THIRD SEMESTER

THEORY

Subject title : MECHANICAL ENGINEERING SCIENCE – I
Semester : 4 periods per week in 3rd semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Trainees will be able to understand the mechanical concepts used in various bench works.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Safety	01
2	Engineering materials	11
3	Bench work and metal cutting theory	09
4	Cutting tool materials and geometry	04
5	Cutting fluids and its importance	01
6	Drilling	06
7	Turning and screw threads	10
8	Milling	10
9	Grinding	08

SUBJECT CONTENT :

1.0 SAFETY

1.1 Safety in workshop, Labs, Personal Safety. Causes of accidents and importance of safety.

2.0 ENGINEERING MATERIALS

2.1 Role of engineering material and Mechanical, Physical, Chemical and Thermal properties, stress, strain and its types, Elastic limit, Hooke's law, Young's modulus, problems.

2.2 Ferrous Metals and its alloys.

2.3 Non ferrous Metal and its alloys.

3.0 BENCH WORK AND METAL CUTTING THEORY

3.1 Hand Tools and Devices, Bench Layouts, Types of Vices, Types and Specification of Files, Hack saw frames and Blades, Types of Chisels and angles, Hammers and Spanners and Screw drivers, Scraping.

3.2 Theory of chip removal, Orthogonal and oblique Cutting Speeds, Feeds, Depth of Cuts.

4.0 CUTTING TOOL METERIALS AND GEOMETRY

4.1 Cutting Tools properties, Types, Characteristics and composition.

4.2 Tool angles – rake, clearance, Lip and wedge angles, Nomenclature of single point cutting tool and types.

5.0 CUTTING FLUIDS AND ITS IMPORTANCE

5.1 Importance of cutting fluids, types and its application.

6.0 DRILLING

6.1 Introduction to Drilling machine, Types, Specification, Mechanism Operation, work holding and tool holding devices.

6.2 Drills – Nomenclature of twist drill, types, material, size designation as per ISI, sharpening of drills, counter boring and counter sinking.

6.3 Reamers and Taps – Types, importance and operation.

7.0 TURNING AND SCREW THREADS

7.1 Introduction to Lathe, types of Lathes, parts of Lathes – Bed, Tail stock and Carriage, accessories and attachments.

7.2 Driving mechanism, Feed mechanism, thread cutting.

7.3 Lathe Operations – Plain, step, different tapers, turning Methods and calculations.

7.4 Function and Nomenclature of screw threads, Types of threads – metric, BSW, pipe square, trapezoidal, acme knuckle, buttress.

8.0 MILLING

8.1 Introduction to Milling Machine, Types, Mechanism, Attachments and accessories, work and tool holding devices.

8.2 Milling cutters – Types and its cutting angles, cutting speeds, Feeds depth of cuts and machine time calculations.

8.3 Milling process and Operations – Up milling and down milling Plain milling, Face milling, end milling, side milling, straddle milling, gang milling, form milling.

9.0 GRINDING

9.1 Introduction to grinding machines, types and features.

9.2 Grinding operations – Types, wet and dry grinding.

9.3 Grinding Wheels – specification, abrasives, grain, grade, structure and types of wheels, Dressing of wheels, mounting and balancing and their importance.

Reference Books :

1.	**Work shop Technology (Part & Part2)**	**-**	**W.A.J. Chapman**
2.	**Work shop Technology (Part & Part2)**	**-**	**Hazra Choudhury**
3.	**All about Machine Tools**	**-**	**H. Gerling**
4.	**Modem Workshop Practice**	**-**	**Wright Bake**

Subject title	**:**	**ELECTRICAL ENGINEERING SCIENCE**
Semester	**:**	**3rd semester**
Periods	**:**	**60 periods**
Theory	**:**	**80**
I.A.	**:**	**20**

COURSE OBJECTIVES :

- To study, design and build different types of transformers.
- To study and understand the construction and working of DC Generator types and their characteristics.
- To study and understand various types of Motors and its controls.
- To study the operation of various special purpose Motors.

MAJOR TOPICS

1. **TRANSFORMERS**
2. **DC GENERATORS**
3. **DC MOTORS**
4. **MOTOR CHARACTERISTICS**
5. **INDUCTION MOTORS**
6. **SPECIAL PURPOSE MOTORS**
7. **ALTERNATORS**

Sl. No.	Topics	Periods
	UNIT - 1	
1.0	**TRANSFORMERS**	**13**
1.1	Definition, Construction & Principle of operation	2
1.2	Types of Transformers	1
1.3	EMF Equation and Voltage Transformers Ratio	2
1.4	Tests on transformers – OC & SC Test	2
1.5	Losses and Efficiency of a Transformer	1
1.6	Three Phase Transformer and Connections	2
1.7	Auto Transformers - Principle & Working	1
1.8	Instrument Transformers – Current & Potential Transformers	2
	UNIT - 2	
2.0	**DC GENERATORS**	**11**
2.1	Generator Principle, Construction & Working	2
2.2	Parts of a Generator	1
2.3	EMF Equation of a Generator	1
2.4	Classification of Generators depends on various considerations	2
2.5	Losses and Efficiencies in DC Generators	2
2.6	Armature Reaction in DC Generators	2
2.7	Open circuit characteristics of DC Generators	1
2.8	On load characteristics of DC Generators	

3.0	**DC MOTORS**	**9**
3.1	Motor Principle, Comparison of Motor and Generator Principle	2
3.2	Back EMF and Voltage Equation of a Motor	1
3.3	Torque, Armature Torque and Shaft Torque	1
3.4	Rated Speed and Speed Regulation	1
3.5	Speed Control of DC Motors	2
3.6	Electric Braking of Motors	2

UNIT - 3

4.0	**MOTOR CHARACTERISTICS**	**3**
4.1	T vs Ia, N vs Ia of a DC Shunt motor	1
4.2	T vs Ia, N vs Ia of a DC Series motor	1
4.3	T vs Ia, N vs Ia of a DC Compound motor	1
5.0	**INDUCTION MOTORS**	**12**
5.2	General Principle & Construction	2
5.2	Classification of AC Motors	1
5.3	Single Phase and Three Phase Induction Motors	2
5.4	Starting of Induction Motor	2
5.5	Relationship between Slip, Torque.	2
5.6	Power stages in Induction Motor	2
5.7	Speed Control of an Induction Motor	1

UNIT – 4

6.0	**SPECIAL PURPOSE MOTORS**	**9**
6.1	Universal motors and its spatiality	2
6.2	Classification of single phase Induction motors	2
6.3	Comparison between Synchronous and Induction motors	1
6.4	Stepper Motors and Hysterisis motor and PMDC Motor	2
6.5	Introduction to Servo Motors	2
7.0	**ALTERNATORS**	**3**
7.1	Basic Principle & Details of Construction	1
7.2	Stationary Armature & Rotor	1
7.3	Speed and Frequency Relation	1

Reference Books :

1.	**Electrical Technology**	**-**	**B.L. Thereja (Volume-II)**
2.	**Electrical Machines**	**-**	**H. Cotton**
3.	**Electrical Machines**	**-**	**J.B. Guptha**

Subject title	**:**	**BASIC ELECTRONICS**
Semester	**:**	**3rd semester**
Periods	**:**	**60 periods**
Theory	**:**	**80**
I.A.	**:**	**20**

COURSE OBJECTIVES :

- To study and analyse the operation of Differential Amplifier.
- To Familiarize with Op Amp Parameters.
- To study the applications of linear and non linear Op Amp circuits.
- To Familiarize with the operation of fixed and variable voltage regulators.

MAJOR TOPICS

1. **POWER AMPLIFIERS.**
2. **DIFFERENTIAL AMPLIFIERS.**
3. **OPEATIONAL AMPLIFIERS.**
4. **LINEAR OP-AMP CIRCUITS.**
5. **NON LINEAR OP-AMP CIRCUITS.**
6. **FILTERS & OSCILLATORS.**
7. **REGULATED POWER SUPPLIES.**

Sl. No.	Topics	Periods
	UNIT - 1	
1.0	**POWER AMPLIFIERS**	**8**
1.1	Amplifier Terms – DC Load Line – AC Load Line	2
1.2	Classes of Operations	2
1.3	Types of Coupling and Frequency ranges, Power Rating of a Transistor	2
1.4	Frequency effects – Frequency Response of an amplifier Decibel Power and Voltage Gain	2
2.0	**DIFFERENTIAL AMPLIFIERS**	**8**
2.1	Introduction.	1
2.2	DC and AC Analysis of Differential Amplifiers.	2
2.3	Input Characteristics.	2
2.4	Common Mode Gain and CMRR.	1
2.5	Simple Problems on Differential Amplifiers.	2
	UNIT - 2	
3.0	**OPERATIONAL AMPLIFIERS**	**10**
3.1	Introduction & Pin Configuration of Op Amp 741.	2
3.2	Block Diagram of 741 Op Amp.	1
3.3	Op Amp Parameters – Slew Rate, Bias, Offset, Input & Output Impedance.	2

3.4	Ideal OP-AMP and Open loop operation of Op-Amp.	2
3.5	Data sheet of OP-AMP 741.	1
4.0	**LINEAR OP AMP CIRCUITS**	**8**
4.1	Inverting Amplifier Circuits – Applications.	2
4.2	Non Inverting Amplifier circuits – Applications.	2
4.3	Voltage follower, Instrumentation Amplifiers & Summing Amplifiers Circuits.	2
4.4	Current Boosters and Current Sources.	2

UNIT – 3

5.0	**NON LINEAR OP AMP CIRCUITS**	**8**
5.1	Comparator Circuits and Zero Crossing detector	2
5.2	Integrator and Differentiator	2
5.3	Waveform Generators – Square, Triangular, Saw tooth Waveform and Converter	2
5.4	Active Diode Circuits	2
6.0	**FILTERS AND OSCILLATORS**	**10**
6.1	Ideal Responses.	1
6.2	Low Pass and High Pass Filters.	2
6.3	Band Pass, Band Stop and All Pass Filters.	2
6.4	Sinusoidal Oscillators.	2
6.5	RC and LC Oscillators.	1
6.6	Timer IC 555 – Pin configuration, Monostable, Astable Operation and its application.	
7.0	**REGULATED POWER SUPPLIES**	**8**
7.1	Power Supply characteristics.	2
7.2	Series and Shunt Regulators.	2
7.3	Linear and Switching Regulators.	2
7.4	Variable Regulators – LM 317.	2

Reference Books :

1.	**Electronic Principles**	**-**	**Malvino**
2.	**Linear Integrated Circuits**	**-**	**D. Roy Choudhury & Skail Jain**

OP - AMPS and Linear Integrated Circuits – Ramakant A. Gayakwad

Subject title : DIGITAL ELECTRONICS
Semester : 4 periods per week in 3rd semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. To understand the difference between analog and digital system.
2. To familiarize with number system and logic gates.
3. To familiarize with logic circuit design using Boolean expression and Karnaugh map technique.
4. To familiarize with counters and registers.
5. To familiarize with data converters and logic families.
6. To understand timing circuits.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction	02
2	Number systems and codes	04
3	Logic gates	04
4	Boolean algebra and karnaugh maps	06
5	Combinational logic circuits	10
6	Latches and flip flops	10
7	Timers and timing circuits	08
8	Sequential logic circuits	10
9	Data converters	04
10	Integrated logic families	02

SUBJECT CONTENT :

1.0 Introduction

Introduction to Digital System – Difference between Analog and Digital Systems, Logic Levels and Pulse Waveforms – Elements and Functions of Digital Logic, Digital Integrated Circuits.

2.0 Number Systems and Codes

Decimal, Binary, Octal, Hexadecimal Numbers – 9's & 10's Complements – 1's & 2's Complements – Conversion of Number Systems – BCD Code – Digital Codes – Gray, Excess 3, Alphanumeric Codes, ASCII, EBCDIC Codes.

3.0 Logic gates

Inverter, AND, OR, NAND, NOR – Gate Propagation Delay Time – Power Dissipation – Noise Immunity – Fan In & Fan Out – Loading Considerations – Applications.

4.0 Boolean Algebra & Karnaugh Maps

Boolean Operations – Logic Expressions – Rules and Laws of Boolean Algebra DeMorgan's Theorem – Simplifications of Boolean Expressions – Karnaugh Map.

5.0 Combinational Logic - Circuits

AND – OR Logic, AOI Logic, XOR Logic – Universal Property of NAND and NOR Logic – Half and Full Adders – Decoders and Encoders – Multiplexers and Demultiplexers – Parity Generators and Checkers.

6.0 Latches & Flip Flops

Latches – Different Types of Latches – Latch Operation – Flip Flops – Different Types of Flip Flops – Flip Flop Operations – Operating Characteristics – Applications of Flip Flops.

7.0 Timers & Timing Circuits

Multivibrators – One Shot, Astable Multivibrators – 555 Timer – Block Diagram – Modes of Operation and Application – IC Mono shots – Application of Timing Circuits.

8.0 Sequential Logic Circuits

Introduction to Counters – Asynchronous Counters – Synchronous Counters – Up/Down Counters – Cascaded Counters – Counter ICs – Counter Decoding – Counter Applications – Counter Design – Introduction to Registers – Types of Registers – SISO, SIPO, PISO, PIPO – Bidirectional Shift Registers – Shift Register Counters – Shift Register Applications.

9.0 Data Converters

Introduction to D/A Converters – Types of D/A Converters – Specifications – Applications – Introduction to A/D Converters – Types of A/D Converters – Applications.

10.0 Integrated Logic Families

Introduction to Logic Families – TTL Logic – CMOS Logic – TTL driving CMOS – CMOS driving TTL – ECL Circuits – I^2 L Circuits.

