM and PM. Frequency spectrum - AM and FM transmitters and receivers - Introduction to microwave communication systems - Principle of satellite communication.

2. PULSE COMMUNICATION SYSTEMS
PAM - PPM - PDM - PCM - Delta modulation - Differential PCM - Merit and demerits.

3. DATA TRANSMISSION
Base band signal receiver - Error probability - Optimum and matched filter techniques - Coherent reception - Digital modulation systems - ASK - FSK and PSK - Comparison of data transmission systems.

4. TRANSMISSION MEDIUM
Characteristics of cables - Optical fibers - Effect of EM radiation - Bandwidth and noise - Concept of multiplexing - FDM and TDM.

5. TELEVISION
Scanning methods - B/W and colour systems - Camera and picture tubes - Synchronization - Transmitter and receivers.

L = 45 TOTAL = 45
TEXT BOOKS


REFERENCE BOOKS


PTEI 376 ELECTRONIC INSTRUMENTATION

1. ANALOG INSTRUMENTS


2. DIGITAL INSTRUMENTS


3. DISPLAY AND RECORDING DEVICES


4. VIRTUAL INSTRUMENTATION


5. BUS CHARACTERISTICS

RS 232 - RS 485 - RS 422 – ISA - PCI bus characteristics – Introduction to CAN bus and MODBUS.

L = 45 TOTAL = 45

TEXT BOOKS

2. Cooper W.D., Electronic Instrumentation and measurement techniques, Prentice Hall of India, New Delhi, 1981.

REFERENCES


PTEI 286 TRANSDUCER ENGINEERING LAB

2. Characteristics of strain gauge.
3. Characteristics of Load cell.
5. Characteristics of Hall effect transducer.
7. Characteristics of LVDT.
8. Characteristics of LDR and thermistor and thermocouple.
10. Step response characteristic of RTD and thermocouple
11. Study of Flapper nozzle system.
12. Study of smart transducers.

P = 45 TOTAL = 45

PTEI 371 CONTROL ENGINEERING

1. SYSTEMS AND THEIR REPRESENTATION


2. TIME RESPONSE ANALYSIS


3. FREQUENCY RESPONSE ANALYSIS


4. STABILITY OF CONTROL SYSTEM


5. CONTROL SYSTEM DESIGN

Performance criteria – Selection of controller modes – Lag, lead, and lag-lead networks – Compensator design for desired response using root locus and Bode diagrams.

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES


PTEI 373 INDUSTRIAL INSTRUMENTATION - I

1. MEASUREMENT OF FORCE, TORQUE AND VELOCITY

Electric balance - Different types of load cells - Hydraulic, pneumatic strain gauge- Magneto elastic and Piezo electric load cell - Different methods of torque measurement- strain gauge-Relative angular twist-Speed measurement-Revolution counter- Capacitive tacho- Dragecup type tacho-D.C and A.C tachogenerators - Stroboscope.

2. MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

Accelerometers - LVDT, Piezo-electric, Strain gauge and Variable reluctance type accelerometer - Mechanical type vibration instruments - Seismic instruments as an accelerometer - Vibrometers- Calibration of vibration pickups - Units of density and specific gravity used in industries - Baume scale API scale- Pressure head type densitometers- Float type densitometers - Ultrasonic densitometer- Bridge type gas densitometer.

3. PRESSURE MEASUREMENT

Units of pressure-Manometers-Different types -Elastic type pressure gauges -Bourdon tube, bellows and diaphragms-Electrical methods-Elastic elements with LVDT and strain gauges -Capacitive type pressure gauge -Piezo-resistive pressure sensor-Resonator pressure sensor-Measurement of vacuum-McLeod gauge-Thermal conductivity gauges-Ionization gauges - Cold cathode type and hot cathode type-Testing and calibration of pressure gauges-Dead weight tester.

4. TEMPERATURE MEASUREMENT

Definitions and standards-Primary and secondary fixed points -Calibration of thermometers - Different types of filled in system thermometer-Sources of errors in filled in systems and their compensation-Bimetallic thermometers - Electrical methods of temperature measurement-Signal conditioning of industrial RTDs and their characteristics-3 lead and 4 lead RTDs.

5. THERMOCOUPLE MEASUREMENT


REFERENCES


2. LINEAR INTEGRATED CIRCUITS

Introduction to linear IC - Operational amplifiers - DC characteristics: bias, offset and drift – AC characteristics: bandwidth, slew rate and noise - Inverting and noninverting amplifiers - Zero crossing detector with hysteresis - Arithmetic circuits.

3. APPLICATIONS OF OPAMP

Precision rectifiers - Active filters - Basic low pass filter and high pass butterworth filters - Waveform generators using op/amp - Square, triangular and sine wave generation - V to I converter, I to V converter - Instrumentation Amplifier - Log and antilog amplifiers.

4. ADC and DAC CONVERTERS


5. SPECIAL APPLICATIONS

Sample and Hold circuits - ON/OFF controller circuit – Temperature Transducer AD590-Basic functional internal block diagram - Characteristics and applications of ICs: 555, 565, 566, LM 723 voltage regulator and current regulators.

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES


PTEI 375 MICROPROCESSORS AND MICROCONTROLLERS 3 0 100

1. ARCHITECTURE 5
General 8-bit microprocessor - Architecture - 8085 functional block diagram - Bus configuration - basic memory and I/O Interfacing concepts.

2. INSTRUCTION SET AND PROGRAMMING 10

3. PERIPHERALS AND INTERFACING 9
PPI (8255) - USART(8251) - Timer(8253)- Programmable DMA Controller (8257) - Programmable Interrupt controller (8259)- Keyboard display controller (8279)- ADC/DAC Interfacing.

4. 8086 PROCESSOR 12
8086 Architecture- Pin configuration- Minimum and maximum mode configurations- Addressing modes- Instruction set- Assembly language programming.

5. MICROCONTROLLERS 9
Evolution of microcontrollers- Architecture of 8-bit microcontroller (8051) - Bus configuration - Reset circuitry - Power down considerations - Instruction sets - Programming exercises - Applications.

L 45 TOTAL 45

TEXT BOOKS


REFERENCES


PTEI 378  MICROPROCESSOR AND MICRO CONTROLLER LAB  0 3 100

1. 8085 assembly language programming exercise.
2. Interfacing D/A and A/D converter.
3. Interfacing of 8255.
4. Interface of keyboard and display using programmable controllers.
5. Stepper motor control using Microprocessor.
6. Interface of programmable timers.
7. Familiarisation of 8051 Microcontroller kit.
8. 8051 assembly language programming exercises.
9. Study of TMS 320 C5X DSP processor and programming exercises.
10. Microprocessor based Data Acquisition system.
12. Microprocessor based PID controller.

PTEI 372  DIGITAL SIGNAL PROCESSING  3 0 100

1. DISCRETE TIME SIGNALS AND SYSTEMS  9
Sampling of Analog signals – Aliasing, Standard discrete time signals – Classification of discrete time systems –
Linear time invariant systems, causality, stability – Convolution sum-Difference equation representation.

2. Z-TRANSFORM AND FOURIER TRANSFORM  9

3. FAST FOURIER TRANSFORM (FFT)  9

4. IIR FILTER DESIGN  9

5. FIR FILTER DESIGN  9

L = 45 TOTAL = 15
TEXT BOOKS


REFERENCES


PTEI 381 ANALYTICAL INSTRUMENTATION

1. SPECTRO PHOTOMETERS 12


2. ION CONDUCTIVITY AND DISSOLVED COMPONENT ANALYSER 6


3. GAS ANALYSER 9


4. CHROMATOGRAPHY 9

Gas chromatography – Liquid chromatography – Principles- Types and Applications – HPLC – Detectors

5. NMR, X-RAY AND MASS SPECTROMETRIC TECHNIQUES 9


L=45 TOTAL= 45

TEXT BOOKS


REFERENCES


PTEI 382 INDUSTRIAL INSTRUMENTATION – II

1. MECHANICAL TYPE FLOWMETERS

Theory of fixed restriction variable head type flow meters-Orifice plate – Venturi tube- flow nozzle-Dall tube-Installation of head flow meters –Piping arrangement for different fluids –Pitot tube.

2. QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS


3. ELECTRICAL TYPE FLOW METER


4. LEVEL MEASUREMENT

Gauge glass technique coupled with photoelectric readout system - Float type level indication – Different schemes – Level switches level measurement using displacer and torque tube – Bubbler system – Boiler drum level measurement - Differential pressure method - Hydra step systems - Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

5. MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE

Viscosity terms- Say bolt viscometer – Rotameter type viscometer - Industrial consistency meters - humidity terms - Dry and wet bulb psychrometers - Hot wire electrode type hygrometer – Dew cell –Electrolysis type hygrometer-commercial type dew point meter - moisture terms –Different methods of moisture measurement – Moisture measurement in granular materials, solid penetratable materials like wood, web type material.

TEXT BOOK


REFERENCES
1. **INTRODUCTION**


2. **CONTROLLER MODES**

Basic control actions - Characteristic of on-off, proportional, single speed floating, integral and derivative control modes - P+I, P+D and P+I+D control modes - Pneumatic and electronic controllers to realize various control actions - Auto/manual transfer, Reset windup

3. **FINAL CONTROL ELEMENT**

I/P converter - Pneumatic and electric actuators - Valve positioner - Control valves - Characteristic of control valves: inherent and installed characteristics - Modeling of pneumatic control valve - Valve body - Commercial valve bodies - Control valve sizing - Cavitation and flashing - Selection criteria - P&ID diagram

4. **CONTROLLER TUNNING**

Evaluation criteria - IAE, ISE, ITAE and $\frac{1}{4}$ decay ratio - Determination of optimum settings for mathematically described process using time response and frequency response - Process reaction curve method - Continuous cycling method - Auto tuning of PID controller - $L_c$ max

5. **MULTILOOP CONTROL**

Feed forward control - Ratio control - Cascade control - Inferential control - Split range and introduction to multivariable control - Examples from distillation column and boiler systems - Advanced control systems - IMC - Model predictive control - Adaptive control - Introduction to plant wide control - Controller design for nonlinear process.

**TEXBOOKS**


**REFERENCE**


**PTEI 386 PROCESS CONTROL LAB**

(Any TEN experiments)

1. Operation of interacting and non-interacting systems.
2. Responses of different order processes with and without transportation lag.
3. Response of on-off controller and PID controller.
5. Tuning of PID controllers.
6. Operation of on-off controlled thermal process.
7. Closed loop response of flow control loop.
8. Closed loop response of level control loop.
10. Closed loop response of pressure control loop.
11. Study of complex control system (ratio/ cascade/ feed forward).
12. Design of Multi loop and Multi variable PID controllers.
13. Auto tuning of PID controller.
15. Design of dead time compensator.

PTEI 385 DIGITAL SYSTEM AND VLSI DESIGN 30 100

1. BASIC CIRCUITS FOR DIGITAL SYSTEMS 9
CMOS Inverter -Design principles -Construction of multiplexers - Transmission gates - Principles and design considerations of specific PROM, EPROM, SRAM and SDRAM.