Reference Books :

1. **Digital Fundamentals - Thomas L. Floyd**
2. **Digital Fundamentals - Floyd and Jain**
3. **Digital Circuit and Logic Design - Samuel C. Lee**
4. **Digital Fundamentals - Malvino & Leech**

Subject title : METROLOGY
Semester : 3rd semester
Periods : 45 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVES :

- To familiarize with different measuring instruments and their working principles.
- Familiarize with marking and marking tools.
- To make the trainees learn about tolerance.
- To impart knowledge on different types of gauges.
- To create understanding on common measuring errors and need to calibrate instruments.

Sl. No.	Major Topics	Time Allotted Total Periods : 45
1	Introduction to Metrology, measuring instruments and their importance.	06
2	Limits Fits and Tolerances.	08
3	Gauges.	05
4	Screw thread Measurements and Surface Texture measurements.	06
5	Optical Measuring Instruments.	04
6	Comparators.	04
7	Measurement of Mass, Weight, Force and Torque.	06
8	Speed Measurement.	03
9	Errors in measurements and Calibration.	03

SUBEJCT CONTENT :

1.0 Introduction to Metrology, measuring instruments and their importance.

1.1 What is measurement, aims, methods of measurements, static measurements and time element in measurement.

2.0 Limits, Fits and Tolerance.

2.1 Necessity of tolerance in manufacturing system, Limit system – nominal size, basic size, actual size, allowance, limits, upper and lower tolerance, unilateral, bilateral.

2.2 Fits – Hole basis system and Shaft basis system, Types of fits namely, interference, transition, clearance.

2.3 ISO tolerance – 25 fundamental deviations, 18 – tolerance grades, symbols-numeral, letter, deviation – upper and lower.

3.0 Gauges

3.1 Gauges – Necessity, types namely limit gauges, optical gauges, pneumatic and electronic, materials for gauges, gauge tolerance, types of limit gauges namely plug gauge, ring gauge etc.

3.2 Slip gauges – Description of slip gauge, grade, number of blocks, wringing.

4.0 Screw Thread Measurement and Surface Texture Measurement.

4.1 Thread parameters, errors in thread pitch, progressive, periodic, irregular error, measurement of various elements – pitch diameter, use of screw thread micrometer, three wire measurements, selection wire diameter, necessary calculation.

4.2 Meaning of surface texture, measurement definition, primary texture, secondary texture, lay sampling length, mean line of profile, center line of profile, Method of measuring – comparison method, touch method, visual inspection, microscopic inspection, surface photographs, Direct measurements – stylus probe instruments, parts, skid, stylus, amplifying device, mean for analyzing the trace.

5.0 Optical Measuring Instruments.

5.1 Interferometry principle, interference wavelength, wave in face, wave out face formation interference, interference bands and optical flat method of checking.

5.2 Tool maker's microscope principle advantages working principles.

5.3 Optical projector parts, working principles, measuring techniques, comparison method – measurement.

6.0 Comparators.

6.1 What is comparator, classification based on magnification, advantages and disadvantages.

6.2 Mechanical comparator – Types, working principles, mechanism etc.

6.3 Optical comparator, electronic comparator – working principles, method of use.

7.0 Measurement of Mass, Weight, Force and Torque.

7.1 Measuring instruments used for mass, weight, force and torque.

8.0 Speed Measurement.

8.1 Introduction, mechanical tachometers, electrical tachometers, types like contact less, frequency type etc.

9.0 Errors in measurements and Calibration.

9.1 Measurement error, types, controllable and systematic error, calibration error due to temperature pressure.

9.2 Calibration of vernier instruments zero errors, parallelism of measuring jaws, calibration of micrometer, zero setting – flatness of measuring jaws.

Reference Books :

1.	**Engineering Metrology**	**-**	**R.K. Jain**
2.	**Mechanical & Industrial Measurement**	**-**	**R.K. Jain**
3.	**Dimensional Metrology**	**-**	**M.K. Khare**
4.	**Engineering Metrology**	**-**	**K.J. Jume**
5.	**Quality Control**	**-**	**M.W. Raman**

PRACTICAL

Subject Title : CADD
Semester : 3rd semester
Periods : 90 periods
End Examination : 50
Sessional : 25

1.0	**INTRODUCTION TO COMPUTERS AND ITS APPLICATIONS**	**22**
1.1	Definition of Computer – Computer Applications – Classification Parts of Computer – Functions – I/O Devices – Computer Peripherals Hardware & Software – Categories of Software – Operating Systems Functions of Operating Systems – Computer Languages.	04
1.2	DOS – Internal Commands & External Commands Practice Exercise.	02
1.3	Introduction to Windows Operating System Practice Exercise.	02
1.4	Exploring MS Office (MS Word, MS Excel, MS PowerPoint)	04
1.5	One simple project in MS Word, MS Excel, MS PowerPoint)	10
2.0	**INTRODUCTION TO CAD**	**40**
2.1	Importances of CAD, menu selection, begin new drawing, editing existing drawing and practice simple drawing.	5
2.2	Co-ordinate system in CAD - absolute, relative and polar.	5
2.3	Introduction to utility commands - Help, End, Quit, Save, Limits, Units practice.	5
2.4	Introduction to entity draw commands - Line, Point circles, Oops, Undo, Copy, Move practice.	5
2.5	Introduction to display commands - Zoom, Pan, Redraw practice.	5
2.6	Layers and its uses.	5
2.7	Various file formats – export and import of files.	5
3.0	**ORTHOGRAPHIC PROJECTIONS CONTINUED**	**28**
3.1	Exercises on drawing the 3 views of different types of objects in 1st angle projection.	28

Reference Books :

1. Auto CAD 2000 - George Omura

Subject Title : WORKSHOP PRACTICE
Semester : 3rd semester
Periods : 90 periods
End Examination : 50
Sessional : 25

OBJECTIVES :

- Introduced to importance to different angles required for single point cutting tool.
- Practicing for different angle grinding on pedestal grinding machine.
- Introduced to lathe machine and different turning operations.
- Practicing various turning operations such as straight, step, taper etc.
- Practicing of die passing on lathe machine.
- Introduced to milling machine and different milling operations.
- Practicing the setting of work piece on machine.
- Practicing of various milling operations such as face, step milling etc.
- Introduced to surface grinding, cylindrical grinding machine and its operations.
- To understand the importance of grinding and practicing different surface grinding.
- Practicing sheet metal fabrication and to understand its importance.
- Introduced to welding process and welding machine.
- Practicing edge preparation and welding operation.

Ex. No.	Exercise Name	Periods
1	Tri Square	12
2	Right Hand Knife Tool Grinding	5
3	Straight Roughing Tool Grinding	5
4	Taper Plug Gauge	08
5	Stud	14
6	T – Nut	08
7	Channel Milling	08
8	Parallel Block Grinding	08
9	Tray	05
10	Dust Pan	05
11	Cylinder	05
12	T – weld (Welding Exercise)	07

Subject Title : ELECTRICAL LAB PRACTICE
Semester : 3rd semester
Periods : 75 periods
End Examination : 25
Sessional : 25

Sl. No.	Topics	Periods
	TRANSFORMERS	**10**
1	Transformer Familiarization.	2
2	Transformation Ratio, Polarity Test – and measurement of internal resistance.	2
3	Open Circuit Test & Short Circuit Test on Transformers.	2
4	Load test on Single phase Transformer.	2
5	Three phase Transformer Star and Delta Connection.	2
	GENERATORS	**15**
6	Open circuit characteristics on DC Self excited Generator	5
7	Open circuit characteristics on DC Separately excited Generator	5
8	Load test on DC Generator	5
	MOTORS	**50**
9	Characteristics of DC Series Motor.	5
10	Characteristics of DC Shunt Motor.	5
11	Familiarization of Timer / Contractors.	5
12	Speed Control of DC Motor by varying armature voltage.	5
13	Speed Control of DC Motor by varying Flux.	5
14	Starting of Induction Motor by Star-Delta starter.	5
15	Starting of Induction Motor by Auto transformer.	5
16	Starting of Induction Motor by D.O.L. starter.	5
17	Automatic starting of three phase induction.	5
18	Automatic operation of two three phase induction motor.	5

Subject title : ELECTRONICS LAB PRACTICE
Semester : 4 periods per week in 3rd semester
Periods : 60 periods
End Examination : 25
Sessional : 25

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction and Familiarization	10
2	Rectifiers, clippers and clampers	20
3	Transistor Characteristics	15
4	Characteristics of FET	15

SUBEJCT CONTENT :

1.0 Introduction and Familiarization
1.1 Lab safety, usage of Toolkit and Lab procedure.
1.2 Familiarization of CRO / FG / PG.
1.3 Familiarization of resistors by comparing using color codes and DMM.
1.4 VI – Characteristics Diode.

2.0 Rectifiers, Clippers and Clampers
2.1 Half wave Rectifiers with and without filters.
2.2 Full wave Rectifiers with and without filters.
2.3 Bridge Rectifiers with and without filters.
2.4 Zener Diode Characteristics.
2.5 Zener Diode as regulator.
2.6 Positive and Negative Clipper circuit using Diode.
2.7 Positive and Negative Clampers using Diodes.
2.8 Voltage Doubler.

3.0 Transistor Characteristics
3.1 Transistor Characteristics.
(i) $Ic_{VS\ IB}$
(ii) $V_{BE}{}^{VS}\ I_B$
(III) $VBE_{VS}\ I_C$
3.2 Transistor Biasing with voltage divider.
3.3 Transistor as switch.
3.4 Transistor as switch using LED and photo diode.
3.5 CE amplifier, frequency response and Bandwidth.

4.0 Characteristics of FET
4.1 Characteristics of FET – Transconductance.
4.2 JFET as switch.
4.3 Amplifier using JFET.
4.4 Analog Multiplexer using JFET.
4.5 Input and Transfer characteristics of MOSFET.
4.6 MOSFET as switch.

FORUTH SEMESTER

THEORY

Subject title	**:**	**MECHANICAL ENGINEERING SCIENCE - II**
Semester	**:**	**4th semester**
Periods	**:**	**60 periods**
Theory	**:**	**80**
I.A.	**:**	**20**

COURSE OBJECTIVES :

- Trainees will be able to understand the mechanical concepts used in various machines.
- To understand various manufacturing methods to used in a company.
- To understand the concepts of heat treatment.
- To understand power transmission elements.
- Will be able to select right type of bearings and its lubrication.
- To understand an overview on steam turbines and IC engines.

MAJOR TOPICS

1. **MANUFACTURING METHODS.**
2. **SUPER FINISHING OPERATION.**
3. **HEAT TREATMENT.**
4. **TRANSMISSION OF POWER.**
5. **BEARING MATERIALS AND ANTIFRICTION BEARINGS.**
6. **LUBRICANTS.**
7. **AN OVERVIEW ON STEAM TURBINES, IC ENGINES, REFRIGERATION.**
8. **JIGS AND FIXTURES.**
9. **INFORMATION ON NON CONVENTIONAL MACHINING**
10. **CLUTCHES AND COUPLINGS.**

Sl. No.	Topics	Periods
	UNIT - 1	
1.0	**MANUFACTURING METHODS**	**10**
1.1	Introduction to various methods of manufacturing like forming, machining, joining methods (fabrication).	2
1.2	Forming process – An over view on casting, forging, rolling, drawing, press work, powder material technology etc.	2
1.3	Joining methods – Temporary joints like screws, bolts, Rivets – Types and types of riveted joints, Soldering, brazing, Arc and Gas Welding, Types of welding like Spot welding, seam welding butt welding etc.	6
2.0	**SUPER FINISHING OPERATIONS**	**2**
2.1	An over view of various super finishing operations like honing, lapping, its process advantages and disadvantages.	2

3.0	**HEAT TREATMENT**	**5**
3.1	Principle of heat treatment, phase transformation in steel during heating.	2
3.2	Heat treatment process – Annealing, normalizing, hardening, tempering, case hardening, surface hardening, vacuum hardening and induction hardening.	2
3.3	Defects in Hardening.	1

UNIT - 2

4.0	**TRANSMISSION OF POWER**	**13**
4.1	Belt drives – types like flat, "V', timing belt, poly v belt, rope ways and their designation and application slip and creep in belts, use of idlers and jockey pulleys, Fast and loose pulleys, stepped pulleys, crowning of pulleys.	6
4.2	Chain drives – types and application, power transmitted by chains.	1
4.3	Gear and Gear drives – types like spur, helical, double helical, spiral, worm and worm gear, bevel gear, rack and pinion and their application, center distance.	5
4.4	Speed ratio, simple problems.	1
5.0	**BEARING MATERIALS AND ANTIFRICTION BEARINGS**	**6**
5.1	Introduction of bearings, characteristics , types, composition of common bearing materials like white metal (Babbitt), bronze, brass, aluminum alloys, cadmium, alloys etc. bimetal and tri metal bearings.	2
5.2	Types of antifriction bearings, designation of each type, ball bearings, roller bearings and needle bearings, preloading of angular contact bearings.	4
6.0	**LUBRICATION**	**3**
6.1	Characteristics of lubrication, types of lubricants.	1
6.2	Methods of lubrication – self lubrication, manual feed, auto feed and aerosol lubrication, auto lubrication systems – time and motion based.	2

UNIT - 3

7.0	**AN OVERVIEW ON STEAM TURBINES, IC ENGINES, REFRIGERATION**	**4**
7.1	Working principles of boilers and turbines, types of IC engines, construction, classification – two stroke and four stroke petrol and diesel engines, thermal efficiency and mechanical efficiency. Refrigeration concepts, functions and types. Vapor compression and vapor absorption refrigerants, principles of air conditioning.	4
8.0	**JIGS AND FIXTURES**	**11**
8.1	Introduction to Jigs and Fixtures and advantages.	1
8.2	Planes of movement and degrees of freedom.	2

8.3	Methods of location, different types of clamps and clamping devices, drill bushes and supports.	2
8.4	Types of jigs and fixtures.	2
8.5	Types of locators and location methods.	2
8.6	Jigs and Fixtures design – elements, factors to be considered with examples.	2
9.0	**INFORMATION ON NON CONVENTIONAL MACHINING**	**3**
9.1	Chemical etching, ultrasonic machining, electro chemical machining.	1
9.2	Electrical discharge machining, wire cut EDM.	1
9.3	Plasma arc machining, laser beam machining, water jet machining and abrasive machining.	1
10.0	**CLUTCHES AND COUPLINGS**	**3**
10.1	Working principle of single and multi plate clutch. Clutch lining materials.	1
10.2	Types of Couplings and their applications.	2

Reference Books :

1.	**Workshop Technology (Part1 & Part2)**	**-**	**W.A.J. Chapman**
2.	**Workshop Technology (Part1 & Part2)**	**-**	**Hazra Choudhury'**
3.	**All about Machine Tools**	**-**	**H. Gerling**
4.	**Modern Workshop Practice**	**-**	**Wright Baker**
5.	**Machine Technology Vol.1, 2, 3**	**-**	**P.M. Johnston**

Subject title : APPLIED MECHANICS
Semester : 4 periods per week in 4th semester
Periods : 60 periods
Theory : 80
I.A. : 20

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Forces and Moment of Inertia	13
2	Strength of Material	17
3	Simple Machines	06
4	Basic Kinematics	09
5	Transmission of Power and Motion	09
6	Gear Driver	06

SUBJECT CONTENT :

1.0 Forces

1.1 Moment of a force. Beams and types of beams and their applications.
1.2 To draw SFD and BMD (analytical method).
1.3 Introduction to moment of inertia.
1.4 Determination of moment of inertia of different sections analytically.

2.0 Strength of Material

2.1 Types and importance of stress, determination and explanation of Young's modulus of elasticity (simple problems on these).
2.2 Strut and columns – Definition, classification of columns, strength of columns, Euler's column Theory, Problems.
2.3 Thick and Thin Cylinders – Stress in thick and thin cylinders subjected to fluid pressures.
2.4 Bending Stress – Pure bending, types of load acting on beams, principle of bending action, bending moment.
2.5 Torsion of shaft – Definition, effect of torsion, twisting moment, torsion of shafts power transmitted, strength of shaft and torsion rigidity.
2.6 Torsion of springs – Introduction, types of springs, close coiled springs subjected to loads.

3.0 Simple machines

3.1 Definitions – Mechanical advantages, velocity ratio, and efficiency and relationship between the three.
3.2 Effort in friction, simple screw jack, and efficiency of the screw jack, worm and worm wheel.

4.0 Basic Kinematics

4.1 Introduction to theory of machines, machine structure and kinematics.
4.2 Difference between machine and mechanism. Kinematics pair, types of kinematics pair, kinematics chain.
4.3 Four bar chain, application of quadric cycle.

5.0 Transmission of power and motion

5.1 Belt drive – velocity ratio, effect of belt thickness, and effect of belt slip on velocity ratio. Slip and creep in belts.

5.2 Length and width of belt – open and cross belt driver.

5.3 Use of idlers and jockey pulleys, fast and loose pulley, stepped pulley crowning of pulleys.

5.4 Vee belt advantages, rope driver – types of power transmitted by rope driver and chain drivers – classification based on hoisting chain, conveyor chain and power transmitted by chains.

6.0 Gear Driver

6.1 Law of gearing.

6.2 Properties of involute profile toothed gears. Types of gear trains – simple, compound, reverted and unicyclic gear trains.

Reference Books :

1.	**Applied Mechanics and Graphics statics**	**-**	**R.S. Khurmi**
2.	**Applied Mechanics and Graphics statics**	**-**	**I.B. Prasad**
3.	**Engineering Materials**	**-**	**Roy Chowdhary**
4.	**Theory of Machines**	**-**	**R.S. Khurmi**
5.	**Machine Design**	**-**	**R.S. Khurmi**
6.	**Theory of Machines**	**-**	**Rattan**

Subject title : COMPUTER PROGRAMMING – C, C++, UNIX
Semester : 4 periods per week in 4th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Will be competent using application software tools.
2. Analyze problem and arrange them logically using C language.
3. Analyze problem and arrange them logically using C++ language.
4. Will be competent in using UNIX commands and shell programming.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	C Language Programming	25
2	C++ Language Programming	20
3	UNIX	15

SUBJECT CONTENT :

C LANGUAGE PROGRAMMING

1.0 Introduction
1.1 Introduction to C and history.
1.2 Meaning of constants, variables and reserved word.
1.3 Data types, Type modifiers, Declaration and Initialization.

2.0 Operators and Expressions
2.1 Arithmetic, Relational and Logical operators.
2.2 Bitwise Increment and Decrement operator.
2.3 Hierarchy of operators.
2.4 Data type conversion and mixed mode operations.
2.5 Assignment Statement operator.

3.0 Input and Output
3.1 Input and Output functions (scanf, printf).
3.2 Formatted input and output.
3.3 Unconditional-control-GOTO statement.
3.4 Bidirectional conditional control – IF ELSE statement.
3.5 Multi directional conditional control – SWITCH statement.
3.6 Loop control – FOR, WHILE, DOWHILE Loop.
3.7 Break and Continue Statement.
3.8 Programming exercises.

4.0 Arrays and Character Strings
4.1 Single dimensional arrays.
4.2 Array Declaration and Initialization.
4.3 Operational arrays.

4.4 Multidimensional arrays String operations.
4.5 Programming exercises.

5.0 Functions.
5.1 Library functions.
5.2 User defined functions.
5.3 Arguments and parameters Return statement.
5.4 Function declaration.
5.5 Scope of variable – local and global variables.
5.6 Storage class specifications Parameters passing mechanism.
5.7 Nesting of functions.
5.8 Recursion.
5.9 Passing arrays to function and function returning arrays.
5.10 C functions.
5.11 Exercises.

6.0 Structures and Unions
6.1 Definition of structure.
6.2 Giving values to members.
6.3 Structure initialization.
6.4 Comparison of structure variables.
6.5 Arrays of structures, Structures within structures.
6.6 Structures and Functions.
6.7 Unions.
6.8 Size of structures.
6.9 Bit Fields.

7.0 Pointers
7.1 Pointer declaration and definition.
7.2 Pointer arrays.
7.3 Function pointers.
7.4 Structure pointers.

C++ LANGUAGE PROGRAMMING

8.0 Introduction
8.1 Overview of C++ structures.
8.2 Specifying a class.
8.3 Defining member functions.
8.4 C++ programming on class.
8.5 Making an outside function inline.
8.6 Nesting of member functions.
8.7 Private member functions.
8.8 Arrays within a class.
8.9 Memory allocation for objects.
8.10 Static data members.
8.11 Arrays of objects.
8.12 Objects as function arguments.
8.13 Friend functions returning objects.

9.0 Constructors and Destructors

9.1 Introduction to constructors.
9.2 Parameterized constructors.
9.3 Multiple constructors in a class.
9.4 Constructors with default arguments.
9.5 Dynamic constructors.
9.6 Constructing two dimensional arrays.
9.7 Destructors.

10.0 Overloading.

10.1 Define Operator overloading.
10.2 Overloading unary operators.
10.3 overloading binary operators.
10.4 Using friend functions.
10.5 Manipulation of strings using operators.
10.6 Rules for overloading operators.
10.7 Type conversions.
10.8 Function overloading.

11.0 Inheritance

11.1 Defining derived classes.
11.2 Single inheritance.
11.3 Multiple inheritance.
11.4 Hierarchical inheritance.
11.5 Hybrid inheritance.
11.6 Virtual base class.
11.7 Abstract class.
11.8 Construction in derived classes.
11.9 Nesting of classes.

UNIX

12.0 Introduction to UNIX

13.0 UNIX Commands

14.0 Shell Programmming.

Reference Books :

1. The 'C' Programming Language- Kernigham and D.M. Ritchie – PHI

2. C++ - Balaguruswamy

3. C, C++ Programming - Schaum Series

Subject title : MEASURING SYSTEM
Semester : 4 periods per week in 4th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. To get an overview of various industrial instrumentation and its utility.
2. To understand various sensors / transducers.
3. To understand different electrical / electronics measuring instruments.
4. To understand ultrasonic / optical measurement and usages.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction	09
2	Electronics instrumentation	04
3	Temperature measurement	12
4	Pressure measurement	10
5	Displacement measurement	10
6	Force, weight and flow measurement	09
7	Speed measurement	03
8	Ultrasonic measurement	03

SUBJECT CONTENT :

1.0 INTRODUCTION
1.1 Definition of measuring system.
1.2 Measurement system and it's constituent elements.
1.3 Sensors and transducers.
1.4 Performance Terminology.
1.5 Static and Dynamic characteristics.

2.0 ELECTRONIC INSTRUMENTATION
2.1 V-F Converter.
2.2 F-V Converter.

3.0 TEMPERATURE MEASUREMENT
3.1 Introduction to Temperature Measurement.
3.2 Thermocouples, Principle, Types, Selection, Standard table of Thermocouples and signal conditioning circuits.
3.3 RTD, Principles, Types, Selection of RTD's and signal conditioning circuits.
3.4 Thermistor and Bimetallic Strip.
3.5 Measurement of temperature using Diodes.
3.6 IC temperature Transducer using LM35 and AD590.

4.0 PRESSURE MEASUREMENT

4.1 Introduction to pressure measurement.
4.2 Pressure Standards.
4.3 Conventional Pressure sensors.
4.4 Electrical and Electronic pressure transducers.
4.5 Introduction to Calibration and Calibration of Pressure Gauge.

5.0 DISPLACEMENT MEASUREMENT

5.1 Introduction to displacement measurement.
5.2 Potentiometer Sensor, Types, Construction, Operation and Errors.
5.3 LVDT, Principle, Operation and Application.
5.4 inductive Proximity Switch.
5.5 Digital Encoder : Contact, Magnetic and Optical Encoder.
5.6 Rotational Displacement / Angular position : Using optical Encoder and Signal Conditioning circuits.

6.0 FORCE, WEIGHT AND FLOW MEASUREMENT

6.1 Introduction to force, weight and flow measurement.
6.2 Strain gauge and it's function.
6.3 Load Cell, principle and operation of load cell.
6.4 Flow measurement using Orifice plate.

7.0 SPEED MEASUREMENT

7.1 Introduction, mechanical tachometers, electrical tachometers, types like contact less, frequency type.

8.0 **ULTRASONIC MEASUREMENT**

8.1 Basic Ultrasonic Transmission Link, piezoelectric, ultrasonic, transmitter and receiver, principle and example.

Reference Books :

1.	**Mechatronics**	**-**	**Bolton, Pearson Education Asia**
2.	**Principle of measurement Systems 2000**	**-**	**JP Bentlley Addision Wesley**
3.	**Industrial Control Electronics**	**-**	**J. Michael Jacob**
4.	**Mechanical and Industrial Measurement**	**-**	**R.K. Jain, Kanna Publication**
5.	**Instrumentation and Control System**	**-**	**Bhasker, Anuradha Agencies**

Subject title : MECHATRONICS SYSTEM
Semester : 4 periods per week in 4th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. To understand the Mechatronics concepts.
2. To understand the Mechatronics approach.
3. To understand the actuation systems.
4. To know the assembly technique.
5. To know about the data presentation techniques.
6. To understand motion control and rotational drives.

Sl. No.	Major Topics	Time allotted Total Periods : 60
1	Introduction to mechatronics	05
2	Mechatronics elements	12
3	Assembly techniques	08
4	Data presentation systems	05
5	Actuation systems	15
6	Motion control	07
7	Rotational drives	08

SUBJECT CONTENT :

1.0 INTRODUCTION TO MECHATRONICS

1.1 What is Mechatronics, System, Measurement System.
1.2 General system configuration, Building blocks of Mechatronics system.
1.3 Control system, microprocessor based controllers.
1.4 Mechatronics in manufacturing and products, Mechatronics & Technology.
1.5 Conventional vs Mechatronics.

2.0 MECHATRONICS ELEMENTS

2.1 Introduction, Machine Structure.
2.2 Guide ways – Classification, Friction & Anti Friction, other guide way.
2.3 Drive system – Servo principle, servo motors, drive optimizations, Drive protection, selection criteria for drives, power supply for CNC, electric panel cooling.
2.4 Mechanical Transmission System.
2.5 Mechanism used to convert rotary motion to linear motion.
2.6 Torque transmitting elements.
2.7 Spindle bearing, Antifriction bearings, Hydrostatic and Hydrodynamic Bearings.
2.8 Direct and Indirect measuring system.
2.9 Tool monitoring and changing system.

3.0 ASSEMBLY TECHNIQUES

3.1 Introduction, guide ways - LM guide ways, tychoways, rolling elements, Aerostatic & Hydro static guide ways – its assembly precautions.

3.2 Ball screw and nut – assembly technique alignment, fitting and dismantling, failures and thermal displacement.

3.3 Feed back elements – Preferred mounting positions of linear scale assembly, incremental angle encoder, Assembly care of mounting of proximity switch.

3.4 Spindle bearings – general assembly precautions, misalignment, noise and vibration.

4.0 DATA PRESENTATION SYSTEMS

4.1 Loading and data presentation elements.

4.2 Magnetic recordings and data acquisition systems.

4.3 Displays.

4.4 Data acquisition systems.

5.0 ACTUATION SYSTEMS

5.1 5.1.1 Pneumatics and Hydraulics system.