2. BUILDING BLOCKS OF DIGITAL SYSTEMS 9
Combinational logic and Sequential logic circuits - Data path circuits – Adder - Multiplier architecture and Accumulators.

3. BUS CHARACTERISTICS 6

4. PROGRAMMABLE LOGIC DEVICES AND FPGA 9
Principles of PAL – PLD-GAL- CPLD and their design considerations- Programmable Logic interconnect principles and types - Programmable logic elements and AND-OR arrays - Routing procedures in FPGA and CPLD

- Programming methods for FPGA and CPLD - Comparison of ACTEL - Altera and Xilinx FPGA.

5. PRINCIPLES OF VHDL 12
Introduction to VHDL- Sequential and concurrent descriptions- Signal, port and variable statements - Sequential statements- Block, process, component and generate descriptions- Test bench creations and principle of operation of VHDL simulator- Introduction to Verilog and brief comparison with VHDL.

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES

PTEI 471 COMPUTER CONTROL OF PROCESSES 30 100

1. STATE VARIABLE ANALYSIS AND DESIGN 9
State models – Solution of state equations – Controllability and observability- Pole assignment by state feedback – Full and reduced order observers.
2. ANALYSIS OF DISCRETE DATA SYSTEM

State space representation of Discrete Data Systems - Selection of Sampling period - Data Hold - Z transform - Pulse transfer function - Modified Z-transform - Response of open loop system - Stability of Discrete Data System.

3. DESIGN OF DIGITAL CONTROLLER

Control algorithm-Digital PID - Deadbeat - Dahlin - Kalman and Pole placement technique - Response of closed loop system - Design of feed forward controller - Dead-time Compensation - Internal model control - Model Predictive Control

4. PROGRAMMABLE LOGIC CONTROLLER


5. COMMUNICATION IN PLC

Requirement of communication networks of PLC - Connecting PLC to computer - Use of PC as PLC - Comparative study of Industrial PLCs - Case studies.

REFERENCES

PTEI 472 COMPUTER NETWORKS AND DCS

1. DATA NETWORK FUNDAMENTALS

Network hierarchy and switching - Open system interconnection model of ISO -Data link control protocol - BISYNC-SDLC-HDLC - Media access protocol - Command-Response -Token passing-CSMA/CD - TCP/IP.

2. INTER NETWORKING

Bridges-Routers-Gateways - Standard ETHERNET and ARCNET configuration-Special requirement for networks used for control.

3. DISTRIBUTED CONTROL SYSTEMS

Evolution - Different architecture - Local control unit - Operator interface - Displays-communication facilities - Redundancy concept- Engineering interface.

4. APPLICATIONS OF DCS

DCS applications in power plants- Iron and steel plants - Chemical plants - Cement plants - Pulp and Paper plants.
5. HART AND FIELD BUS


L=45 TOTAL=45

TEXT BOOKS


REFERENCES

2. Popovic D.and Bhatkar V.P., Distributed computer control for industrial automation, Marcel Dekkar Inc., 1990 (for Unit 4)

PTGE 381 TOTAL QUALITY MANAGEMENT

1. INTRODUCTION


2. TQM – OLD TOOLS

3. TQM – MANAGEMENT TOOLS


4. TQM – PRINCIPLES


5. TQM TECHNIQUES


L=45 TOTAL=45

REFERENCES


PTEI 071 FIBRE OPTICS AND LASER

INSTRUMENTATION

3 0 100

1. OPTICAL FIBRES AND THEIR PROPERTIES 12


2. INDUSTRIAL APPLICATION OF OPTICAL FIBRES

3. LASER FUNDAMENTALS


4. INDUSTRIAL APPLICATION OF LASER

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect - Material processing - Laser heating, welding, melting and trimming materials, removal and vaporization.

5. HOLOGRAM AND MEDICAL APPLICATION


L=45 TOTAL=45

TEXT BOOKS


REFERENCES


PTE1072 BIOMEDICAL INSTRUMENTATION 30100

1. ANATOMY, PHYSIOLOGY AND TRANSDUCERS 12

Review of human anatomy and physiology of heart, lungs, eye and nervous systems - Introduction to different types of bioelectric potentials - Action and resting potentials - Propagation of action potentials - Components of biomedical instrumentation system - Different type of electrodes, sensors used in biomedicine - Selection criteria for transducer and electrodes.

2. ELECTRO- PHYSIOLOGICAL MEASUREMENT 6

ECG, EEG, EMG, ERG - Lead systems and recording methods - Typical waveforms.

3. NON ELECTRICAL PARAMETER MEASUREMENT 9


4. MEDICAL IMAGING AND TELEMETRY 9

X-ray machine - Computer tomography - Magnetic resonance imaging system - Positron emission tomography and endoscopy - Introduction to telemetry systems - Different types of telemetry systems.
5. ASSISTING AND THERAPUTIC DEVICES


L=45 TOTAL=45

TEXT BOOKS


REFERENCES


2. MEASUREMENTS IN POWER PLANTS

Electrical measurements – Current, voltage, power, frequency, power factor -Non electrical parameters - Flow of feed water, fuel, air and steam with correction factor for temperature - Steam pressure and steam temperature - drum level measurement - Radiation detector - Smoke density measurement.

3. ANALYZERS IN POWER PLANTS

Flue gas oxygen analyzer - Analysis of impurity in feed water and steam - Dissolved oxygen analyzer – Chromatography - pH meter - Fuel analyzer - Pollution monitoring instruments.

4. CONTROL LOOPS IN BOILER

Combustion control - Air/fuel ratio control - Furnace draft control - Drum level control - Main steam and reheat steam temperature control - Super heater control - Attemperator – Deaerator control - Distributed control system in power plants - Interlocks in boiler operation.

5. TURBINE MONITORING AND CONTROL

Speed, vibration, shell temperature monitoring and control - Steam pressure control - Lubricant oil temperature control - Cooling system.

L=45 TOTAL=45

TEXT BOOKS


REFERENCES


PTEI 074  INSTRUMENTATION IN PETROCHEMICAL INDUSTRY  30100

1. PETROLEUM PROCESSING  9

2. UNIT OPERATIONS IN PETROLEUM INDUSTRY  9
Thermal cracking – Catalytic cracking – Catalytic reforming – Chemical oxidation – Chemical reduction – Precipitation – Polymerization – Alkylation – Isomerization – Production of ethylene, Acetylene and Propylene from petroleum

3. CHEMICAL FROM PETROLEUM PRODUCTS  9
Chemical from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products

4. MEASUREMENT IN PETROCHEMICAL INDUSTRY  6
Parameter to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of instruments

5. CONTROL LOOPS IN PETROCHEMICAL INDUSTRY  12
Process control in refinery and petrochemical industry – Control of distillation column control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control on vinyl chloride and PVC production.

L=45 TOTAL=45

TEXT BOOKS


REFERENCES

1. Waddams A.L., Chemical from petroleum, Butter and Janner Ltd., 1968

PTEI 075  OPERATING SYSTEMS  30100

1. OPERATING SYSTEMS – AN OVERVIEW  9
4. I/O SYSTEMS


5. DISTRIBUTED SYSTEMS


TEXT BOOK:


REFERENCES:

1. BASIC STRUCTURE OF COMPUTERS


2. ARITHMETIC

Addition and subtraction of signed numbers - Design of fast adders - multiplication of positive numbers - Signed operand multiplication and fast multiplication - Integer division - floating point numbers and operations.

3. BASIC PROCESSING UNIT

Fundamental concepts - Execution of a complete Instruction - Multiple bus organization - Hardwired control - Microprogrammed control - Pipelining - Basic concepts - Data hazards - Instruction hazards - Influence on Instruction sets - Data path and control consideration - Superscalar operation.

4. MEMORY SYSTEM

Basic concepts - semiconductor RAMs, ROMs - Speed, size and cost - cache memories - Performance consideration - Virtual memory - Memory Management requirements - Secondary storage.

5. I/O ORGANIZATION

uncertainty – Introduction to non-monotonic reasoning – Logic for monitoring reasoning.

4. PERCEPTION – COMMUNICATION AND EXPERT SYSTEMS

Natural language processing – Pattern recognition – Visual image understanding – Expert system architecture.

5. KNOWLEDGE ACQUISITION


L=45, TOTAL = 45

TEXT BOOKS


REFERENCES


PTEI 078 DATA BASE MANAGEMENT SYSTEMS

1. INTRODUCTION AND CONCEPTUAL MODELING


2. RELATIONAL MODEL

SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF).

3. DATA STORAGE AND QUERY PROCESSING


4. TRANSACTION MANAGEMENT


5. CURRENT TRENDS


L = 45 TOTAL = 45
TEXT BOOKS:


REFERENCES:


PTEI 079 VISUAL PROGRAMMING 30 100

1. FUNDAMENTALS OF WINDOWS AND MFC 9


Drawing the lines - Curves - Ellipse - Polygons and other shapes. GDI pens - Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard:

- Keystroke messages - Virtual key codes - Character & dead key messages.

2. RESOURCES AND CONTROLS 9

Creating a menu - Loading and displaying a menu - Responding to menu commands - Command ranges - Updating the items in menu, update ranges - Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus - Cascading menus - Context menus.

The C button class - C list box class - C static class - The font view application - C edit class - C combo box class - C scrollbar class. Model dialog boxes - Modeless dialog boxes.

3. DOCUMENT / VIEW ARCHITECTURE 9


Creating & initializing a toolbar - Controlling the toolbar’s visibility - Creating & initializing a status bar, Creating custom status bar panes - Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing - C file derivatives - Serialization basics - Writing serializable classes.

4. FUNDAMENTALS OF VISUAL BASIC 9

Menu bar - Tool bar - Project explorer - Toolbox - Properties window - Form designer - Form layout - Intermediate window. Designing the user interface:
Aligning the controls – Running the application – Visual development and event driven programming.


5. DATABASE PROGRAMMING WITH VISUAL BASIC


Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

L = 45 TOTAL = 45

REFERENCES


PTEI 080 ADVANCED CONTROL SYSTEM

1. NONLINEAR SYSTEM


2. STABILITY ANALYSIS OF NON LINEAR SYSTEM


3. OPTIMAL CONTROL

Problem formulation – Necessary conditions of optimality – State regulator problem – Matrix Riccati equation – Infinite time regulator problem – Output regulator and
4. ADAPTIVE CONTROL

Parameter Estimation: Least square method - Recursive least square method - MRAC systems - Different configuration - Classification - Mathematical description - Direct and indirect MRAC - Self tuning regulator - Different approach to self tuning - Implicit and explicit STR - Gain scheduling.

5. MULTIVARIABLE CONTROL

Relative gain array and selection of control loops - Decoupler - Multivariable PID controller - Multi-loop PID controller - Model Based controller.

L=45 TOTAL=45

TEXT BOOKS


REFERENCES


1. BASIC CONCEPTS

Definition and origin of Robotics- different types of robotics - various generations of robots - degrees of freedom- Asimov’s laws for intelligent robotics - dynamic stabilization of robots.