5.1.2 Cylinders.

5.1.3 Process control valves – Valve bodies and plugs, Control valve sizing.

5.1.4 Example of fluid control system – Rotary actuators.

5.2 5.2.1 Mechanical Systems – Types of motion – Freedom and constraints Loading – Quick return Mechanism.

5.2.2 Cams - Gear Trains – Ratchet and Pawl – Chains.

5.2.3 Bearings – Plain Journal Bearings – Ball & Roller bearing – Selection of bearings.

5.2.4 Mechanical aspects of Motor selection – Moment of inertia - Torque.

5.3 5.3.1 Electrical systems – Mechanical switches – Solid state switches.

5.3.2 Control of D.C. motors – Stepper motor control.

5.3.3 Stepper motor specifications – Stepper motor control.

6.0 MOTION CONTROL

6.1 Linear systems – Pneumatic rams – Rod & Rodless type.

6.2 Pneumatic diaphragms and bellows.

6.3 Hydraulic cylinders.

6.4 Motor and ball screw / lead screw.

6.5 Direct linear electrical actuators.

6.6 Solenoids and other forms of electrical actuators.

7.0 ROTATIONAL DRIVES

7.1 Pneumatic motors, continuous and limited rotations.

7.2 Hydraulic motors, continuous and limited rotations.

7.3 Motion converters – Fixed ratio, invariant motion profile, variants, remotely controlled couplings.

Reference Books :

1 **System design - Devdas Shetty & Richard A. Kolk, PWS Publications – 3rd reprint 2004 : ISBN : 981 – 240 – 067 – 2**

2 **Mechatronics - Electronics control systems in Mechanical Engineering W. Bolton – 2nd Edition Pearson Educational Ltd. ISBN 81 – 7808 – 339 – 6.**

3 **Mechatronics - HMT (TMH)**

4 **Mechatronics - Prof. C.R. Venkataramana, Sapna book house, First Edition, 2nd reprint October, 2002**

5 **Mechatronics - Electronics in Product & Process – D.A. Bradley, D. Dawson, N.C. Burd and A.J. Loader Nelson Thomes Ltd. First Indian Reprint 2004 ISBN 0**

PRACTICAL

Subject Title : ELECTRONICS LAB - II
Semester : 4th semester
Periods : 75 periods
End Examination : 25
Sessional : 25

Sl. No	Topics	Periods
1	DC analysis of a Differential Amplifiers.	06
2	Familiarization of IC 741 & Verification of its Parameters.	06
3	Op Amp Applications – Voltage Follower, Summing Amplifier.	5
4	Design and Verification of Inverting Amplifier Circuit.	5
5	Design and Verification of Non Inverting Amplifier Circuit.	5
6	Op Amp as Instrumentation Amplifier – Verification of gain and CMRR.	06
7	Op Amp as Comparator with Zero and Non Zero references.	5
8	Op Amp as Integrator and Differentiator.	5
9	Op Amp as Schmitt Trigger.	5
10	Op Amp as Filter Circuits and Study of Frequency Response (LPF, HPF, BPF).	06
11	Op Amp as RC phase shift Oscillator.	06
12	Monostable Multivibrators using IC 555.	5
13	Astable Multivibrators using IC 555.	5
14	Familiarization of Fixed Regulators – 7805, 7905.	02
15	Familiarization of Variable Regulators – LM, 371.	03

Subject title : COMPUTER PROGRAMMING LAB - I
Semester : 6 periods per week in 4th semester
Periods : 90 periods
End Examination : 50
Sessional : 25

Sl. No.	Major Topics	Time allotted
		Total Periods : 120
1	Programming on C Language	40
2	Programming on C++ Language	30
3	UNIX Programming	20

SUBJECT CONTENT :

PROGRAMMING ON C LANGUAGE

1. Program to find the roof of quadratic equation.

2. Find the value of PI = Sqrt ($6/1^2 + 6/2^2 + 6/3^2 + \ldots\ldots\ldots$) to a given accuracy.

3. Program to find sin of angle in degree using Taylor's series compare the result with actual value.

4. Read matrix A (M x N) and find the following using functions.
   (i) Sum of elements of each of M Rows.
   (ii) Sum of elements of each of N Columns.
   (iii) Sum of all elements of matrix using function in (a).

5. Generate and print prime numbers up to an integer N.

6. Program to count the number of vowels and consonants in a given line of text.

7. Program to print the resistance value of the resistor given its color.

8. Program to search an element in a given list of numbers using binary search method.

9. Program to sort a given list of numbers in ascending or descending order.

10. Program to find 'n' Fibonacci series using recursive function.

11. Convert a given number into another specified base.

12. Program to read today's date and print tomorrow's date.

13. Program to find number of lines, words, alphabetic digits and punctuation in a given text.

14. Program to swap two numbers using pointers.

15. Multiplication of a matrix and transpose of a matrix.

16. To form a pyramid of numbers for a given number.

17. Program to check whether given string is palindrome or not.

18. To find the factorial of a number.

19. Write a program to find the sum of the digit's of the integer.

20. Write a program to perform all the arithmetic operations using command line arguments.

PROGRAMMING ON C++ LANGUAGE

1. Write a program to swap two numbers in C++.

2. Write a program by having the class name marks with data members ml, m2, m3, total, average and calculate total and average of the given numbers.

3. Write a program to input age, name using the array size of 5.

4. Write a program to input age, name and salary using scope resolution operator.

5. Write a program to overload operators such as ++,>= etc.

6. Write a program using unary operators (+,-).

7. Write a program to prove single inheritance and multiple inheritances.

8. Create a base class called XXX and derive two classes i.e. YYY from XXX and ZZZ from XXX.

9. Create a class called counter which counts and increment and decrement with different arguments.

10. Write overloaded functions to convert an string to an int and to convert to an float.

UNIX PROGRAMMING

1. Practice of UNIX commands.
2. Shell Programming.
   - (i) Write a shell program to find the biggest of 3 numbers.
   - (ii) Write a shell program to find the sum of ‘n’ numbers.
   - (iii) Write a shell program to find the number of vowels in given line of text.
   - (iv) Write a shell program to find the factorial.
   - (v) Write a shell program whether given string is palindrome or not.
   - (vi) Write a shell program to reverse an integer.

Subject title : CAD LAB
Semester : 6 periods per week in 4th semester
Periods : 90 periods
End Examination : 25
Sessional : 25

GENERAL OBJECTIVE :

1. The trainees should be exposed to solid modeling, assembly, Drafting, 3-D wire frame geometry and surfacing using **PRO-ENGINEERING** Willfire-3 Software.

Sl. No.	Major Topics	Time allotted
		Total Periods : 90
1	Introduction to CAD	4
2	Constraining Geometry and Dimensional constrains	10
3	Construction Tools	2
4	Construction Features	6
5	Local Operation	2
6	Datum	2
7	Advanced Modeling Technique	20
8	Duplication Features	4
9	Master Surfacing Creating Surfaces	6
10	Manipulation of Surfaces	12
11	Assembly	12
12	Drafting	10

SUBJECT CONTENT :

1. **Introduction to CAD.**

2. **Constraining Geometry** – Types of geometry constrains, using geometry constrains, **Dimensional constraints** – Creating Dimension, Modifying Dimensions.

3. **Construction Tools** – Fillet, Offset, Trim / Extend, Mirror.

4. **Construction Features** – Extrude, Revolve.

5. **Local Operation** – Filler / Shell / Draft / Chamfer / Hole.

6. **Datum** – Datum Planes / Datum Axis.

7. **Advanced Modeling Techniques** – Sweep / Blend / Slept Blunt / Variable Section Sweep.

8. **Duplication Features** – Copy / pattern.

9. **Master Surfacing** – **Creating Surfaces** – Extrusion / Revolve / Sweep / Boundary blend, style / extend / offset surface. **Manipulation of Surfaces** – Stitch surfaces / Extend surfaces / Bridge / Fillet / Offset surfaces / Mid surfaces.

10. **Assembly** – Constrains / Patters / Creating components within assembly / Cloning assembling / Substituting components.

11. **Drafting** – Detailing.

Subject title : DIGITAL ELECTRONICS LAB
Semester : 3 periods per week in 4th semester
Periods : 45 periods
End Examination : 25
Sessional : 25

GENERAL OBJECTIVE :

1. To design the circuits.
2. To understanding their working.
3. To verify their truth tables or outputs.

Sl. No.	Major Topics	Time allotted Total Periods : 45
1	Familiarization of digital trainer kit	1
2	Familiarization of Logic gate ICs	2
3	Verification of Boolean Rules	2
4	Implementing and verifying Karnaugh's Map	2
5	Implementing Combinational circuits.	4
6	Half Adder and Full Adder circuits	2
7	Comparators, Decoders, Encoders, MUX and DeMUX	4
8	Latches and Flip Flops	4
9	Timer IC 555 and Mono stable ICs 74121, 74123	2
10	Multi vibrator circuits	2
11	Counters using logic gates	4
12	Counters using ICs	6
13	Registers using Flip Flops	4
14	Registers using ICs	4
15	DAC 0808	1
16	ADC 0808	1

SUBJECT CONTENT :

1. Familiarization of digital trainer kit.

2. Familiarization of logic gate IC's.

2.1 NAND gate (IC 7400)

2.2 NOR gate (IC 7402).

2.3 INVERTER or NOT gate (IC 7404).

2.4 AND gate (IC 7408)

2.5 OR gate (IC 7432).

2.6 EX – OR gate (IC 7486).

3.0 Implementing and verifying Boolean Rules.

4.0 Implementing and verifying Karnaugh's Map.

5.0 Implementing Combinational circuits.

5.1 Realizing Universal property of NAND gate.

5.2 Realizing Universal property of NOR gate.

6.0 Construct and realize Half Adder and Full Adder circuit using minimum no. of gates.

7.0 Familiarization of comparator 97485), Decoder (74138), Encoder (74147), MUX (74151) and DeMUX (74138).

8.0 Familiarization of Latches and Flip flops (SR Latch, D Latch, JK Flip-Flop).

8.1 IC 7474 (Dual D-Flip flop).

8.2 IC 7474 (Dual J.K. Flip flop).

8.3 IC 74373.

8.4 IC 74374.

9.0 Familiarization of Timer ICs IC 555 & IC 74121, IC 74123.

10.0 Construction of multi vibrator circuits (Monostable and Astable).

11.0 Design and construction of Counters (Asynchronous & Synchronous Mod 16 & BCD, Presettable).

12.0 Familiarization of Counter ICs (7490, 7493, 74163, 74193).

13.0 Design and construction of Register circuits (SISO, SIPO, PIPO, PISO, RING & JOHNSON Counter).

14.0 Familiarization of Register ICs (74164, 74165, 74194).

15.0 Familiarization of DAC 0808.

16.0 Familiarization of ADC 0808.

17.0 Verify the characteristics of Logic Families fan-in, fan-out, V_{IL}max, V_{IH}min, V_{OL}min, V_{OH}max.

FIFTH SEMESTER

THEORY

Subject title : MICRO PROCESSOR
Semester : 5th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

At the end of the semester the student would be able to :

1. Describe architecture of 8085 Microprocessor.
2. Program the 8085 Microprocessor.
3. Interface 8085 with Memory & I/O Devices.
4. Use the Programmable Peripheral Devices.
5. Describe Advanced Microprocessor.
6. Understand the Applications of Microprocessor.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction to Microprocessor	3
2	Study of Memory	3
3	8085 Microprocessor Architecture	10
4	Interrupts of 8085	4
5	Programming 8085	11
6	Interfacing of Memory & I/O Devices	11
7	Intel 8086 Microprocessor	5
8	Assembly Language Programming of 8086	7
9	Introduction to Advanced Microprocessor	1
10	Microprocessor Applications	5

SUBJECT CONTENT :

1.0 INTRODUCTION TO MICROPROCESSORS

1.1 Introduction to Microprocessors & Microcomputers Evolution of Microprocessors.

1.2 Comparison of Microprocessors of Intel, Motorola and Zilog.

2.0 STUDY OF MEMORY

2.1 Basic Memory storage element, 4x8 – Bit Register, R/W Memory Model, ROM Memory model.

2.2 Memory Map and Addresses, Memory Classification, Memory Decoding.

3.0 8085 MICROPROCESSOR ARCHITECTURE

3.1 Pin-Configuration.

3.2 Functional block diagram – registers, accumulator, flags, ALU, timing & control unit, instruction register / decoder, address / data buffer.

3.3 Timing diagram, instruction cycle, machine cycle, memory read / white, opcode fetch, examples.

4.0 INTERRUPTS OF 8085

4.1 Vectored & Non-Vectored, Hardware & Software, Maskable & Non-Maskable Interrupts.

4.2 Interrupt Priority, Interrupt Restart Address, Interrupt Service, Subroutines.

5.0 PROGRAMMING 8085

5.1 8085 Addressing Modes.

5.2 8085 Instruction Set.

5.3 Assembly Language, Flow Chart & Simple Programs with 8085.

5.4 Stack & Sub Routines.

5.5 Counters & Time delays.

6.0 INTERFACING OF MEMORY & I/O DEVICES

6.1 Basic Concepts & Interfacing I/O devices.

6.2 Programmable Peripheral Interface – 8255.

6.3 Programmable Display / Keyboard Controller – 8279.

6.4 Programmable Interrupt Controller – 8259.

6.5 Programmable Interval Timer – 8253 / 8254.

6.6 Programmable Serial Interface – 8251.

7.0 INTEL 8086 MICROPROCESSOR

7.1 Architecture with Functional Block Diagram.

7.2 Pin Configuration & Memory Organization.

7.3 Interrupts of 8086.

8.0 ASSEMBLY LANGUAGE PROGRAMMING OF 8086

8.1 Addressing Modes of 8086.

8.2 Instruction Set of 8086.

8.3 Simple Programming (five).

8.4 Stack & Subroutine.

9.0 INTRODUCTION TO ADVANCED MICROPROCESSOR

9.1 Introduction to 32 / 64 Bit Microprocessor.

9.2 Comparison of Microprocessors (8 bit, 16 bit & Advanced).

10.0 MICROPROCESSOR APPLICATIONS

10.1 Data Acquisition System.

10.2 Temperature Control System.

10.3 DC Motor Control.

10.4 Traffic Light Control.

10.5 Stepper Motor Control.

Reference Books :

1	**Microprocessor Architecture, Programming and Applications with 8085**	**-**	**Ramesh S. Gaonkar**
2	**Fundamentals of Microprocessor and Microcomputers**	**-**	**Badri Ram**
3	**The Intel Microprocessors 8086/88, 80186/188, 80286, 80386, 80486, Pentium and Pentium Processors**	**-**	**Barry B. Brey**
4	**The 8086 Microprocessors Programming & Interfacing the PC**	**-**	**Kenneth J. Ayala**
5	**The 8085/8086 Microprocessors**	**-**	**Leu & Gibson**
6	**The 8085 Microprocessors Programming & Interfacing**	**-**	**A.P. Godse**

Subject title : INDUSTRIAL ELECTRONICS
Semester : 5th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Design and troubleshot circuits for demagnetizing inductors with switch.
2. Selections of Power switch for a given application.
3. To understand High Frequency Converters and to select the Components.
4. To understand the working of Drive Circuits.
5. To understand the working and specifications of UPS.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction	2
2	Power Semiconductor Devices	6
3	Electrical Vs Magnetic Circuits	6
4	Uncontrolled Rectifiers	6
5	Phase Controlled Rectifiers	6
6	Converters	6
7	Inverters	6
8	Protection Circuits	3
9	Thermal Management	3
10	Motor Drive Circuits	6
11	Power Supplies	6
12	Application Circuits	4

SUBJECT CONTENT :

1.0 INTRODUCTION
1.1 Introduction
1.2 Power Electronics Vs Linear Electronics
1.3 Scope & Applications

2.0 POWER SEMICONDUCTOR DEVICES
2.1 Introduction
2.2 Basic Structure, Characteristics, Operation, Limitations
- Power Diodes
- BJTs & MOSFETs
- Thyristors, GTOs
- IGBTs

3.0 ELECTRICAL VS MAGNETIC CIRCUITS
3.1 Introduction
3.2 Electric Circuits – Steady State Response.
3.3 Magnetic Circuits.

3.4 Flux and Flux Density.
3.5 Ampers Law, Right Hand Rule, Faradays Law.

4.0 UNCONTROLLED RECTIFIERS
4.1 Introduction
4.2 Rectifiers Concepts.
4.3 Single Phase & Three Phase Rectifiers & Comparison.

5.0 PHASE CONTROLLED RECTIFIERS
5.1 Introduction
5.2 Thyristor Circuits
5.3 Single Phase Converters
5.4 Three Phase Converters

6.0 CONVERTERS
6.1 Introduction
6.2 Control of dc – converters
6.3 Buck Converter
6.4 Boost Converter
6.5 Buck – Boost Converter
6.6 Full Bridge dc – dc Converter

7.0 INVERTERS
7.1 Introduction
7.2 Basic concepts of switch mode Inverters.
7.3 Single Phase Half, Full Bridge, Push-Pull Inverters.
7.4 Three Phase Inverters.

8.0 PROTECTION CIRCUITS
8.1 Snubher Circuits and their Functions
8.2 Turn OFF Snubbers.
8.3 Turn ON Snubbers.
8.4 Over Voltage Snubbers.

9.0 THERMAL MANAGEMENT
9.1 Control of Temperature in Semiconductor Devices.
9.2 Heat Transfer Techniques.
9.3 Heat Sinks – Need & Concept.

10.0 MOTOR DRIVE CIRCUITS
10.1 Introduction
10.2 Selection Criteria of Drive Components.
10.3 dc Motor – Equivalent dc Motors.
10.4 Permanent – Magnet dc Motors.
10.5 dc Servo Drives.
10.6 Induction Motor Operation – Basic Principles.
10.7 Variable Frequency Converters Classifications & Comparison.
10.8 Synchronous Motor Drives & Cycloconverters.

11.0 POWRE SUPPLIES

11.1 Introduction.
11.2 Linear Power Supplied.
11.3 Switching Power Supplies.
11.4 Protection, Isolation and Specifications.
11.5 Disturbances and Conditioners.
11.6 Uninterruptible Power Supplies.

12.0 APPLICATION CIRCUITS

12.1 Residential Application Circuit Examples.
12.2 Industrial Application Circuits.
12.3 Electricity Utility Applications.

Reference Books :

1.	**Industrial Electronics**	**-**	**James T. Homphires & Lestie P. Sheets**
2.	**Power Electronics Circuits, Devices & Applications**	**-**	**M.H. Rashid**
3.	**Power Electronics**	**-**	**P.C. Sen, Kjeld Thorborg**

Subject title : CONTROL SYSTEM
Semester : 5th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Understanding types of control systems and block diagram of an open loop and close loop control systems.
2. Modeling and transfer function evaluation of control system elements and components.
3. Modeling and analysis of speed control and velocity control servo system.
4. Time response analysis of first order and second order system.
5. Frequency response analysis of first order and second order system.
6. Control systems performance parameters i.e. Stability, response time and steady state error.
7. Control system compensation purpose methods.
8. Structure of a PID controller and its turning method using Zeigler and Nichols procedure.
9. Process control Computerization.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Control System – Introduction	5
2	Modeling of Control System	7
3	Components of Control System	4
4	Time response Analysis	4
5	Frequency Response Analysis	5
6	Stability – Time Response Analysis	2
7	Compensation	4
8	Tuning	2
9	Computerized Numerical Control	3
10	Optimal Control	2
11	Sequence Control and Programmable Controller	3
12	Process Control System	4
13	Computer Process Control	5
14	Control Devices	6
15	Modulation and Demodulation	4

SUBJECT CONTENT :

1.0 CONTROL SYSTEM – INTRODUCTION

1.1 Introduction to control system, close loop and open loop systems, Examples – Temperature control, Traffic control, Numeric control.
1.2 General block diagram of a control system, transfer function.
1.3 Effect of disturbance, transfer function of Op amp.
1.4 Introduction to Laplace transfer pairs.

2.0 MODELING OF CONTROL SYSTEM

2.1 Introduction to modeling of control system.
2.2 Elements and variables of an electrical system, transfer function.
2.3 Elements and variables of a mechanical translational system, transfer function.
2.4 Elements and variables of mechanical rotational system, transfer function.
2.5 Transfer function of armature controlled dc motor.
2.6 Transfer function of field controlled dc motor.
2.7 Block diagram construction.

3.0 COMPONENTS OF CONTROL SYSTEMS

3.1 Components of control systems, potentio meter.
3.2 Synchros and synchro transmitter.
3.3 Controllers – Two position controllers, preparation of controllers, analysis.
3.4 Integrated controllers, electronic PID controllers.

4.0 TIME RESPONSE ANALYSIS

4.1 Time response, test signals, order of system.
4.2 Step response of first order lag element, examples.
4.3 Step response of first order lead element, examples.
4.4 Step response of second order element.

5.0 FREQUENCY RESPONSE ANALYSIS

5.1 Frequency response – advantages, gain and phase, frequency domain specification.
5.2 Frequency response of 1^{st} order lag elements.
5.3 Frequency response of 1^{st} lead elements.
5.4 Frequency response of 2^{nd} order elements.
5.5 Bode transfer function factors.

6.0 STABILITY – TIME RESPONSE ANALYSIS

6.1 Definition of stability Route locus, control systems stability – Time domain view.
6.2 Control system stability, frequency domain view, gain and phase margin.

7.0 COMPENSATION

7.1 Control system compensation, Introduction.
7.2 Lag compensation.
7.3 Lead compensation.
7.4 PID compensation, electronic PID compensator.

8.0 CONTROL LOOPS OF NC

8.1 Control system tuning – open loop transient response, Ziegler – Nichols method.

9.0 CONTROL LOOPS OF NC

9.1 Introduction, Control loops in Point to Point Systems.
9.2 Control loops in contouring systems-principle of operation.

10.0 OPTIMAL CONTROL

10.1 Structural model of a manufacturing process.
10.2 Steady state optimal control.
10.3 Adaptive control.

11.0 SEQUENCE CONTROL AND PROGRAMMABLE CONTROLLER

11.1 Logic control and sequencing logic, Logic control elements.
11.2 Ladder logic diagrams, Programmable controller.

12.0 PROCESS CONTROL SYSTEMS

12.1 Introduction, Boiler Control, Combustion Control, Feed Water Control, Steam Temperature Control.

13.0 COMPUTER PROCESS CONTROL

13.1 Computer process monitoring.
13.2 Types of computer process control, Direct Digital control, Supervisory, Computer control, Programming for computer process control.
13.3 Computerization of Numerical Control – Reference pulse technique, Sample of data function.

14.0 CONTROL DEVICES

14.1 Electro hydraulic Control Devices.
14.2 Flapper controlled Electro hydraulic Servo valve.
14.3 Proportional Solenoid controlled Electro dynamic valve.
14.4 Electro Pneumatic proportional controls.
14.5 Direct proportional controls for Pressure and Flow.
14.6 Pulse width modulation control of Solenoid valves.
14.7 Control of electric Drives, Diodes, Thyristors, GTO, TRIAC, Power Transistors, Power MOSFETS, IGBT, Smart Power devices.

15.0 MODULATION AND DEMODULATION

15.1 Modulation Types – Amplitude Modulation, Frequency Modulation, Pulse Modulation.
15.2 Demodulation – Necessity, Essentials.

Reference Books :

1	**Control Systems**	**-**	**A Nagoor Kani (RBC Publishes – First Edition)**
2	**Computer control of Manufacturing Systems**	**-**	**Yoram Korner (TATA McGRAW-Hill – 2005 Edition)**
3	**Process Control Instrumentation Technology**	**-**	**Curtis D. Jhonson (PEARSON Education – Seventh Edition)**
4	**Automation, Production Systems and Computer Integrated Manufacturing**	**-**	**Mikell P. Groover (Prentice – Hall Fifteenth Indian Reprint)**
5	**Control Systems Principles and Design**	**-**	**M. Gopal (TATA McGRAW-Hill**
6	**Electronics in products and Processes**	**-**	**D.A. BRADLEY, A.J. LOADER, First Indian Reprint 2004)**

Subject title	**:**	**PNEUMATICS AND HYDRAULICS**
Semester	**:**	**5th semester**
Periods	**:**	**60 periods**
Theory	**:**	**80**
I.A.	**:**	**20**

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1. **Introduction to Fluid Power and Properties of Fluids.**
2. **Industrial application of Pneumatic and Hydraulic Powers.**
3. **Compressed Air.**
4. **Pneumatic Working Elements.**
5. **Basic Pneumatic Circuits.**
6. **Hydraulic Working Elements.**
7. **Basic Hydraulic Circuits.**
8. **Hydro Pneumatic Systems.**
9. **Electrical Controls in Pneumatics and Hydraulics.**
10. **Maintenance and Troubleshooting.**

1.0 **Introduction to Fluid Power & Pneumatic Power.**

1.1 Fluid Power – History, advantages, disadvantages and applications.

1.2 Pneumatic power – History, advantages, disadvantages and applications.

2.0 **Properties of Fluids**

2.1 Properties of Fluids – properties o fluids like density, specific volume, specific weight, relative density, atmospheric pressure, gauge, absolute pressure, viscosity.

2.2 Hydro statics – determination of pressure at a depth below free surface of a liquid, Pascal's law definition and its applications.

2.3 Hydrodynamics – Bernoulli's theorem – practical application of law of volume of flow.

2.4 Gas laws – Boyle's law, charle's law, Gay Lussac's Law, problems.

3.0 **Compressed Air Production and Preparation**

3.1 Characteristics – positive and negative characteristics.

3.2 Compressor types.

3.3 Terms associated with compressor – delivery volume, theoretical and effective working pressure, operation pressure, pressure losses.

3.4 Cooling of compressor – needs, methods, fins, fans, water cooling.

3.5 Regulation of compressors – no load regulation, low speed regulation, on/off regulation.

3.6 Compressed air receiver – need, selection, delivery volume, pressure, drive, cooling method, regulation, determination of receiver size.

3.7 Compressed air preparation – need, functions of suction air filter, functions of intercooler and recooler, functions of air filter, requirements of air filter, functions of pressure regulators, functions of all lubricator, functions of service unit.

3.8 Distribution of compressed air – System of distribution, criteria for selecting pipe diameter, flow volume, pipe length, pressure drop, working pressure, number of restrictions in pipe line, pipe diameter calculation, pipe material.

1.0 Pneumatic working elements

4.1 Pneumatic cylinders – construction details and working of SAC, DAC, diaphragm cylinder, rolling diaphragm cylinder, cylinders with end position cushioning, cylinders with double sided piston rod, tandem cylinder, multi position cylinders, impact cylinder, rotary cylinder, constructional features of pneumatic cylinders, calculation for cylinders, piston force, air consumption.

4.2 Pneumatic motors – characteristics of pneumatic motor, working of sliding vane motor, gear motor.

4.3 Pneumatic valves – constructional details and functioning of directional control valves, non return valves, pressure control valves, shutoff control valve, quick exhaust valve, sequence control valves, time delay valves, representation of pneumatic valves with symbols.