2. POWER SOURCES AND SENSORS

Hydraulic, Pneumatic and electric drives - determination of HP of motor and gearing ratio- variable speed arrangements -path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fibre optic and tactile sensors.

3. MANIPULATORS, ACTUATORS AND GRIPPERS

Construction of manipulators - manipulator dynamics and force control-electronic and pneumatic manipulators control circuits-end effectors- various types of grippers-design considerations.

4. KINEMATICS AND PATH PLANNING

Solution of inverse kinematics problem-multiple solution Jacobean work envelope -hill climbing techniques-robot programming techniques.

5. CASE STUDIES

Multiple robots-machine interface -robots in manufacturing and non-manufacturing applications-robot cell design-selection of a robot.

REFERENCES

PTEI 082 ADAPTIVE CONTROL 3 0 100

1. IDENTIFICATION METHODS


2. STATE ESTIMATION


3. SELF TUNING REGULATORS (STR)


4. MODEL REFERENCE ADAPTIVE SYSTEM (MRAS)

Introduction - MIT rule - Lyapunov theory-Design of MRAS using MIT rule and Lyapnov theory – Relation between MRAS and STR.

5. GAIN SCHEDULING & AUTO TUNING

Introduction to Gain scheduling – Design of Gain scheduling controllers- Applications of Gain scheduling - Introduction to Auto tuning - Auto tuning techniques-Methods Based on Relay feed back – Practical issues and implementation -Introduction to stochastic adaptive control

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES


PT EI 083 VIRTUAL INSTRUMENTATION 3 0 100

1. INTRODUCTION


2. DATA ACQUISITION IN VI

A/D, D/A converters, plug-in Analog input/output cards - Digital Input/Output cards, Organisation of the DAQ VI system - Opto isolation - Performing analog input and analog output - Scanning multiple analog channels - Issues involved in selection of data acquisition cards - Data acquisition modules with serial communication - Design of digital voltmeters with transducer input – Timers and counters.

3. COMMUNICATION NETWORKED MODULES


4. REAL TIME CONTROL IN VI

Design of ON/OFF controller, PID controller and Fuzzy software - Level and Reactor control using VI – Case studies on development of HMI, SCADA in VI.

5. APPLICATIONS

PC based digital storage oscilloscope, Sensor technology and signal processing, VI laboratory, spectrum analyser , waveform generator – Data visualization from multiple locations, Distributed monitoring and control devices , vision and motion control.

TEXT BOOKS


REFERENCE


PTEI 084 DIGITAL IMAGE PROCESSING 3 0 100

1. DIGITAL IMAGE FUNDAMENTALS

Elements of Digital Image Processing systems – Digital image representation - Elements of visual perception-
Image sampling and quantization - Imaging geometry - Discrete Image transforms - Properties.

2. PREPROCESSING AND ENHANCEMENT
Point Processing methods – Contrast stretching - Gray level slicing - Histogram modification techniques - Spatial filtering - Enhancement in the frequency domain.

3. RESTORATION AND SEGMENTATION

4. REGISTRATION AND COMPRESSION
Image registration - translational misregistration detection - statistical correlation function, two state methods - Image fusion. Fundamentals of Image Compression - Lossy versus Lossless coding techniques, pixel coding, predictive techniques, Transform coding, algorithms and case studies.

5. APPLICATIONS OF DIGITAL IMAGE PROCESSING
Applications in medicine, manufacturing, measurement - case studies.

L = 45 TOTAL = 45

TEXT BOOKS

REFERENCES

PTEI 085 MICROCONTROLLER BASED SYSTEM DESIGN 3 0 100

1. THE ROLE OF MICROCONTROLLERS

2. MICROCONTROLLER RESOURCES
Program and data memory - parallel ports - Serial ports - D/A and A/D converters - Reset circuitry - Watchdog timers - Power-down considerations

3. REAL TIME CONTROL
Interrupt Structures - Programmable timers – Real time clock – Latency – Interrupt density and interval constraints
4. PROGRAMMING FRAMEWORK FOR 8051

CPU register - Structure - Addressing modes - Instruction sets - Assembly programming - Assemblers

5. SOFTWARE BUILDING BLOCKS

Queues - Tables and strings - Program organization - Microcontroller expansion methods - I/O hardware alternatives - Development tools - RTOS - Motorola (MC68HC11) and Intel Micro controller (8051)

L = 45 TOTAL = 45

TEXT BOOKS


REFERENCES

1. S. Yeralan and A. Ahluwalia, ‘Programming and Interfacing the 8051 Microcontroller’, Addison Wesley, 1995


3. Motorola manual on 8 and 16 bit microcontrollers


5. Peter Spasov, Microcontrol Technology: The 68HC11, Prentice Hall


PTEI 086 REAL TIME EMBEDDED SYSTEM

1. SYSTEM DESIGN

Definitions - Classifications and brief overview of Microcontrollers – Microprocessors and DSP - Embedded processors. Architectural definitions - Typical application scenarios of embedded systems.

2. INTERFACE ISSUES RELATED TO EMBEDDED SYSTEMS


3. TECHNIQUES FOR EMBEDDED SYSTEMS

Embedded system design - Design metrics - State machine and state tables in embedded design - Simulation and emulation of embedded systems - High level language descriptions of S/W for embedded systems - Java based embedded system design.

4. REAL TIME MODELS, LANGUAGE AND OPERATING SYSTEMS

Event based - Process based and graph based models - Petrinet models - Realtime languages - Real time kernel - OS tasks - Task states - Task scheduling - Interrupt processing - Clocking communication and synchronization - Control blocks - Memory requirements and control - Kernel services.
5. CASE STUDIES
Discussion of specific examples of complete embedded systems using MC68HC11, MC805, ADSP2181, PIC series of Microcontrollers.

TEXT BOOK

REFERENCES

PTEI 473 NEURAL AND FUZZY LOGIC CONTROL

1. INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS

2. NEURAL NETWORKS FOR CONTROL
Schemes of Neuro-control – Identification and control of dynamical systems – Parameterized neuro-controller (PNC) and optimization aspects – Adaptive neuro controller – Case study.

3. INTRODUCTION TO FUZZY LOGIC

4. FUZZY LOGIC CONTROL SYSTEM

5. HYBRID CONTROL SCHEMES
Fuzzy Neuron – Fuzzification and rule base Using ANN – Introduction to GA – Optimization of membership
function and rule base using Genetic Algorithm – Case study.

\[ L=45 \quad \text{TOTAL}=45 \]

TEXT BOOKS


REFERENCES


### ANNA UNIVERSITY

### AUTOMOBILE ENGINEERING CURRICULUM

#### (PART TIME 7 SEMESTER PROGRAM)

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<td>Engine Testing and Automotive Electronics Lab</td>
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### LIST OF ELECTIVES

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<td>Tractor and Farm Equipments</td>
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<td>Process Planning and Cost Estimation</td>
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**SEMESTER V**

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**SEMESTER VI**

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<td>Vehicle Maintenance and Testing Lab.</td>
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**SEMESTER VII**

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SEMESTER – I

PTMA171 MATHEMATICS – I  3 0 100

1. MATRICES


2. THREE DIMENSIONAL GEOMETRY  9


3. SEQUENCE AND SERIES  9

Sequences Convergence – Series of positive terms – Test of convergence (Comparison tests, Integral test, Comparison of ratios and D’Alembert’s ratio test) – Alternating series – Series of positive and negative terms – Power series – Convergence of exponential, Logarithmic and Binomial series.

4. FUNCTIONS OF SEVERAL VARIABLES  9


5. ORDINARY DIFFERENTIAL EQUATIONS  9

Higher order Linear equations with constant coefficients – Method of variation of parameters – Method of
undetermined coefficients – equations reducible to linear equations with constant coefficients – Simultaneous first order linear equations with constant coefficients.

**Text Book:**


**Books for Reference:**


**PTPH171 PHYSICS – I**

1. **ACOUSTICS AND ULTRASONICS**


2. **CRYSTALLOGRAPHY AND NON-DESTRUCTIVE TESTING**

Unit cell, Bravais lattices, Lattice plans, Miller indices calculation of number of atoms per unit cell, Atomic radius, coordination number and packing factor for simple cubic, BCC, FCC, HCP – NDT methods: Liquid penetrant method, Ultrasonic flaw detector, X-ray radiography eddy current magnetic particle inspection.

3. **WAVE OPTICS**


4. **QUANTUM PHYSICS**

Planck’s quantum theory of black body radiation (qualitative), photo electric effect – Compton effect (derivation) and Experimental verification of Compton effect – Schrodinger wave equation – Time dependent and time independent equations (derivation), Physical
5. LASER & FIBRE OPTICS


TEXT BOOKS:


3. CHEMICAL KINETICS


4. ELECTRO CHEMISTRY

5. SPECTROSCOPY

Total: 45

TEXT BOOKS:
1. Puri B.R. Sharma L.R. and Madan S. Pathania, Principles of Physical Chemistry,

References:

PTEC184 ELECTRONICS ENGINEERING

1. ELECTRONIC COMPONENTS AND DEVICES

2. ANALOG CIRCUITS
Rectifier and Power Supply Circuits, clipper, clamper using diodes. Operational Amplifiers (Ideal) – properties and typical circuits like differentiator, integrator, summer, comparator, single-stage BJTs and FETs amplifiers - Multistage Amplifier Principles.

3. DIGITAL CIRCUITS
4. MEASUREMENTS AND INSTRUMENTS

Definitions of Accuracy, Precision, Sensitivity, Resolution, Linearity, Range, Measurement of Electrical Quantities - Voltmeter, Ammeter, Watt-meter, CRO, Measurement of Non-electrical Quantities - pressure, temperature, acceleration transducers - DMM.

5. MICROPROCESSORS AND APPLICATIONS

Architecture of 8085 processors, Address Modes Instruction set, simple programming like addition, subtraction, multiplication, logical operation, Peripherals and Interfacing - 8255, 8251. Applications like motor control, keyboard and PC interface.

TOTAL 45

TEXT BOOK


REFERENCES


PTGE172 FUNDAMENTALS OF COMPUTING

2 1 100

1. INTRODUCTION


2. COMPUTER ARITHMETIC AND SOFTWARE


3. PROBLEM SOLVING AND OFFICE AUTOMATION


4. INTRODUCTION TO C

Overview of C - Constants, Variables and Data Types - Operators and Expression - Managing Input and Output Operators - Decision Making and Branching - Decision Making and Looping.

5. FUNCTIONS AND POINTERS

TEXT BOOKS:


REFERENCES:


SEMESTER – II

PTMA072 NUMERICAL METHODS  3 0 100

1. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

Linear interpolation methods (method of false position) – newton’s method - statement of fixed point theorem – fixed point iteration: x = g(x) method – solution of linear system by gaussian elimination and gauss-jordon methods – iterative methods” gauss jacobi and gauss-seidel methods – inverse of a matrix by gauss jordon method – eigenvalue of a matrix by power method and jacobi’s method.

2. INTERPOLATION AND APPROXIMATION

Lagrange Polynomials – Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulas.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION


4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS


5. BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution of second order ordinary differential equation – Finite difference solution of one-dimensional heat equation by explicit and implicit methods – One – dimensional wave equation and two dimensional Laplace and Poisson equations

Total: 45

TEXT BOOKS


REFERENCES


PTAE271 FLUID MECHANICS AND MACHINERY

1. BASIC CONCEPTS


2. BASIC EQUATIONS OF FLUID FLOW ANALYSIS


3. INCOMPRESSIBLE INVISCID FLOW


4. INCOMPRESSIBLE VISCOUS FLOW

Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss – Pipe flow problems – Hydraulic and energy grade lines – Moody’s diagram

5. FLUID MACHINERY


TOTAL 45

TEXT BOOKS


REFERENCE BOOKS


1. BASIC THERMODYNAMICS


2. AIR CYCLE AND COMPRESSORS

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure, Reciprocating compressors.

3. STEAM PROPERTIES AND JET PROPULSION

Properties of steam - Rankine cycle - Steam Nozzles - Simple jet propulsion system - Thrust rocket motor - Specific impulse.

4. REFRIGERATION AND AIR-CONDITIONING


5. HEAT TRANSFER

Conduction in parallel, radial and composite wall - Basics of Convective heat transfer - Fundamentals of Radiative heat transfer - Flow through heat exchangers.

TOTAL 45

TEXT BOOKS


REFERENCES


PTAT 272 SOLID MECHANICS

1. INTRODUCTION


2. BENDING OF BEAMS

Beams - Loads - Shear force and bending moment diagrams for simply supported and cantilever beams -
3. TORSION AND COLUMNS

Torsion of circular shafts – Shear stresses and twist in solid and hollow shafts – Combined bending and torsion – Closely coiled helical springs – Definition of columns – Types of columns – Equivalent length – Slenderness ratio – Rankine’s formula.

4. BIAXIAL STRESSES

Analysis of biaxial stresses – Mohr’s circle – Principle stresses and maximum shear stress – Deductions from Mohr’s circle – Stresses in thin walled pressure vessels – Combined bending and torsion.

5. DEFLECTION OF BEAMS


REFERENCES:


REFERENCES:

1. INTRODUCTION AND CASTING:


2. METAL FORMING AND POWDER METALLURGY

Basic concepts and classification of forming processes – Principles – application of the following processes – forging, rolling, extrusion, wire drawing, spinning, sheet metal forming – powder metallurgy – steps involved, applications.

3. CONVENTIONAL MACHINING

General principles (with schematic diagrams only) of working, types and commonly performed operations in the following machines – lathe, shaper, planer, milling machining, drilling machine, grinding machines – basic of CNC machines.
4. WELDING


5. UNCONVENTIONAL MACHINING PROCESSES 10

Need for unconventional machining processes – principles and application of the following processes – abrasive jet machining, ultrasonic machining, Electro discharge machinery, electrochemical machining, chemical machining, LASER beam machining, Electro beam machining plasma arc machining.

Total: 45

Text Book:

References:

1. ENGINE CONSTRUCTION AND OPERATION 10


2. SI ENGINE FUEL SYSTEM 10

Carburettor working principle. Requirements of an automotive carburetor – starting, idling, acceleration and normal circuits of a carburetor – Compensation – Maximum power devices – Constant choke and constant vacuum carburetor, multi barrel and multiple venturi systems – Fuel feed system – Mechanical and electrical pumps – Petrol injection.

3. COOLING AND LUBRICATION SYSTEM 08

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems, Forced circulation system, pressure cooling system – Need for Lubrication system. Mist lubrication system, wet sump lubrication – Properties of lubricants, properties of coolants.

4. COMBUSTION AND COMBUSTION CHAMBERS 09

5. TWO STROKE ENGINES


TOTAL 45

TEXT BOOKS


REFERENCES


PTAT282 AUTOMOTIVE CHASSIS

1. LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM


2. DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL


3. REAR AXLES, WHEELS, RIMS AND TYRES

4. SUSPENSION SYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension. Effect of roll in the case of vehicle with: rigid axle, independent suspension. Rubber suspension - Pneumatic suspension - Shock absorbers.

5. BRAKING SYSTEM

Need for braking system, stopping distance, time and brake efficiency, effect of weight transfer during braking. Classification of brakes - Drum brakes & Disc brakes. Constructional details. Braking torque developed by brake shoes. Mechanical hydraulic and pneumatic brakes. Power and power assisted brakes - Different types of retarders like eddy current and hydraulic retarder - Anti lock braking systems. Brake testing

TOTAL 45

TEXT


REFERENCES


PTPR281 MECHANICS OF MACHINES 3 0 100

1. MECHANISMS


2. FRICTION

Types of friction - friction in screw and nut - pivot and collar - thrust bearings - collar bearing - plate and disc clutches - belt (flat & vee) and rope drives - creep in belts - Jockey pulley - open and crossed belt drives - Ratio of tensions - Effect of centrifugal and initial tension - condition for maximum power transmission.

3. GEARING AND CAMS

Gear profile and geometry - nomenclature of spur & helical gears - laws of gearing - interference - requirement of minimum number of teeth in gears - gear trains - simple and compound gear trains - determination of speed and torque in epicyclic gear trains - cams - different types of followers - cam design for different follower motions.
4. BALANCING
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – balancing single and multi cylinder Engines – Governors and Gyroscopic effects.

5. VIBRATION

TOTAL 45

TEXT BOOK

REFERENCE


PTAT371 ENGINEERING DESIGN 3 0 100

1. INTRODUCTION 12

2. DESIGN OF SHAFTS AND SPRINGS 9

3. GEAR DESIGN 8

4. FLYWHEELS 7
Determination of the mass of a flywheel for a given coefficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.
5. DESIGN OF BEARINGS

Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

TOTAL 45

TEXTBOOK


REFERENCES

3. Design Data Book, PSG. College of Technology, Coimbatore, 1992

PTAT286 AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LAB

1. Components by dismantling, comparing with recent engine components and assembling various parts: study of the following engines and its

a. Tata engine
b. Leyland engine
c. Ambassador engine
d. Fiat engine
e. Maruthi 800 CC engine
f. Maruthi 1000 CC engine
g. Ford Car engine
h. Two stroke engines (TVS Suzuki, Hero Honda, Scooters, Mopeds etc.)
i. MPFI Engine

2. STUDY AND MEASUREMENT OF THE FOLLOWING CHASSIS

a. Tata
b. Leyland
c. Ambassador
d. Premier Padmini
e. Maruthi car (Front engine, front wheel drive & constant velocity joint)
f. Mahindra & Mahindra Jeep
g. Tata Mini Lorry

3. STUDY, DISMANTLING & ASSEMBLING

a. Front axle – Rzeppa joint assembly
b. Rear axle
c. Clutch 2 types – Coil spring & Diaphragm spring clutches
d. Gear box – Sliding mesh, Constant mesh & Synchromesh Gear Box

e. Transfer case

f. Steering system

g. Braking system

h. Differential mechanism

i. Power steering mechanism

SEMESTER IV

PTAT283 AUTOMOTIVE ELECTRICAL SYSTEMS

3 0 100

1. BATTERIES

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods. Details of modern storage batteries.

2. STARTING SYSTEM


3. CHARGING SYSTEM

Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

4. IGNITION SYSTEM

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition system. Digital ignition system.

5. LIGHTING SYSTEM & ACCESSORIES


TOTAL 45

TEXT BOOK


REFERENCES


PTAT372 AUTOMOTIVE DIESEL ENGINES 3 0 100

1. DIESEL ENGINE BASIC THEORY 10


2. FUEL INJECTION SYSTEM 10


3. AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10


4. SUPERCHARGING AND TURBOCHARGING 08


5. DIESEL ENGINE TESTING AND PERFORMANCE 07


TOTAL 45

TEXT


REFERENCES


1. CLUTCH AND GEAR BOX

2. HYDRODYNAMIC DRIVE

3. PLANETARY GEAR BOXES
Ford - T-model gear box, Wilson Gear box, Cotal electromagnetic transmission.

4. AUTOMATIC TRANSMISSION APPLICATIONS
Need for automatic transmission, principle, hydraulic control system for automatic transmission. Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) - Types - Operations - Torotrak IVT - Anderson CVT.

5. HYDROSTATIC AND ELECTRIC DRIVE

TOTAL 45

REFERENCES
2. SAE Transactions 900550 & 930910.
5. www.Howstuffworks.com

PTAT375 AUTOMOTIVE MATERIALS AND PRODUCTION TECHNIQUES
30 100

I. ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS
Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying,
polyphase mixture, martensitic precipitation, dispersion, fibre and texture strengthening - iron carbon diagram.

2. HEAT TREATMENT AND SURFACE TREATMENT

Heat treatment of steel - Annealing - Types, normalising, Types, hardening and tempering with specific relevance to automotive components, surface hardening techniques, Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating. Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings.

3. 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, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.

4. CASTING FOR AUTOMOTIVE ENGINE COMPONENTS

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts.

5. MACHINING OF AUTOMOTIVE ENGINE COMPONENTS

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings- valves - front and rear axle housings - fly wheel - Honing of cylinder bores

References


AT379 ENGINE TESTING AND AUTOMOTIVE ELECTRONICS LAB

1. Study and use of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
4. Performance study of petrol engine at full throttle and part throttle conditions.
5. Performance study of diesel engine both at full load and part load conditions.
6. Morse test on petrol and diesel engines.
7. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
8. Head balance test on a Automotive diesel engine.
10. Testing of 2 and 4 wheelers using chassis dynamometers.
11. Study of NDIR Gas Analyser and FID.
12. Study of Chemiluminescent NOx analyzer.
14. Diesel smoke measurement.

Study of the following devices for Automotive Application
1. Logic gates, Adders, Flip flops
2. SCR and IC Timers
3. Interfacing seven segment displays
4. Study of Microprocessor and Microcontrollers

5. Interfacing Sensors like RTD, LVDT, Load Cell etc.
6. Interfacing ADC for Data Acquisition
7. Interfacing DAC for Control Application
8. Interfacing Actuators
9. EPROM Programming
10. Mini Project

TOTAL 45

SEMESTER V

ELECTRONIC & ENGINE MANAGEMENT SYSTEMS 3 0 100
FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 7
Current trends in modern Automobiles, Open loop and closed loop systems – Components for electronic engine management.

SENSORS AND ACTUATORS 8
Introduction, basic sensor arrangement, types of sensors such as – oxygen sensors, Crank angle position sensors – fuel metering/vehicle speed sensor and detonation sensor – Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

ELECTRONIC FUEL INJECTION ANDignition SYSTEMS 12
Introduction, Feed back carburetor systems (FBC) Throttle body injection and multi port or point fuel injection. Injection system controls. Advantages of electronic ignition systems. Transistor assisted ignition system,
Contactless ignition systems and Distributorless ignition system, Electronic spark timing control.