4.4 Symbols used in Pneumatics (ISO 1219/ DIN 24300).

2.0 Basic Pneumatic Circuits

5.1 Design of basic pneumatic circuits employing SAC, design of basic pneumatic circuits employing DAC, rigging up circuits.

3.0 Hydraulic Working Elements

6.1 Hydraulic Pumps – Constructional details of gear pump, functions of gear pump.

6.2 Hydraulic cylinders – Constructional details and working of SAC, DAC, DAC with double piston rod, cylinder with end position cushioning, telescopic cylinders, tandem cylinders, determination of force developed by cylinders.

6.3 Hydraulic motors – Working of basic hydraulic motor and cam type axial piston motor.

6.4 Hydraulic filters – Functions of filter, air breather filter, suction line filter, pressure line filter and return line filter.

6.5 Hydraulic valves – Construction and function of pressure relief valve, directional valve, flow control valve, representation of various hydraulic valves with symbols.

6.6 Symbols used in hydraulics (ISO 1219/ DIN 24300).

4.0 Basic Hydraulic Circuits.

7.1 Design of basic hydraulic circuits employing DAC, rigging up circuits.

5.0 Hydro Pneumatic Systems

8.1 Principles of hydro-pneumatic systems, advantages, pressure converter, pressure intensifier, functions of feed units, functioning of hydraulic accumulators and hydraulic intensifiers.

6.0 Electrical control in Pneumatics and Hydraulics

9.1 Electro-pneumatics, actuating magnets, relays, limit switches, applications of switching functions, circuits.

7.0 Maintenance and Trouble Shooting

10.1 Maintenance of pneumatic system, common problems in pneumatic system, seals failure, maintenance of compressor.

10.2 Instruction for removal of operating troubles of air compressor.

Reference Books :

1.	**Fundamentals of Pneumatic Control Engineering**	**-**	**Festo**
2.	**Introduction to Pneumatics**	**-**	**Festo**
3.	**Fluid Mechanics and Hydraulics**	**-**	**Dr. Jagdish Lal**
4.	**Hydraulic and Pneumatic Power for Production**	**-**	**Stewart**

Subject title : COMPUTER PROGRAMMING – MS ACESS, VB NETWORK
Semester : 5th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVES :

1. Understand and learn programs on MS – Access and Visual Basic.
2. Understand an overview of Computer Network.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	MS – ACCESS	10
2	VISUAL BASIC	40
3	COMPUTER NETWORK	10

SUBJECT CONTENT :

1.0 MS – ACCESS

1.1 Introduction to Database Management System.
1.2 Introduction to MS – Access elements.
1.3 Creating tables, data types.
1.4 Creating forms and reports.
1.5 Creating queries and filters.
1.6 Building relationship – one to one, one to many, many to many.

2.0 VISUAL BASIC

2.1 Difference between back end and front end tools.
2.2 Introduction to Visual Basic.
2.3 VB 6.0 Programming Environment.
2.4 Integrated Development Environment.
- Working with forms
- Setting Properties
- Working with Programming Constructs
  - Sequences
  - Selection or Decision Making
  - Iteration or Loop

2.5 Arrays in Visual Basics
2.6 Working with Controls
- a. Creating and using control.
- b. Classification of controls.
- c. Tab index property of control.
- d. Using text body control.
- e. Using Label control.
- f. Using command button.
- g. Using option button.
- h. Using list box.
- i. Using combo box.
- j. Scroll bar controls.

2.7 Menus, Mouse events and Dialog Box

a. Menu Interface.
b. Using menu editor.
c. Working with Program.
d. Writing code for menu controls.
e. Adding Separator bar and menu short cut keys.
f. Popup Menus.
g. Making menu control invisible.
h. Using check marks.
i. Mouse events.
j. Graphical mouse application.
k. Dialog boxes.
l. Model and model less dialog boxes.
m. Using input box function.
n. Using the common dialog control.
o. Rich text box control.

2.8 Graphics

a. Fundamentals of graphics
b. Using graphical control
c. Line control
d. Shape control
e. Image control
f. Adding a picture
g. Removing picture
h. Moving and sizing picture

2.9 How to make use of data control, ADO

3.0 COMPUTER NETWORK

3.1 Introduction.
3.2 Types of Network.
3.3 Network structure, OSI model.
3.4 Examples in networks.
3.5 Transmission media.
3.6 Analog and digital transmission.
3.7 Internet Working.

Reference Books :

1. Data base Management System - Jeffery Ullman

2. Computer Networks - Tanenbaum

3. Visual Basic 6 - Tech media Publications

4. MS – Access 2000 - Tech media Publications

PRACTICAL

Subject title : MEASURING SYSTEM LAB
Semester : 3 periods per week in 5th semester
Periods : 45 periods
End Examination : 25
Sessional : 25

GENERAL OBJECTIVE :

1. To design the circuits.
2. To understanding their working.
3. To verify their truth tables or outputs.

Sl. No.	Major Topics	Time allotted
		Total Periods : 45
1	Converters	4
2	Thermocouples & RTD	4
3	Sensors	5
4	Temperature Controllers	4
5	Pressure gauges	4
6	Measurement of displacement	2
7	Design of Counter	6
8	Measurement of load.	3
9	Measurement of speed.	2
10	Familiarization of Proximity, switch.	11

SUBJECT CONTENT :

1. V to F Converter using ICL 8038.
2. F to V Converter using LM 2907.
3. Study of types of Thermocouple and characteristics of Thermocouple.
4. Study to RTD and characteristics of RTD.
5. Temperature sensing using Diodes.
6. Using LM 35 and AD 590 as temperature sensor.
7. Study of ON OFF control using temperature controller using Thermocouple and RTD.
8. Finding error in the given pressure gauge with respect to Digital Gauge.
9. Finding error in the given pressure gauge with respect to Dead Weight.
10. Measurement of Displacement using LVDT.
11. Designing a counter circuit using Proximity Sensor.
12. Measurement of load by using load cell.
    (b) Expansion Method.
    (c) Compression Method.
13. Measurement of Speed using.
    (a) Contact type (Tachometer).
    (b) Non – contact type (Proximity Sensor & Stroboscope).
14. Familiarization of Inductive Proximity, Capacitive Proximity, IR and Reed Switch.

Subject title	**:**	**COMPUTER PROGRAMMING LAB**
Semester	**:**	**5th semester**
Periods	**:**	**105 periods**
End Examination	**:**	**25**
Sessional	**:**	**25**

UNIT - 1

MS – ACCESS **20**

1. Using MS – Access create a database on students mark list.
2. Create three tables and show the relationship.
3. Create query on student mark card list using formulas like sum, average, result etc.
4. Create employees table with following of options.
   a. Filtering records using one field and one value.
   b. Filter by selection.
   c. Filter by form.
   d. Filter for.
   e. Filter excluding selection.
5. Create form on item transaction which has following fields Item No., Name, Quality, Quantity, Price etc.
6. Create report on payroll system which was following fields Emp. No., Name, Grade, Basic Salary, Other Allowances DA, CA, HRA, TA etc., Deductions – PF, Balance.
7. Create macro on opening table minimize, maximize.

UNIT – 2

VISUAL BASIC PRACTICAL **40**

1. **Program to give a message what form is loaded and unloaded by changing the color.**
2. Program to change the color of the circle when mouse is moved on the circles.
3. Program for lost focus and got focus.
4. Program using command button.
5. Program on List box, combo box, option button.
6. Program on shapes, image box and picture box.
7. Display the images clicking on the image files of a directory within a particular drive.
8. Create a common dialog box, using this change the font.
9. Develop a calculator.
10. Develop a notepad.
11. **Using option button design some question with four option in each question and the result should be displayed ex : KBC.**
12. Store the information of your friends in a database and access it through VB.

UNIT – 3

III Project **60**

Subject title	**:**	**PNEUMATICS AND HYDRAULICS LAB**
Semester	**:**	**5th semester**
Periods	**:**	**90 periods**
End Examination	**:**	**50**
Sessional	**:**	**25**

1.0 PNEUMATICS **30**

1.1 Exercise on Direction Control **12**

1.1.1 Actuation of single acting cylinder by 3/2 D.C. valve.
1.1.2 Actuation of double acting cylinder by 5/2 D.C. valve.
1.1.3 Direct control of DAC by 5/2 D.C. valve.
1.1.4 Indirect control of DAC by 5/2 D.C. valve.

1.2 Exercise on Flow Control **04**

1.2.1 Speed control of SAC by throttle valve.
1.2.2 Speed control of DAC by flow control valve.
1.2.3 Speed control of DAC by quick exhaust valve.

1.3 Logic Conditions **08**

1.3.1 Use of OR logic to actuate DAC.
1.3.2 Use of AND logic to actuate DAC.
1.3.3 Circuits using logical conditions.

1.4 Advanced Circuit Design **08**

1.4.1 Retraction of DAC after preset pressure is reached.
1.4.2 Memory circuit and speed control of DAC.
1.4.3 Examples for using Time delay valve.

1.5 Electro – Pneumatics **08**

1.5.1 Actuation of SAC by solenoid operated valves.
1.5.2. Sequence control by solenoid operated valves.

2.0 HYDRAULICS **24**

2.1 Pressure Control **04**

2.1.1 Use of pressure relief valve in DAC.
2.1.2 Use of pressure regulating valve in DAC.

Subject title	**:**	**INDUSTRIAL ELECTRONICS LAB**
Semester	**:**	**5th semester**
Periods	**:**	**60 periods**
End Examination	**:**	**50**
Sessional	**:**	**25**

Sl. No. **List of Experiments**

1. Switching characteristics of Diode.

2. Switching characteristics of BJT.

3. Switching characteristics of MOSFET.
   (a) Non Isolated Gage Drive.
   (b) Isolated Gate Drive.

4. Inductor Design, Calculation and Winding Exercises.

5. Inductor Switching Circuits
   (a) With Resistor
   (b) With Diode
   (c) With Zener

6. Switching Characteristics of SCR.

7. Triggering of SCR.
   (a) With Resistor.
   (b) With R and C.

8. Case Study of Pulse Transformer driving of SCR.

9. Case Study of SCR Controlled Full Bridge Rectifier.

10. Familiarization of PWM IC-SG 3524.

11. Case Study of Buck Converter
    (a) Open Loop
    (b) Closed Loop

12. Case Study of Boost Converter
    (a) Open Loop
    (b) Closed Loop

13. Familiarization of TCA 785.

14. Case Study of SCR Controlled DC Drive.

15. Familiarization of an UPS Control Circuit.

SIXTH SEMESTER

THEORY

Subject title : EMBEDDED SYSTEM
Semester : 4 periods per week in 6th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Describe architecture and instruction set of 8051 & PIC 16F87X.
2. Understand the Applications of 8051 & PIC 16F87X.
3. Describe an Embedded system.
4. Understand the Real Time operating system.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction to micro controllers	1
2	Overview of 8051 micro controller	2
3	8051 architecture	4
4	8051 addressing modes	3
5	Assembly language programming 8051	6
6	8051 application examples	4
7	Introduction to PIC micro controllers	1
8	PIC 16f87x architecture	2
9	PIC 16f87x instruction set	2
10	PIC 16f87x special features	5
11	PIC 16f87x programming	6
12	PIC 16f87x application examples	4
13	Embedded systems – introduction	5
14	Real time operating systems	10
15	Case studies and applications	5

SUBJECT CONTENT :

1.0 INTRODUCTION TO MICRO CONTROLLERS
1.1 Introduction to Micro Processors & Micro Controllers.

2.0 OVERVIEW OF 8051 MICRO CONTROLLER
2.1 Introduction
2.2 Pin description.

3.0 8051 ARCHITECTURE
3.1 Registers.
3.2 I/O Ports.
3.3 Memory Organization.

4.0 8051 ADDRESSING MODES
4.1 8051 addressing modes.
4.2 Instructions set.
4.3 Instruction and simple programs.

5.0 ASSEMBLY LANGUAGE PROGRAMMING 8051
5.1 8051 assembly language programming.
5.2 Development system and tools.
5.3 Software simulators of 8051.

6.0 8051 APPLICATION EXAMPLES
6.1 Square wave generator.
6.2 Rectangular wave generator.
6.3 Pulse generator.
6.4 Staircase ramp generator.

7.0 INTRODUCTION TO PIC MICRO CONTROLLERS
7.1 Introduction to peripheral interface controllers (PIC).

8.0 PIC 16F87X ARCHITECTURE
8.1 Pin diagram, memory organization.
8.2 I/O ports.

9.0 PIC 16F87X INSTRUCTION SET
9.1 Addressing modes.
9.2 Instruction set.

10.0 IC 16F87X SPECIAL FEATURES
10.1 RISC processors.
10.2 Harvard architecture.
10.3 Power on reset feature.
10.4 Watch dog timer, SLEEP mode.
10.5 Interrupt handling capability.

11.0 PIC 16F87X PROGRAMMING
11.1 Fixed - point numbers.
11.2 Addition of two 16 bit numbers.
11.3 Unsigned 32-bit addition.
11.4 Binary to BCD conversion.
11.5 Integration.
11.6 Differentiation.

12.0 PIC 16F87X APPLICATION EXAMPLES
12.1 Measurement application.
12.2 Automation and control applications.

13.0 EMBEDDED SYSTEMS

13.1 Introduction : Categories, over view of embedded system, Architecture, special features, recent trends.
13.2 Hard ware Architecture.
13.3 Software Architecture.
13.4 Programming for embedded system.

14.0 REAL TIME OPERATING SYSTEMS

14.1 Operating system basics, Architecture of Kernel, Tasks and Task scheduling, Context switching.
14.2 Interrupt service routines.
14.3 Inter process communication : Semaphores, mutex, mailbox, Queue, Event registers, pipes, signals, timers.
14.4 Memory management – segmentation, paging, fragmentation.
14.5 RTOS – Micro C/OS-II.