4. DIGITAL ENGINE CONTROL SYSTEM 10
Open loop and closed loop control systems – Engine cracking and warm up control – Acceleration enrichment – Deceleration leaning and idle speed control. Integrated engine control system, Exhaust emission control engineering.

5. ELECTROMAGNETIC INTERFERENCE SUPPRESSION 8
Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system, security and warning system.

TOTAL 45

TEXT


REFERENCES


PTAT382 VEHICLE BODY ENGINEERING 30 100

1. CAR BODY DETAILS 10

2. VEHICLE AERODYNAMICS 9
Objectives – Vehicle drag and types – various types of forces and moments – effects of forces and moments – Side wind effects on forces and moments – Various body optimization techniques for minimum drag – Wind tunnel testing. Flow visualization techniques, Scale model testing. Component balance to measure forces and moments.

3. BUS BODY DETAILS 9
Types: Mini bus, single decker, double decker, two level, split level and articulated bus. – Bus body lay out – Constructional details: Types of metal sections used. Regulations – Conventional and integral type construction.

4. COMMERCIAL VEHICLE DETAILS 8
Different types of commercial vehicle bodies – Light commercial vehicle body types – Construction details of
flat platform body, Tipper body & Tanker body – Dimensions of driver’s seat in relation to controls – Drivers cab design.

5. BODY MATERIALS, TRIM AND MECHANISMS


TOTAL 45

TEXT


REFERENCES


PTAT384 AUTOMOTIVE POLLUTION AND CONTROL

1. INTRODUCTION

Pollutants – sources – formation – effects – transient operational effects on pollution.

2. S.I. ENGINE COMBUSTION AND EMISSIONS

Chemistry of SI engine combustion – HC and CO formation in 4-stroke and 2-stroke SI engines – NO formation in SI engines – Particulate emissions from SI engines – Effect of operating variables on emission formation.

3. CI ENGINE COMBUSTION AND EMISSIONS

Basics of diesel combustion – Smoke emission in diesel engines – NO emission from diesel engines – Particulate emission in diesel engines. Color and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

4. CONTROL TECHNIQUES FOR REDUCTION OF SI AND CI ENGINE EMISSION


5. TEST PROCEDURE & INSTRUMENTATION FOR EMISSION MEASUREMENT AND EMISSION STANDARDS


TOTAL 45
TEXT BOOK


REFERENCES

3. SAE Transactions, Vehicle emission, 1982 (3 volumes).

PTAT471 VEHICLE DYNAMICS

1. INTRODUCTION 08

2. MULTI DEGREES FREEDOM SYSTEMS 08

3. SUSPENSION AND TYRES 09
Requirements, Sprung mass frequency, Wheel hop, wheel wobble, wheel shimmy, Choice of suspension spring rate, Calculation of effective spring rate, Vehicle suspension in fore and aft directions, Ride characteristics of tyres – Behaviour while cornering – Power consumed by tyre – Effect of driving and braking torque – Gough’s tyre characteristics.

4. VEHICLE HANDLING AND STABILITY OF VEHICLES 11
Oversteer, under steer, steady state cornering, Effect of braking, driving torques on steering, Effect of camber, transient effects in cornering, Directional stability of vehicles, Load distribution, Calculation of Tractive effort and reactions for different drives – Stability of a vehicle on a slope, on a curve and a banked road.

5. NUMERICAL METHODS 09
Approximate methods for fundamental frequency, Dunkerley’s lower bound, Rayleigh’s upper bound, Holzer method for close coupled systems and branched systems.

TOTAL 45

TEXT


REFERENCES


PTAT376 VEHICLE DESIGN DATA CHARACTERISTICS 0 3 100

1. PERFORMANCE CURVES 15
   Resistance. Power and torque curves. Driving force against vehicle speed. Acceleration and gradability in different gears for a typical car or truck plotted from specifications available in Automobile Journals.

2. EXPECTANCY CURVES 30

TOTAL 45

REFERENCES

SEMESTER VI

PTAT472 VEHICLE MAINTENANCE 3 0 100

1. MAINTENANCE RECORDS AND SCHEDULE 09

2. MAINTENANCE, REPAIR AND OVERHAULING OF ENGINE 09
3. MAINTENANCE, REPAIR AND OVERHAULING OF CHASSIS DRIVE LINE COMPONENTS


4. MAINTENANCE, REPAIR AND SERVICING OF ELECTRICAL SYSTEMS


5. MAINTENANCE, REPAIR AND SERVICING OF COOLING LUBRICATION SYSTEM, FUEL SYSTEM AND BODY

Cooling system – types, water pump, 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, tinking, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

TOTAL 45

REFERENCES


PTAT386 CAD FOR AUTOMOTIVE ENGINE DESIGN

1. Design of piston, piston pin and piston rings and drawing of these components.
2. Designing of connecting rod small end and big end, shank design, design of big and cap bolts and drawing of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations, development of short long crankarms, front end and rear end details, drawing of the crankshaft assembly.
4. Design and drawing of flywheel, ring gear design, drawing of the flywheel including the development of ring gear teeth.

5. Design and drawing of the inlet and exhaust valves.

6. Computer aided design of the above components.

7. Design of Cam and Camshaft, Cam profile generation. Drawing of cam and camshaft.

8. Design of combustion chamber.

9. Design and drawing of engine complete assembly involved with cylinder block, cylinder head, crankcase, valve ports, water jackets.

TOTAL = 45

TEXT BOOK


REFERENCES


3. Khovak, Motor vehicle engines, MIR Publishers


PTAT 474 VEHICLE MAINTENANCE AND TESTING LAB

1. Study and lay out of an automobile repair, service and maintenance shop.

2. Study and preparation of different statements / records required for the repair and maintenance works.

3. Study and preparation of the list of different types of tools and instruments required.

4. Minor and major tune up of gasoline and diesel engines.

5. Fault diagnosis in electrical ignition system, gasoline fuel system, diesel fuel system and rectification.

6. Study of the faults in the electrical systems such as Head lights, Side or Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and Charging system.

7. Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet).

8. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.

9. Practice the following:
   i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
   ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
iii) Wheel bearings tightening and adjustment.

iv) Adjustment of head lights beam.

v) Removal and fitting of tyre and tube.

TOTAL = 45

REFERENCES

1. Service manuals of reputed vehicles.

SEMESTER VII

PTAT383 TWO AND THREE WHEELER TECHNOLOGY 3 0 100

1. THE POWER UNIT 09


2. CHASSIS AND SUB-SYSTEMS 08

Main frame, its types. Chassis and shaft drive. Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

3. BRAKES AND WHEELS 08


4. TWO WHEELERS 10

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

5. THREE WHEELERS 10

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

TOTAL 45

TEXT


REFERENCES


PTAT381 AUTOMOTIVE CHASSIS DESIGN 3 0 100

1. VEHICLE FRAME AND SUSPENSION 09

Study of loads - moments and stresses on frame members. Computer aided design of frame for passenger and

51
commercial vehicle - Computer aided design of leaf springs - Coil springs and torsion bar springs.

2. FRONT AXLE AND STEERING SYSTEMS

3. CLUTCH

4. GEAR BOX
   Gear train calculations, layout of gear box. Calculation of bearing loads and selection of bearings. Complete assembly drawing using Drafting software. Design of three speeds and four speed gear boxes.

5. DRIVE LINE AND REAR AXLE

TOTAL 45

TEXT BOOK


REFERENCES


PTAT481 PROJECT WORK

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a Guide who is a member of the faculty of the University. Twelve periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.
The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

**ELECTIVES**

**PTAT385  COMPUTER CONTROL OF VEHICLE SYSTEMS  3 0 100**

1. **INTRODUCTION**  
   Understanding autonomy - Review of the role of control in autonomy (Speed control, suspension control, integrated vehicle dynamics) – Role of Sensors and actuators Examples of autonomy, cruise control and ABS.

2. **ENGINE CONTROL SYSTEM**  

3. **DRIVELINE CONTROL SYSTEM**  

4. **INTELLIGENT TRANSPORTATION SYSTEM**  
   Overview - Control architecture - Collision avoidance, pitch, yaw, bounce control – Traffic routing system - Automated highway systems - Lane warning system – Driver Information System - Data communication within the car.

5. **SAFETY IMPACTING DEVICES**  

**TEXT BOOK**


**REFERENCE**


**PTAT473  FINITE ELEMENT METHOD  3 0 100**

1. **INTRODUCTION**  

2. **DISCRETE ELEMENTS**  
   Use of bar and beam elements in structural analysis. Bar Element – Stiffness matrix calculation by direct and polynomial methods. Boundary condition and assemblage
3. CONTINUUM ELEMENTS


4. ISO PARAMETRIC ELEMENTS


5. SOLUTION SCHEMES AND APPROXIMATE METHODS


TOTAL 45

TEXT BOOK


REFERENCES


PTAT071 THEORY AND DESIGN OF JIGS AND FIXTURES

INTRODUCTION

Definitions of Jigs and Fixtures – Principles of Jigs and Fixtures design – Preliminary analysis and planning of jigs and fixture parts and their materials – Basic steps in the design of jigs and fixtures – Advantages of Jigs & Fixtures.

2. LOCATION AND CLAMPING


3. LOADING AND UNLOADING PROBLEMS

Loading - Entering, locating and clamping, symmetric consideration.
Unloading – Bur clearance, ejectors, receivers, chip problems, relief and projection, shields and seals.

4. CUTTER GUIDANCE

5. DESIGN OF JIGS AND FIXTURE
Three construction principles – Built up type, casting and weldment. Practising the various types of jigs – Practising the various types of milling fixtures – broaching fixtures – function of broaching fixtures – Internal and external broaching fixtures.

TOTAL 45

TEXTBOOK

REFERENCES

PTAT072 EMBEDDED SYSTEMS FOR AUTOMOBILES 3 0 100

1. INTRODUCTION
Overview of System and Engineering Principles – Classification of system – Introduction to Embedded system – History and classification of Embedded systems – typical application.

2. HARDWARE COMPONENTS OF EMBEDDED SYSTEM
Processor, Power Source, Clock, Memories, Timer, IO Ports, IO Buses, IO Interface, Interrupt Handler, ADC, DAC, Display units, Keyboard.

3. SOFTWARE COMPONENTS OF EMBEDDED SYSTEM

4. STAGES IN EMBEDDED SYSTEM DESIGN
Need Analysis – Conceptual design – embodiment design – detailed design – implementation and verification phase – documentation phase.

5. CASE STUDIES
Discussion of specific example of complete embedded system in Automobile using MC68HC11 – MC8051.

TOTAL 45

TEXT BOOK
REFERENCES


PTAT073 ALTERNATE FUELS AND ENERGY SYSTEMS 3 0 100

1. INTRODUCTION 06


2. ALCOHOLS 09


3. NATURAL GAS, LPG, HYDROGEN AND BIOGAS 09

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

4. VEGETABLE OILS 10

Various vegetable oils for engines – Esterification – Performance in engines – Performance and emission characteristics.

5. ELECTRIC AND SOLAR POWERED VEHICLES 11


TOTAL 45

TEXTBOOK


REFERENCES


3. SAE Paper Nos.840367, 841156, 841333, 841334.

1. **EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS**

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrapers, motor graders etc. criteria for selection of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

2. **POWER TRAIN CONCEPTS**


3. **VEHICLE SYSTEMS, FEATURES**


4. **SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS**

Constructional features, capacity and stability of jib cranes. Vibratory compactors.

5. **FARM, MILITARY AND COMBAT VEHICLES**

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles.

**TOTAL 45**

**TEXTBOOK**


2. SAE Handbook Volume III


**REFERENCES**

1. B. Geleman and M. Moskvin, Farm tractors, MIR publishers, Moscow.


**PTAT075 AUTOMOTIVE SAFETY 3 0 100**

1. **TRENDS IN POWER PLANTS**

2.  SUSPENSION BRAKES AND SAFETY  
Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

3.  NOISE & POLLUTION  
Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

4.  VEHICLE OPERATION AND CONTROL  
Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

5.  VEHICLE AUTOMATED TRACKS  
Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

REFERENCES:
3. ARAI Safety Standards

PTAT076 RUBBER TECHNOLOGY FOR AUTOMOBILES  3 0 100
1.  INTRODUCTION  06
PTAT077  AUTOMOTIVE INSTRUMENTATION

1. LINEAR AND ANGULAR MEASUREMENTS  9
Errors in measurement & calibration - Length standards -
Length measuring instruments - Vernier, micrometers,dial
guages, comparators, Limits, fits, tolerances. Gauges and
their types - Angular measuring instruments -bevel
protractor, spirit level, sine bar - measurement of
straightness ant flatness - Measurement of surface finish.

2. MEASUREMENT OF SCREW THREAD AND GEAR  9
Various elements of thread - Two wire & three wire
method - thread gauge - Various elements of gears -
Various gear tooth measurement methods, composite error
measurement.

3. PRESSURE & FLOW MEASUREMENT  11
Diaphragm - various elastic elements - Transduction
methods - Potentiometric strain gauge, variable
reluctanceand capacitive device, LVDT type transducer,
piezo electric transducers and its application to high speed
engine.Farnboro Engine indicator. Low pressure
measurement - McLeod gauge, pirani gauge, thermocouple
typeconductivity gauge.
Classification of flow meters - Orifice plate, venturimeter,
flow nozzles, pitot tubes, rotameter, electromagnetic flow
meters, anemometers, ultrasonic and magnetic flow
meters, alcoelc viscous flow meter.

4. TEMPERATURE MEASUREMENT  8
Temperature scales - Mechanical temperature sensors -
liquid in glass, vapour pressure, bimetal - resistance
type temperature sensors and their measuring circuits -

Thermistors, thermocouples, laws, types,
construction,circuits - Radiation methods - Optical
pyrometer.

5. LOAD AND TORQUE MEASUREMENT  8
Force measuring devices, balances, platform scale weigh
bridges, load cells. Torque measurement, prony brake, rope
brake. Dynamometers. Electric cradle dynamometer, Eddy
current dynamometers. Hydraulic dynamometer,
Transmission and chasis dynamometer.

TOTAL 45

TEXT BOOKS
Instrumentation Devices and Systems " Tata McGraw

REFERENCES
1. Patranabis.D., " Principles of Industrial
New Delhi, 1996.
2. Beckwith,T.G. & Buck.N.L., " Mechanical
Measurements ", Oxford and IBH Publishing House,
New Delhi, 1990.
5. Khare and Vajpayee, " Dimensional Metrology ",
PTAT078  ADVANCED THEORY OF IC ENGINES  3 0 100

1. CYCLE ANALYSIS  05

2. COMBUSTION OF FUELS  12

3. COMBUSTION MODELLING  12
Basic concepts of engine simulation – Governing equations – Flow models, thermodynamic models – SI engine and CI engine models.

4. ADVANCES IN IC ENGINES  08

5. OPERATION AND PERFORMANCE  08
Computer control of engine parameters for pollution control and better efficiency – Closed loop control of engine parameters – Hybrid operation – performance maps.

TOTAL 45

TEXT BOOK


REFERENCES


PTAT079  AUTOMOTIVE AERODYNAMICS  3 0 100

1. INTRODUCTION  10

2. AERODYNAMIC DRAG OF CABS  08

3. SHAPE OPTIMIZATION OF CABS  07
Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back –
Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

4. VEHICLE HANDLING


5. WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS


TOTAL 45

TEXT BOOK


REFERENCES


PTAT080 VEHICLE AIR-CONDITIONING

1. AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS

Basic air conditioning system – Location of air conditioning components in a car – Schematic layout of a refrigeration system. Compressor components – Condenser and high pressure service ports. Thermostatic expansion valve & orifice tube – Expansion valve calibration – Evaporator temperature controls for TXV & CCOT systems.

2. AIR CONDITIONER–HEATING SYSTEM

Manually controlled air conditioner – Heater system – Ford automatically controlled air conditioner – heater systems – Chrysler automatically controlled air conditioner – Heater system, General Motors automatically controlled air conditioner – Heater system – Flushing & Evacuating.

3. REFRIGERANT

Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure - Ambient conditions affecting system pressures.

4. AIR ROUTING & TEMPERATURE CONTROL

Objectives – Evaporator case air flow through the Dash recirculating unit – Automatic temperature control – Duct system – Controlling flow – Vacuum reserve – Testing the air control and handling systems.
5. HEATER – AIR CONDITIONER TROUBLE SHOOTING & SERVICE

Air conditioner maintenance and service – Servicing heater system. Removing and replacing components. Trouble shooting of air conditioner – heating system – Compressor service. 

TOTAL 45

TEXT BOOK


REFERENCES


PTAT081 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

1. INTRODUCTION TO COMBUSTION PROCESSES

Combustion in premixed and diffusion flames – Combustion process in IC engines.

2. NORMAL, ABNORMAL COMBUSTION IN SI ENGINES

Stages of combustion – Flame propagation – Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion.

3. COMBUSTION AND KNOCK IN CI ENGINES


4. HEAT TRANSFER IN IC ENGINES

Basic definitions – Convective heat transfer – Radiative heat transfer – Heat transfer, temperature distribution and thermal stresses in piston – Cylinder liner – Cylinder head – fins and valves.

5. EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT TRANSFER IN IC ENGINES

Photographic studies of combustion processes – P-V diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

TOTAL 45

TEXT BOOK

REFERENCES


PTAT082 COMPUTER INTEGRATED MANUFACTURING SYSTEMS 3 0 100
5. COMPUTER AIDED MANUFACTURING 11

TOTAL 45

TEXT BOOK


REFERENCES


PTAT083 COMPUTER SIMULATION OF IC ENGINE PROCESSES 3 0 100
5. INTRODUCTION 10
volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature – isotropic changes of state.

2. **SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM** 10

Deviation between actual and ideal cycle – Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation – efficiency calculation, part-throttle operation, super charged operation.

3. **PROGRESSIVE COMBUSTION** 9

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

4. **SIMULATION OF 2-STROKE SI ENGINE** 07

Intake, Exhaust, Charging and Combustion Simulation

5. **DIESEL ENGINE SIMULATION** 9

Zero, one and multi zone model for combustion, different heat release and heat transfer models, equilibrium calculations, simulation of engine performance.

**TOTAL 45**

**REFERENCES**


**PTAT084 - FLEET MANAGEMENT**

1. **MANAGEMENT TRAINING AND OPERATIONS** 10


2. **VEHICLE MAINTENANCE** 08


3. **VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET** 10

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses – Fleet management and data processing – Data processing

4. SCHEDULING AND FARE STRUCTURE


5. MOTOR VEHICLE ACT

Schedules and sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – traffic signs – Constructional regulations – Description of goods carrier, delivery van, tanker, tipper, Municipal, fire fighting and break down service vehicle.

TOTAL 45

TEXT BOOK


REFERENCES


PTAT085 ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS 30 100

1. POWDER METALLURGY


2. FORMING PROCESS


3. GEAR MANUFACTURING


4. CONCEPT & PROGRAMMING OF CNC MACHINES


5. RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks
2. CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION


3. ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR

Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operation of the valve mechanism – Valve mechanism troubles.

4. COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR

Cooling system – Classification – Liquid cooling system – Components. Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps.

5. FARM EQUIPMENTS

Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

TOTAL 45

TEXTBOOK


REFERENCES

1. PROCESS PLANNING


2. ESTIMATING, COSTING AND ELEMENTS OF COST


3. ANALYSIS OF OVERHEAD EXPENSES


4. ESTIMATION OF COSTS FOR FORGING, CASTING AND WELDING

Estimation in forging shop – Losses in forging – Forging cost – Illustrative examples.


Estimation in foundry shop – Estimation of pattern cost and casting cost – Illustrative examples.

5. ESTIMATION OF MACHINING TIME

Estimation of machining time for Lathe operation – Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations – Illustrative examples.

TOTAL 45

TEXT BOOKS


REFERENCES


PTAE085 MANAGEMENT SCIENCE

1. PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT


2. INVENTOR MANAGEMENT

3. OPERATIONS MANAGEMENT


4. FINANCIAL MANAGEMENT


5. MARKETING MANAGEMENT


TOTAL 45

TEXT BOOK


REFERENCES


# DEPARTMENT OF PRODUCTION TECHNOLOGY

**ANNA UNIVERSITY: MIT CAMPUS: CHENNAI - 44**

Curriculum for B.E. Production Engineering,
Part-Time 7 Semester Programme
Regulations - 2004

## SEMESTER I

<table>
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SEMESTER VI

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SEMESTER VII

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Elective Subjects

1. PTPR 473 Mechatronics
2. PTPR 071 Precision Engineering
3. PTPR 074 Advanced Manufacturing Processes
4. PTPR 075 Microcontrollers for Automation
5. PTPR 076 Instrumentation & Control
6. PTPR 077 Surface Engineering
7. PTPR 078 Design of Machine Tool Structures
8. PTPR 083 Purchasing and Materials Management
9. PTPR 084 Non Destructive Testing

SEMESTER-I

PTMA 171 MATHEMATICS – I

1. Matrices
   Characteristic equation – Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues – Cayley_Hamilton theorem – Orthogonal reduction of a symmetric matrix to diagonal form.

2. Functions of several variables

3. Ordinary Differential Equations
   Higher order Linear equations with constant coefficients – Method of variation of parameters – Method of undetermined coefficients – Equations reducible to linear equations with constant coefficients – Simultaneous first order linear equations with constant coefficients.

4. Analytic Functions
   Analytic functions – Cauchy’s Riemann equations – Properties – Harmonic conjugates – Conformal Mapping – Mapping by functions $w = \frac{1}{z}$, $z^2$ – Bilinear transformation.

5. Complex Integration
   Cauchy’s integral theorem and integral formula – Taylor and Laurent Series – Singularities – Residues –
Residue theorem – Application of Residue theorem for evaluation of real integrals – use of circular contour and semicircular contour with no pole on real axis.