15.0 CASE STUDIES AND APPLICATIONS

15.1 Data Acquisition System.
15.2 Temperature Control System.
15.3 DIC Motor Control.
15.4 Traffic Light Control.
15.5 Stepper Motor Control.

Reference Books :

1	**The 8051 Micro Controller Architecture, Programming & Applications**	**-**	**Kenneth J. Ayala**
2	**The 8051 Micro Controller & Embedded System**	**-**	**M.A. Mazidi**
3	**Pic 16f87x user's manual**	**-**	**Microchip inc.**
4	**Micro Controller (theory and applications)**	**-**	**Ajay V. Deshmukh**
5	**Real time operating system design and analysis**	**-**	**An Engineer's hand book II edition**
6	**Embedded / real time systems : concepts, Design & Programming**	**-**	**K.V.K. Prasad**

Subject title : CNC TECHNOLOGY
Semester : 4 periods per week in 6th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. To have a knowledge of NC & CNC.
2. To know the principles of NC & CNC.
3. To know the knowledge of design of CNC machine structure and feed back devices, axes identification.
4. To have a knowledge of different types of cutting tool materials, holders, ATC.
5. To have knowledge of CNC manual programming, job planning, cut planning.

Sl. No.	Major Topics	Time allotted Total Periods : 60
1	Introduction to Computer Numerical Control	2
2	CNC Hardware Basics	4
3	CNC Tooling	2
4	CNC Machine Tools and Control Systems	2
5	CNC Programming	20
6	Advanced Part Programming Methods	10
7	Turning Center Programming	20

SUBJECT CONTENT :

1.0 Introduction to Computer Numerical Control
1.1 Introduction.
1.2 Numerical Control.
1.3 Numerical Control Modes.
1.4 Numerical Control Elements.
1.5 NC Machine Tools.

2.0 CNC Hardware Basics
2.1 Structure of CNC Machine Tools
2.2 Spindle Design.
2.3 Drives.
2.4 Actuation Systems.
2.5 Feed back Devices.
2.6 Axes – Standards.

3.0 CNC Tooling
3.1 Cutting Tool Materials.
3.2 Turning Tool Geometry.
3.3 Milling Tooling Systems.
3.4 Tool Presetting.
3.5 Automatic Tool Changers.

3.6 Work Holding.
3.7 Cutting Process Parameter Selection.

4.0 CNC Machine Tools and Control Systems.
4.1 CNC Machining Centers.
4.2 CNC Turning Centers.
4.3 High Speed Machine Tools.
4.4 Machine Control Unit.
4.5 Support Systems.
4.6 Touch Trigger Probes.

5.0 CNC Programming.
5.1 Part Programming Fundamentals.
5.2 Manual Part Programming Methods.
5.3 Preparatory Functions.
5.4 Miscellaneous Functions.
5.5 Program Number.
5.6 Tool Length Compensation.
5.7 Canned Cycles.
5.8 Cutter Radius Compensation.
5.9 Practice of all programs on the Computer using simulation software.

6.0 Advanced Part Programming Methods
6.1 Polar Cp-ordinates.
6.2 Parameters.
6.3 Looping and Jumping.
6.4 Subroutines.
6.5 Mirror Imaging and Scaling.
6.6 Canned Cycles.
6.7 Practice of all programs on the computer using simulation software.
6.8 CAD CAM and its application.

7.0 Turning Center Programming
7.1 Comparison between Machining Centers and Turning Centers.
7.2 Tape Formats.
7.3 Axes System.
7.4 General Programming Functions.
7.5 Motion Commands.
7.6 Cut Planning.
7.7 Thread Cutting.
7.8 Canned Cycles.
7.9 Practice of all programs on the computer using simulation software.

Reference Books :

1. Mechatronics - W. Bokon

2. Automation Production Systems & Computer Integrated Manufacturing - M.P. Groover

3. Computer Numeric control of machine tools - G.E. Thyer

Subject title : MECHATRONICS SYSTEM DESIGN
Semester : 4 periods per week in 6th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. To understand the mechanical system design.
2. To understand principles of modeling and simulation.
3. To know modeling and simulation of physical systems.
4. To build system models.
5. To know the advanced applications in mechatronics.
6. To build models for simulation using bond graphs 20 – SIM.

Sl. No.	Major Topics	Time allotted Total Periods : 60
1	Introduction to Mechatronics	5
2	Principles of Modeling and Simulation	9
3	Modeling and Simulation of Physical Systems	10
4	Basic System Models and System Models	12
5	Advanced Applications in Mechatronics System Design	10
6	Bond Graphs (20 – SIM).	14

SUBJECT CONTENT :

Sl. No.	Topics	Periods
1.0	**INTRODUCTION TO MECHATORNICS SYSTEM DESIGN**	**5**
1.1	Need for Mechatronics in Industries – Benefits – The Mechatronics approach – Challenges before R&D in Mechatronics.	1
1.2	Integrated design issues in Mechatronics – Mechatronics key elements	1
1.3	The Mechatronics design process.	1
1.4	Advanced approaches in Mechatronics.	2
2.0	**PRINCIPLES OF MODELING & SIMULATION**	**9**
2.1	Introduction – Model categories.	1
2.2	FIELDS OF APPLICATION – Bottom up design – Top down design – Relationship of design strategies to modeling – Modeling for the specification – Modeling for the design.	2
2.3	MODEL DEVELOPMENT – Structural modeling – Physical modeling – Experimental modeling.	2
2.4	Model verification – Model validation – Model simplification.	2
2.5	SIMULATORS & SIMULATION – Circuit – Logic – Multibody – Block Diagram – Finite element and Software simulation.	2

3.0	**BASIC SYSTEM MODELS & SYSTEM MODELS**	**10**
3.1	Mathematical models.	1
3.2	Mechanical system building blocks.	1
3.3	Electrical system building blocks.	1
3.4	Fluid system building blocks.	2
3.5	Engineering systems.	1
3.6	Rotational – translational systems.	1
3.7	Electro mechanical systems.	1
3.8	Hydraulic – Mechanical systems.	2

4.0	**MODELING & SIMULATIN OF PHYSICAL SYSTEMS**	**12**
4.1	Simulation & Block diagrams	1
4.2	Analogies and Impedance diagrams	2
4.3	Electrical systems	1
4.4	Mechanical translational systems	2
4.5	Mechanical rotational systems	2
4.6	Electro Mechanical Systems	2
4.7	Fluid systems	2

5.0	**ADVANCED APPLICATIONS IN MECHATRONICS SYSTEM DESIGN**	**10**
5.1	Sensors for condition monitoring	2
5.2	Mechatronic control in automated manufacturing.	2
5.3	Artificial intelligence in mechatronics.	2
5.4	Fuzzy logic applications in mechatronics.	2
5.5	Micro sensors in mechatornics.	2

6.0	**BOND GRAPHS (20 – SIM)** Simple models to be developed and simulated by trainees in lab (Lab. Exercises for internal evaluation only). Only theory for semester examination.	**14**

Reference Books :

1	**Mechatronics system design**	**-**	**Devdas Shetty & Richard A Kolk PWS Publications – 3rd reprint 2004 : ISBN : 981 – 240 – 067 – 2**
2	**Mechatronics – Electronics control systems in Mechanical Engineering**	**-**	**W. Bolton – 2nd Edition, Pearsons Education Ltd., ISBN : 81 – 7808 – 339 – 6**
3	**Mechatronics**	**-**	**HMT (TMH)**
4	**Mechatronics**	**-**	**Prof. C.R. Venkataramana, Sapna Book House, 1st Edition, 2nd reprint, Oct, 2002**
5	**Mechatronics : Electronics in Product & Process**	**-**	**D.A. Bradley, D. Dawson, N.C. Burd, A.J. Loader, Nelson Thomes Ltd., 1st Indian, Reprint 2004, ISBN : 0 7487 5742 2**

Subject title : LOGIC CONTROL DESIGN
Semester : 4 periods per week in 6th semester
Periods : 60 periods
Theory : 80
I.A. : 20

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	PLC basics	2
2	Basic PLC programming	7
3	Basic PLC functions	8
4	Intermediate functions	6
5	Data handling functions	5
6	PLC functions working with bits	10
7	Advanced PLC functions	2
8	Overview of Siemens PLCs, ABB PLCs & Fanuc PLCs	6
9	Other PLCs	2
10	Introduction to VHDL	12

SUBJECT CONTENT :

1.0 PLC BASICS
1.1 Overall look inside PLC.
1.2 General PLC programming procedure and I/O devices.

2.0 BASIC PROGRAMMING
2.1 On/Off inputs and On/Off outputs.
2.2 Relation between digital gates & coil / contact logic.
2.3 Creating ladder diagrams for process control.

3.0 BASIC FUNCTIONS
3.1 Registers basics.
3.2 Timer functions.
3.3 Counter functions.

4.0 INTERMEDIATE FUNCTIONS
4.1 Arithmetic functions.
4.2 Number comparison functions.
4.3 Number conversion functions.

5.0 DATA HANDLING FUNCTION
5.1 PLC SKIP & MASTER CONTROL RELAY functions.
5.2 JMP instruction.
5.3 Data Movement instruction.
5.4 Other Function.

6.0 FUNCTION WORKING WITH BITS

6.1 Digital bit functions and their applications.
6.2 Sequencer functions.
6.3 Robot control with PLC.

7.0 ADVANCED PLC FUNCTIONS

7.1 Analog PLC operations and PID control.
7.2 Networking PLC and trouble shooting PLC.

8.0 OVER VIEW OF DIFFERENT TYPES OF PLC

8.1 Siemen's PLC, AB PLC, FANUC PLC, MISITUBI PLC's etc.

9.0 INTRODUCTION TO VHDL

9.1 VHDL introduction, Capabilities, Hardware abstraction.
9.2 Basic Terminology, Entity Declaration, Architecture Body.
9.3 Configuration Declaration, Package Declaration Package body.
9.4 Model Analysis, Simulation.

Reference Books :

1. Programmable Logic Controllers - John W. Webb, Ronald A. Reis

2. Introduction to Programmable Logical Controller - Gary Dunning

Subject title : ROBOTICS
Semester : 4 periods per week in 6th semester
Periods : 60 periods
Theory : 80
I.A. : 20

GENERAL OBJECTIVE :

1. Familiarization to industrial robot and its application.
2. To get knowledge about different types of manipulator and calculation.
3. To get knowledge about machine vision, implementation principles and issues.
4. To get knowledge about control (movement, force) of the manipulator.
5. Familiarization to the robot programming language.
6. Familiarization to the robot intelligence and task planning.

Sl. No.	Major Topics	Time allotted
		Total Periods : 60
1	Introduction – Robotics	10
2	Robot motion & control and coordinate frames, Mapping, transforms.	12
3	Manipulators kinematics.	6
4	Inverse manipulator kinematics.	6
5	Control of manipulators.	12
6	Machine vision, implementation principles & issues and Robot applications.	4
7	Robot programming language and systems.	5
8	Robot – off line programming systems.	2
9	Robot intelligence and task planning.	3

SUBJECT CONTENT :

1.0 Introduction – Robotics.

1.1 Background, Progressive advancement in robotics, development, Definition of robot, Law of robotics.

1.2 Robot anatomy – Anatomy, Links, joints and joint notation scheme, Configuration, DOF, degree of freedom required in a manipulator, joint drive system, arm configuration, wrist configuration.

1.3 End effectors – Definition, classification of end effectors, Grippers – mechanical grippers – types, magnetic grippers, vacuum & Adhesive gripper, consideration in gripper selection and designing.

1.4 Work cell, work envelope, work volume.

1.5 Specifications of robots and safety measure in robotics.

2.0 Robot motion & control and coordinate frames, mapping, transforms.

2.1 Introduction to manipulator kinematics, homogeneous transformations and robot kinematics, manipulator path control.

2.2 Coordinate frames – mapping, mapping between rotated frames, Mapping between translated frames, mapping between rotated and translated frames.
2.3 Description of objects in space, transformation of vectors – rotation of vectors, translation of vectors, combined rotation and translation of vectors, composite transformation.
2.4 Inverting a homogenous transform.
2.5 Fundamental rotation matrices – principal axes rotation, fixed angle, Representation, Euler angle representation, Equivalent angle axis representation.

3.0 Manipulators kinematics.
3.1 Introduction, link description, link connection description.
3.2 Convention for affixing frames to links, manipulator kinematics.
3.3 Actuator space, joint space and Cartesian space.
3.4 Kinematics of two industrial robot – example.
3.5 Frames with standard names, where is the tool ?
3.6 Computational considerations.

4.0 Inverse manipulator kinematics.
4.1 Introduction, solvability, notation of manipulator subspace when n < 6.
4.2 Algebraic vs. geometric, algebraic solution by reduction to polynomial.
4.3 Piper's solutions when three axes intersect, example of inverse Manipulator kinematics.
4.4 Standard frames, SOLVE – ing a manipulator, repeatability and accuracy, computational considerations.

5.0 Control of manipulators.
5.1 Linear controls of manipulators – introduction, feedback and closed loop control, second order linear systems, control of second order systems, control law partitioning, trajectory following control, disturbance rejection, continuous vs. discrete time control, modeling and control of a single joint, architecture of an industrial robot controller.
5.2 Non linear controls of manipulators – introduction, non linear and Time-varying systems, Multi-input, Multi-output control systems, the control problems of manipulators, practical consideration, present industrial robot control systems, Iyapunov stability analysis, Cartesian-based control systems, adaptive control.
5.3 Force control of manipulators – introduction, application of industrial robots to assembly tasks, a framework for control in partially constrained tasks, the hybrid position / force control scheme, present industrial robot control schemes.