L = 45

TEXT BOOKS


REFERENCES:


PTPH 171 PHYSICS

1. Acoustics


2. Crystallography

Crystal systems – Bravais lattices – Unit cell – Miller indices for planes and directions – interplanar spacing in cubic structure atomic packing factor for SC, BCC and FCC structures – imperfections in crystals – Point defects and dislocations – Effect of imperfections on physical properties.

3. Light


4. Lasers And Fibre Optics


5. Non-Destructive Testing


L : 45

REFERENCES:


PTCY 171 CHEMISTRY

1. Water Treatment and Pollution Control


2. Fuels


3. Thermodynamics and Kinetics


4. Electrochemistry and Corrosion


5. Polymer and Composites


TEXT BOOKS

REFERENCES

PTGE172 FUNDAMENTALS OF COMPUTING

1. Introduction


2. Computer Arithmetic And Software


3. Problem Solving And Office Automation


4. Introduction to C

Overview of C - Constants, Variables and Data Types - Operators and Expression - Managing Input and Output Operators - Decision Making and Branching - Decision Making and Looping.

5. Functions And Pointers

Arrays - Handling of Character Strings - User-Defined Functions - Structures and Unions - Pointers - The

Preprocessor - Developing a C Program: Some Guidelines.

TEXT BOOKS:


REFERENCES:


PTEI 188 ELECTRICAL ENGINEERING

1. Basic Concepts and DC Circuits


2. Electromagnetism

Magnetic flux - MMF - flux density and intensity - B H curves - simple and composite
magnetic circuits - statically induced EMF - self and mutual inductances - coupling coefficient - stored energy - force on a conductor - magnetic pull - force between parallel conductors.
3. A.C. Circuits

RMS and average value of periodic waves - form factor - phase and phase difference -
simple RC, RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three
phase systems - power measurement in 3 phase system. 

4. D.C. Machines

Construction details of DC machines - principle of operation of DC generator -
EMF equation - characteristics of DC generators - principle of DC motor - Back EMF -
Voltage and torque equation - characteristics of shunt, series and compound motors -
speed control of DC motors.

5. A.C. Machines

Principle of ideal transformer - construction and type -
EMF equation - tests on transformer - equivalent circuit -
voltage regulation - construction of synchronous machines -
principle of alternator - EMF equation - starting of
synchronous motor - torque equation - induction motor -
construction, principle of operation - slip - starting and running torques.

REFERENCES


SEMESTER-II

PTMA 072 NUMERICAL METHODS

1. Solution Of Equations And Eigenvalue Problems:
Linear interpolation methods (method of false position) -
Newton's method - Statement of Fixed Point Theorem -
Fixed point iteration: \( x = g(x) \) method - Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss-Jordon method - Eigenvalue of a matrix by power method and Jacobi's method.

2. Interpolation And Approximation:
Lagrange Polynomials - Divided differences -
Interpolating with a cubic spline - Newton's forward and backward difference formulas.

3. Numerical Differentiation And Integration:
Derivatives from difference tables - Divided differences and finite differences - Numerical integration by
trapezoidal and Simpson’s 1/3 and 3/8 rules – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson’s rules.

4. Initial Value Problems For Ordinary Differential Equations:


5. boundary value problems in ordinary and partial differential equations:

Finite difference solution of second order ordinary differential equation – Finite difference solution of one-dimensional heat equation by explicit and implicit methods – One-dimensional wave equation and two dimensional Laplace and Poisson equations.

BOOKS FOR STUDY


REFERENCES:


PTGE 181 ENGINEERING MECHANICS

1. Basics & Statics Of Particles


2. Equilibrium Of Rigid Bodies

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

3. Properties Of Surfaces And Solids

4. Dynamics Of Particles


5. Friction And Elements Of Rigid Body Dynamics

Frictional force -- Laws of Coulomb friction -- simple contact friction -- Rolling resistance -- Belt friction Translation and Rotation of Rigid Bodies -- Velocity and acceleration -- General Plane motion.

REFERENCES


PTPR 282 ENGINEERING METALLURGY

1. Introduction and Constitution of Alloys and Phase Diagrams:

Crystal structure -- BCC, FCC and HCP structure -- unit cell -- crystallographic planes and directions, Miller indices -- crystal imperfection, point, line, planner and volume defects -- Grain size, ASTM grain size number. Constitution of alloys -- Solid solutions, substitutional and interstitial -- phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron -- Iron carbide equilibrium diagram. Classification of steel and cast iron microstructure, properties and application.

2. Heat Treatment:


3. Ferrous and Non Ferrous Metals:

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) -- stainless and tool steels -- HSLH -- mar aging steels -- Gray, white malleable, spheroidal, graphite alloy cast irons and Copper and Copper alloys -- Brass, Bronze and Cupronickel -- Aluminium and Al-Cu -- precipitation strengthening treatment -- Bearing alloys, Alloys of Ti, Zn, Mg and Ni.

4. Mechanical Properties and Testing:

Mechanism of plastic deformation, slip and twinning -- Types of fracture -- Testing of materials under tension,
compression and shear loads — hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep mechanisms — types of wear — preventions.

5. Welding and Foundry Metallurgy:


TEXT BOOKS:


REFERENCES:


PTGE 183 ENVIRONMENTAL SCIENCE AND ENGINEERING

1. Introduction To Environmental Studies And Natural Resources


Field Study of Local Area to Document Environmental Assets — River / Forest / Grassland / Hill / Mountain.

2. Ecosystems And Biodiversity

Concepts of an Ecosystem — Structure and Function of an Ecosystem — Producers, Consumers and Decomposers — Energy Flow in the Ecosystem — Ecological Succession — Food Chains, Food Webs and Ecological Pyramids — Introduction, Types, Characteristics Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems
(Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Biogeographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as A Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.

Field Study of Common Plants, Insects, Birds

Field Study of Simple Ecosystem – Pond, River, Hill Slopes, Etc.

3. Environmental Pollution

Definition – Causes, Effects and Control Measure of: (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management: Causes, Effect and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Field Study of Local Polluted Site – Urban / Rural / Industrial / Agricultural.

4. Social Issues and The Environment


5. Human Population And The Environment


TEXT BOOKS


REFERENCES

PTPR 286 METALLURGY LABORATORY

List of Experiments:
1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
   a. Carbon steels (High, Medium, and Low)
   b. Cast Iron (Gray, White Nodular, Malleable)
   c. Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
3. Cooling Curves
   a. Pure Metal (Pb or Sn)
   b. Alloy (Pb-Sn or Pb-Sb)
4. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)
   a. Annealing
   b. Normalising
   c. Quench Hardening
   d. Tempering
5. Jominy End Quench Test
6. Foundry Sand Testing
   a. Sieve Analysis
7. Electro-chemical Test
   a. Electro deposition
   b. Electro-chemical etching Test

SEMESTER-III

PTPR 281 MECHANICS OF MACHINES

1. Mechanisms:

2. Friction:
3. Gearing and Cams:

Gear profile and geometry - nomenclature of spur & helical gears - laws of gearing - interference - requirement of minimum number of teeth in gears - gear trains - simple and compound gear trains - determination of speed and torque in epicyclic gear trains - cams - different types of followers - cam design for different follower motions.

4. Balancing:

Static and dynamic balancing - single and several masses in different planes - primary and secondary balancing of reciprocating masses - balancing single and multi cylinder engines - governors and gyroscopic effects.

5. Vibration:

Free, forced and damped vibrations of single degree of freedom systems - force transmitted to supports - vibration isolation - vibration absorption - torsional vibration of shafts - single and multirotor systems - geared shafts - critical speed of shafts.

TEXT BOOK


REFERENCE:


PTPR 374 QUANTITATIVE TECHNIQUES IN MANAGEMENT


2. Replacement Models and Game Theory:

Basic replacement model - individual and group replacement problems - applications - game theory - terminology - decision criteria - solution to a 2 x 2 and 2 n games - applications of LP in game theory - applications.

3. Queuing Models and Simulation:

Elements of queue - queue discipline - Poisson arrival and exponential service - queue length - waiting time - steady state conditions - applications - concept of simulation - Monte Carlo method - applications.

4. Forecasting, Sequencing and Project Network Analysis:

Purpose of forecasting - methods of forecasting - sequencing - methods of sequencing - line balancing - project network analysis - CPM - PERT - time crashing - applications.
5. Advanced Topics:
Dynamic programming - Integer Programming – Decision Tree Analysis.

REFERENCES:

3. Fluid Power Elements:

4. Hydraulic and Pneumatic circuits design:

5. Electro pneumatics and PLC circuits:
Use of electrical timers, switches, solenoid, relays, proximity sensors etc. electro pneumatic sequencing; Ladder diagram – PLC Elements and functions – PLC diagram & programming

REFERENCES:

PTPR 284 CASTING AND WELDING TECHNOLOGY

1. Casting Process:

2. Welding Processes:

3. Special Casting Processes:

4. Special Welding Processes:

5. Testing of castings & Weldments:

TEXT BOOK:

REFERENCES:
4. ASM Hand Book.

PTPR 287 FLUID POWER LABORATORY
List of Experiments:
1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values.
5. One shot and regenerative pneumatic circuits.
7. Simulation of Electro-pneumatic latch circuits.
8. Simulation of Logic pneumatic circuits.
9. Simulation of electro pneumatic sequencing circuits.
10. Simulation of PLC based electro pneumatic sequencing circuits.
11. Simulation of hydraulic & pneumatic simulation software.
12. Simulation of PLC simulation software.

SEMESTER-IV
PTPR 373 DESIGN OF MACHINE ELEMENTS

1. Fundamentals of Design
Mechanical Engineering Design – Introduction – The various phases of Design- Stress and Strength considerations – Stiffness and Statistical considerations- Factor Of Safety-Reliability-Economics of Design – Codes


2. Design of Basic Machine Elements

3. Design of Mechanical drives

4. Design of Automotive components

5. Recent Advances
TEXT BOOK:


REFERENCES:


PTPR 471 PROCESS PLANNING AND COST ESTIMATION

1. Process Planning: 6

2. Estimating, Costing and Elements of Cost: 10

3. Analysis of Overhead Expenses: 8

4. Estimation of Costs for Forging, Casting and Welding: 10

5. Estimation of Machining Time: 11
Estimation of machining time for Lathe operation – Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations – Illustrative examples.

TEXT BOOKS:


REFERENCES:


PTPR 375 METAL FORMING PROCESS

1. Fundamentals of Metal Forming: 10

2. Forging and Rolling: 10

3. Extrusion and Drawing Processes: 10

4. Sheet Metal Forming Processes: 10

5. Recent Advances: 5

TEXT BOOK:

REFERENCES:

PTPR 372 METROLOGY AND COMPUTER AIDED INSPECTION

1. Introduction to General Concepts of measurements: 8
Definition – Standards of measurement – Errors in measurement – Limits, fits, tolerances and gauge design –

2. Linear and Angular measurements: 10


3. Measurement of Surface Finish and Measuring Machines: 9


4. Metrology of Screw Thread & Gears: 9


5. Computer Aided Inspection and Laser Metrology 9


L:45

TEXT BOOK:


REFERENCES:


PTPR 377 METROLOGY LAB

List of Experiments:


2. Calibration of a Dial gauge, micrometer, vernier and height gauge.


4. Use of slip gages and Accessories.

5. Gear tooth measurements – various methods.

6. Thread measurement using three-wire method.

7. Study of digital measuring instruments.

8. Surface Roughness measurement.
9. Study and use of CMM.
10. Use of Sine-Bar of Angular measurement.
12. Use of a mechanical comparator.

SEMESTER-V

PTPR 285 ADVANCED MACHINING PROCESS

1. Mechanics of Metal Cutting: 10

2. Tool Material, Tool Wear and Tool Life: 9

3. Gear Manufacture: 8

4. Concept & Programming of CNC machines: 9

5. Advanced CNC programming & Tooling: 9

TEXT BOOK:


REFERENCES:


PTPR 381 INDUSTRIAL MANAGEMENT

1. Principles of Management and Personnel Management: 7
   General Principles of Management – Management Functions – Organization – Types – Comparison –

2. **Inventory Management**


3. **Operations Management**


4. **Financial Management**


5. **Marketing Management**


**TEXT BOOK**


**REFERENCES:**


**PTTR 383 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

1. **Purpose Types and Functions of Jigs and Fixtures**


2. **Jigs**


3. **Fixtures**

   General principles of boring, lathe, milling and broaching fixtures-Grinding, planning and shaping fixtures, assembly, inspection and welding fixtures – Modular fixtures. Design and development of fixtures for given component.
4. Press working Terminologies and Elements of dies and Strip Layout


5. Design and Development of Dies


Total = 45 Periods

Text Books

References
4. PSG College of Technology, Coimbatore, Design Data Hand Book.
5. ASME Hand Book.

PTPR 371 ENGINEERING STATISTICS AND QUALITY CONTROL

1. Sampling Theory and Testing of Hypothesis: 9

2. Statistical Process Control: 10

3. Acceptance Sampling: 10

4. Reliability and Quality: 8

5. Experimental Design and Taguchi Method: 8
REFERENCES:


PTPR 376 CNC LAB

List of Experiments

1. Study of different control systems and NC codes.
2. Program for Turning, Facing operation.
3. Program for circular interpolation, Taper turning operation.
4. Program for thread cutting operation.
5. Program using Do-Loop and Sub-routine.
6. Program for profile milling operation, circular interpolation.
7. Program for Circular, rectangular pocket milling.
8. Program for drilling cycle.
10. NC code generation using CAD software packages.
11. Study of cam packages.
12. Study of CNC Wire cut EDM.

SEMESTER-VI

PTPR 384 COMPUTER INTEGRATED MANUFACTURING

1. Introduction:

2. Automated Manufacturing Systems:

3. Group Technology and FMS:

4. Process Planning:
5. Process Control, Shop Floor and Computer Aided Quality Control.

Computer process interface – Interface Hardware –
Computer process monitoring – Direct Digital control – supervisory computer control.
Shop floor control – factory data collection systems –
Automatic identification systems – Automated Data collection systems.

L:45

TEXT BOOK:


REFERENCES:


PTPR 472 PRODUCTION OF AUTOMOTIVE COMPONENTS

1. Engine:


Production of - Cylinder block, Cylinder head, liners, oil pan, piston and piston rings and testing.

2. Engine Parts:


3. Fuel and Transmission System:


Production of - Friction lining materials for clutch and brakes – propeller shaft – gear box housing – steering column – Energy absorbing steering column.

4. Chassis and Suspension System:

Working Principle of - Suspension system – leaf spring and stock absorbers – wheel housing – design concepts of chassis (aerodynamics and cross worthiness).


5. Recent Advances:

Application of sensors and actuators – Emission control system – Hydro forming of Exhaust manifold and lamp
housing – stretch forming of Auto body panels – MMC liners – Thermal barrier coating on Engine head and valves – Selection of materials for Auto components.

TEXT BOOKS:

REFERENCES:
2. Newton and Steels, the motor vehicle, ELBS, 1990.
3. Serope Kalpakjian and Steven R.Schmid, Manufacturing Processes for Engineering

PTPR 382 COMPUTER AIDED PRODUCT DESIGN

1. Introduction to Computer Aided Design

2. Computer Graphics Fundamentals

3. Geometric Modelling

4. Product Design concepts

5. Recent Advances
Customization Factor – Product Life Cycle Management – Applications of AI in product development process.

TEXT BOOK:


REFERENCES:


PTPR 385 COMPUTER AIDED DESIGN LABORATORY

List of Experiments:

3. Finite Element Modeling and Analysis of typical Automotive Components using ANSYS.
5. 3D modeling of Components using ACIS.
6. Assembly of typical parts using CATIA.

SEMESTER-VII

PTPR 474 FINITE ELEMENT APPLICATION IN MANUFACTURING

1. Introduction:

General Field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method-Variational calculus-Variational formulation of boundary value problems-The method of weighted residuals-Rayleigh-Ritz and Galerkin methods-Solution of large system of equations-Choleski Decomposition-Gaussian elimination procedures

2. General Procedure of FET:

Discretization of Domain-selection of interpolation polynomials-Convergence requirements-Formulation of element characteristics matrices and load vectors-Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results

3. Finite Element Analysis of One Dimensional and Two Dimensional Problems:

One dimensional finite element analysis-Linear bar element-Quadratic bar element-Beam element-Frame element-One dimensional heat transfer-Two dimensional finite element analysis-approximation of geometry and field variables-Three nodded triangular element-Four nodded rectangular element-Six nodded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions-solution of state equilibrium equations-2D fluid problems.
4. Iso-Parametric Elements:

Iso-parametric elements-Dynamic analysis-Equations of motion using Lagrange's approach-Consistent and lumped mass matrices-Formulation of FE equations for vibration problems-Solution of Eigen value problems-Transient vibration analysis-Thermal transients.

5. Application Of Finite Element Analysis:

Finite element analysis of crank shaft torsional vibrations-Axi-symmetric FEA of a pressure vessel-Application of FEM in various metal forming processes-Metal cutting machines-Solidification of castings-Weldment design.

L:45

TEXT BOOKS:


REFERENCES:


PTGE 381 TOTAL QUALITY MANAGEMENT

1. Introduction:

Definition and dimensions of quality – Historical Review – Quality Control and Quality Assurance – Total Quality Management: Definition, benefits - Six basic concepts of TQM – Teaching of Quality Gurus – Obstacles for TQM implementation.

2. TQM – Old Tools:


3. TQM – Management Tools:


4. TQM – Principles:


5. TQM Techniques:


TEXT BOOK:

REFERENCE:

PTPR 473 MECHATRONICS
1. Introduction: 10

Mechatronics - scope key issues - evolution - elements - mechatronics approach to modern engineering and design. Sensors and transducers - resistive, inductive, capacitive, thermo-electric, piezoelectric, photoelectric, electro-mechanical and ultrasonic

Signal conditioning - OP Amps - protection - filtering - Wheatstone bridge - digital signals - multiplexers - data acquisition - pulse modulation

2. Control Systems: 10

Process model formulation - transfer function - control actions - PID controllers - digital controllers, controller tuning - control system performance - adaptive control.
3. Electrical Actuation Systems: 8
DC, AC motors, DC, AC servomotor stepper motor, piezoelectric actuators, switching devices.

4. Microprocessor and Microcontrollers: 9
8085 microprocessor-architecture-applications, microcontroller-8031, 8051, PIC-architecture-instruction set, addressing methods-applications.

5. Applications and Design: 8
Mechatronics Systems in Robotics, Manufacturing, Diagnostics, Automobiles.

L:45

TEXT BOOK:

REFERENCES:

PTPR 071 PRECISION ENGINEERING
1. Concept of Accuracy and of Machine Tools: 10

2. Static Stiffness and its Influence and Inaccuracy Due To Thermal Effects in The Machine Tools: 9

3. Dimensioning Accuracy and Surface finish: 9


5. Smart structures, Materials and Micro Actuators: 8

L:45

REFERENCES:

PTPR 074 ADVANCED MANUFACTURING PROCESSES

1. Manufacturing Processes for Plastic: 9

2. Mechanical, Chemical and Electro-chemical energy based processes: 8

3. Electrical Energy based Waste Processes: 8

4. Thermal Energy Process: 10
Laser Beam machining (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM), Principles - Equipment - Types - Beam control techniques - Applications.

5. Rapid Prototyping and Rapid Tooling:
Introduction-Stereo Lithography-Fused Deposition Moulding-Selective Laser Sintering-Laminated Object Manufacturing-Solid Base Curing-Direct Manufacturing and Rapid Tooling

TEXT BOOK:

REFERENCES:


PTPR075 MICROCONTROLLER FOR AUTOMATION

1. Introduction: 6

Architectures of 8 bit, 16 bit microprocessors, microcontroller (8031,8051 etc), PIC microcontroller (16F84 series), classification of memories –RAM, ROM, EPROM, EEPROM.

2. Assembly Language Programming: 12

Instruction formats of 8031 family, Addressing modes, interrupts, instruction set, Programming examples- addition, subtraction, code conversion, logical computation, time delay generation, timers and counters.

3. Peripheral Devices and Interfacing: 9

PPI 8255- switches, keypads, LEDs, LCDS, A/D and D/A Converters, Communication interfaces through RS232

4. Interfacing Power Electronic Devices: 9

MOSFET, SCR, TRIAC, Opto coupler, power op amps, stepper motor and DC motor interfacing through H Bridge circuits,

5. Applications: 9

Data Acquisition system, Programmable logic controller, temperature control, CNC, Coin counter, walking robot, pick and place robot, automotive application.

L:45

TEXT BOOK:


REFERENCES:


PTPR 076 INSTRUMENTATION AND CONTROL

1. Introduction: 9

Static and dynamic characteristics of measurement systems. Standards and calibration. Error and uncertainty analysis, statistical analysis of data, and curve fitting.

2. Mechanical Measurements and Industrial Instrumentation: 10

Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force, torque, power, strain, stress, pressure, temperature.

3. Data display and recording devices: 8

Data display-CRO, LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.
4. Control: 9
Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole & zero of a system, realization of transfer functions.

5. Stability analysis: 9
Stability criteria, Bode plots, Routh and Nyquist criteria.

TEXT BOOK: L:45

REFERENCES:

PTPR 077 SURFACE ENGINEERING
1. Metal Cleaning and Preview on Surface Engineering: 8

2. Thermal spraying processes and Electrodeposited coatings: 10

3. Hot Dip Coating and Diffusion Coatings: 10

4. Non-Metallic coating oxide and coersion coatings 9

5. Quality assurance, Testing and Selection of coatings 8
TEXT BOOK


REFERENCES:


PTPR 078 DESIGN OF MACHINE TOOL STRUCTURES

1. Introduction: 10

2. Strength and rigidity of machine tool structures: 10

3. Sideways: 9

4. Spindles and spindle supports: 8

5. Machine Tool Dynamics: 9

TEXT BOOK:


REFERENCES:


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