6.0 Machine vision, implementation principles and issues and Robot applications.
6.1 Introduction to machine vision, the sensing and digitizing function in machine vision.
6.2 Image processing and analysis, training and vision system.
6.3 Plant survey to identify potential applications, selection of the best applications, selection of the robot.

6.4 Robot applications – material handling, processing operations, Assembly and inspection, capabilities of robots, obstacle avoidance.

7.0 Robot programming language and systems.

7.1 Introduction, method of robot programming, lead through programming methods, a robot program as a path in space, Motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead through methods.

7.2 Three levels of robot, programming – characteristics of Robot level languages, characteristics of task level languages, concluding remarks.

7.3 A sample application, requirements of a robot programming language.

7.4 An example application coded in the three RPLs, problems peculiar to robot programming language.

8.0 Robot – off line programming systems.

8.1 Introduction, central issues in OLP systems.

8.2 Cimstation, automating subtasks in OLP systems.

9.0 **Robot intelligence and tasks planning.**

9.1 Introduction, state space speech, problem reduction, use of predicate logic.

9.2 Goals of AI research, AI techniques, LISP programming, AI & Robotics, LISP in the factory, Means – Ends analysis, problem solving.

9.3 Robot learning, task planning, basic problem in task planning, expert system and knowledge engineering.

Reference Books :

1	**Introduction to Robotics**	**-**	**Jhon. J. Craig**
2	**Robotics**	**-**	**K.S. Fu, R.C. Gonzalez, C.S.G. Lee**
3	**Industrial Robotics**	**-**	**Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholar, G. Odrey**
4	**Automation Production Systems and Computer Integrated Manufacturing**	**-**	**Mikell P. Groover**
5	**Robotics and control**	**-**	**R.K. Mittal, I.J. Nagrath**
6	**Robotics Technology and Flexible Automation**	**-**	**S.R. Deb**

PRACTICAL

Subject title	**:**	**MICRO PROCESSOR LAB**
Semester	**:**	**6th semester**
Periods	**:**	**60 periods**
End Examination	**:**	**25**
Sessional	**:**	**25**

8085 Micro Processor Lab :

1. Familiarization of 8085 Microprocessor kit.

2. Loading of Four bytes in the Registers A, B, C, D & Moving them to consecutive location 8000h through 8003h.

3. Add two 8-bit numbers, without carry, storing the result in location 9000h.

4. Add of two 16-bit numbers, with carry, storing the result in location 9010h **(LSB)** and 9011h **(MSB)**.

5. Subtract an 8-bit number from another 8-bit number and store the difference in location 9000h.

6. Perform the decimal addition of two 8-bit numbers, storing the sum in decimal system in the location 9100h.

7. Multiplication of two 8-bit numbers and storing the result in register **DE** as well as in the location 9000h **(LSB)** & 9001h **(MSB)**.

8. Division of a 16-bit number with an 8-bit number.

9. Find 1's complement of a 16-bit number and place the result in 9000h.

10. Find 2's complement of an 8-bit number and storing it in 9000h.

11. Shift an 8-bit number to the left by 2 bits and storing it in 9000h.

12. Mask off the most significant 4 bits of an 8-bit and storing it in 9000h.

13. Find the square of a given positive number using look-up table. Store the values of squares starting from address 9500h.

14. Find the larger of the given two 8-bit numbers, placing the bigger number in 9000h.

15. Find the even, odd, +Ve, and –Ve, numbers present in the given array and make separate group for each type to store them.

16. Add 'N' 8-bit numbers stored in memory location 9500h through (9500+N)h and store the sum in location 9000h (LSB) and 9001h (MSB).

17. Arrange the given array of numbers present in memory location 9500h through (9500+N)h, in ascending order and store it with starting memory location 9100h.

18. Arrange the given array of numbers present in memory location 9500h through (9500+N)h, in descending order and store in with starting memory location 9100h.

19. Store the largest in 9100h and smallest in 9101h of the bytes of array stored in the location 9000h & 9010h.

20. Find the square root of a given number and store it in location 9100h.

21. Perform the addition of two 8-bit numbers in sign magnitude form placing the result in 9000h.

22. Find the SUM of a series of 8-bit numbers, SUM : 16 BIT.

23. Find the SUM of a series of 8-bit Decimal numbers, SUM : 16 BIT.

24. Move a block of 'N' Bytes from location 9000h to 9500h.

25. Multibyte addtition – eg : Add two 4 byte numbers.

26. Generate a train of square wave using SOD lines of 8085.

8086 Microprocessor Lab :

1. Familiarization of 8086 Microprocessor kit.

2. Exchange the two blocks of data of location 9000h through 9009h & 9010h through 9019h.

3. Find the Factorial of the Byte in 9000h and store the result in 9100h.

4. Increment the register CX from a count 0000h until it equals the number present in register DX.

5. Find the value of X, where X = A + B * C + D.
   A, B, C, D are the inputs to memory location 9000h through 9003h.

INTERFACING 8085 / 8086 WITH THE MODULES :

1. Traffic Light Control Module.
2. Stepper Motor Control Module.
3. Elevator Control Module.
4. Keyboard Control Module.
5. ADC & DAC.

Subject title : LOGIC CONTROL DESIGN LAB
Semester : 5 periods per week in 6th semester
Periods : 60 periods
End Examination : 25
Sessional : 25

Sl. No.	Major Topics	Time allotted
		Total Periods : 100
1	Basic Programming	15
2	Digital Programming	15
3	Design a program for motor start and stop by using set and reset function	10
4	Design a ladder diagram for following condition using Flip Flop	10
5	Familiarization of ON – Delay Timer.	10
6	Familiarization of Count up – Counter.	10
7	Any Real time application projects.	10
8	Simple digital system design using VHDL.	10

SUBJECT CONTENT :

1. Basic Programming.

(i) Design a PLC Program for the following condition.
Switch – ON Light – Glows.
Switch – OFF Light – Puts Off.
(ii) Design a program DOL Starter for motor.
(iii) Design a program for forward – Reverse – stop with mutual interlock.
(iv) Design a program for forward – Reverse – stop with direct reversal.
(v) Design a program for start – stop – jog.
(vi) Design an Alarm system.

2. Digital Programming.

(i) Design a program
(a) AND, OR and NOT gate.
(b) NAND and NOR gate.
(ii) Design a conveyer control system in which conveyer “C” is to run when any one of the 4 inputs is ON and it should stop when any one of the 4 other inputs are ON.
(iii) Write a program that a fan “P” will run the equation is getting satisfied.
(I1). (I2+I3). (I5.I6) = P
(iv) Draw a program file for following expression
(L + M + N) + (Q.R). R = S

3. Design a program for motor start and stop by using set and reset function.

4. Design a Ladder diagram for following condition using Flip Flop.

(i) When switch – pressed, output light – glows.

(ii) When switch – again pressed, output light – puts off.

5. Familiarization of ON – Delay Timer.

(i) Start a machine after 5 seconds.

(ii) Start 3 machines consequently after 3 seconds.

6. Familiarization of Count up – Counter.

(i) When a sensor hand sensed 5 bottles the machine should ON.

7. Any Real time application projects.

8. Simple digital system design using VHDL.

Subject title : CNC LAB
Semester : 5 periods per week in 6th semester
Periods : 75 periods
End Examination : 25
Sessional : 25

Sl. No.	Major Topics	Time allotted
		Total Periods : 100
1	C N C	40
2	Computer Aided Manufacturing	35

C N C	
Introduction to CNC Machine	1
Machine specification	1
Machine Control Panel	1
Settings of Offset	2
Editing of program	2
Single Block, Dry run	1
Tool setting, DNC	2
Practice on the M/C with different exercises	30

COMPUTER AIDED MANUFACTURING	
Introduction to Master CAM	02
2D contour	07
Pocket	10
Frill	02
Face	02
3D Counter	02
3D Surface Machining	06
Generation of NC Codes	02
Communication of NC Codes to CNC M/C	02

Subject title : ROBOTICS LAB
Semester : 4 periods per week in 6th semester
Periods : 60 periods
End Examination : 25
Sessional : 25

Sl. No.	Major Topics	Time allotted
		Total Periods : 80
1	Robot component recognition	10
2	Manipulating the robot	10
3	Recording the position	5
4	Writing and running robot programs	5
5	Pick and Place tasks	5
6	Inputs (Digital, Analog, Sensors)	5
7	Output	5
8	Joint & XYZ co-ordinate system	5
9	Point-to-point control	5
10	Linear interpolation	5
11	Circular interpolation	5
12	Relative positions	5
13	Writing the programs using Loops	5
14	Writing the programs using Delay	5

Subject Content :

1.0 Robot component recognition.
1.1 What is robot ?
1.2 Robot Arm.
1.3 Robot controller.
1.4 End effectors.
1.5 Identifying robot arm components.
1.6 Robot controller components.
1.7 Identifying robot controller components.
1.8 Accessories.
1.9 Input devices.
1.10 Software.
1.11 Activating software.

2.0 Manipulating the robot.
2.1 Joint coordinates.
2.2 XYZ coordinates.
2.3 Manual mode.
2.4 Auto mode.
2.5 Robot working limits.
2.6 Operating the gripper.
2.7 Changing speed.
2.8 Homing.

3.0 Recording the position.
3.1 Recording desired robot positions.
3.2 Moving robot to the recorded positions.
3.3 Saving and deleting the recorded positions.
3.4 Activating software and loading recorded positions.

4.0 Writing and running robot programs.
4.1 Activating software.
4.2 Writing a simple program.
4.3 Saving the program.
4.4 Loading recorded positions.
4.5 Running the program.
4.6 Aborting program.
4.7 Inserting and deleting the programs.

5.0 Pick and Place tasks.
5.1 Recording Pick and Place tasks.
5.2 Performing Pick and Place movements.
5.3 Writing a Pick and Place program.
5.4 Running the program line by line.
5.5 Running the program continuously.

6.0 Inputs (Digital, Analog, Sensors).
6.1 Digital inputs and outputs.
6.2 Programming with inputs.

7.0 Output.
7.1 Digital relay outputs.
7.2 Writing a program to control outputs.
7.3 Integrating inputs and outputs.

8.0 Joint & XYS co-ordinate system.
8.1 Joint coordinates.
8.2 XYZ coordinates.
8.3 Manipulating robot in Cartesian coordinates.
8.4 Manipulating robot in joint coordinates.
8.5 Displaying position coordinates.
8.6 Recording absolute XYZ positions.

9.0 Point-to-Point control.
9.1 Point-to-point control.
9.2 Manipulating robot in Point-to-point control.
9.3 Writing programs in Point-to-point control.

10.0 Linear interpolation.
10.1 Continuous path control.
10.2 Linear interpolation.
10.3 Manipulating robot in Linear interpolation.
10.4 Writing programs with Linear interpolation.

11.0 Circular interpolation.
11.1 Continuous path control.
11.2 Circular interpolation.
11.3 Manipulating robot in Circular interpolation.
11.4 Writing programs with Circular interpolation.

12.0 Relative positions.
12.1 Relative positions.
12.2 Recording relative positions.
12.3 Using relative position on the “Z” Axis for the pick and place application.
12.4 Changing the reference position.

13.0 Writing the programs using Loops.
13.1 Do while … loop.
13.2 For …… Next.
13.3 Programming using Do while … loop and For …. Next.

14.0 Writing the programs using Delay.
14.1 Time delay.
14.2 Setting of speed.
14.3 Point to point path control.
14.4 Linear interpolation.
14.5 Circular interpolation.
14.6 Integration of inputs and outputs.

Subject title : EMBEDDED SYSTEM LAB
Semester : 5 periods per week in 6th semester
Periods : 45 periods
End Examination : 25
Sessional : 25

Sl. No.	Major Topics	Time allotted Total Periods : 100
1	8051 Micro Controller Programming Exercises	24
2	Interfacing programs on 8051	34
3	Interfacing programs on PIC Micro Controller	30
4	Real Time Operating System	12

SUBJECT CONTENT :

8051 Micro Controller

Programming Exercises :

1. Write a program to place the number 8Dh in RAM locations from 30h to 34h.
2. Write a program to copy the contents of DPTR to registers R0 (DPL) & R1 (DPH).
3. Write a program to exchange the contents of B register and RAM address 30h.
4. Write a program to swap the bytes in timer 0 put TL0in TH0 and TH0 in TL0.
5. Write a program to Double the number in register R2, and put the result in register in R3 (high byte) and R4 (low byte).
6. Write a program to add the unsigned numbers found in internal RAM locations 25h, 26h and 27h together and put the result in RAM locations 31h (MSB) and 30h (LSB).
7. Write a program to multiply unsigned numbers in register R3 by the number in register in R4 and put the result in external RAM locations 10h (MSB) and 11h (LSB).
8. Write a program to subtract the contents of RAM location 13h from the RAM location 2Bh put the result in RAM location 2Ch.
9. Write a program to divide the data in RAM location 3Eh by the number 12h, put the quotient in R4 and the reminder in R5.
10. Write a program to place any number in the internal RAM location 3Ch and increment it until the number equal 2Ah.
11. Write a program to find the address of two internal RAM locations between 20h and 60h, which contain consecutive numbers, if so, set the flat to 1, else, clear the flag.
12. Write a program to find the factorial of the number stored in the internal RAM locations 30h.

Interfacing programs on 8051 :

a. Stepper motor interface.
b. Keyboard interface.
c. Elevator interface.
d. Seven segment display interface.
e. Intelligent LCD interface.

PIC Micro Controller

Interfacing programs on PIC Micro Controller

1. LED.
2. LED and timer.
3. Seven segment display.
4. Keyboard.

Real time operating system

Exercises

1. Familiarization of system level function.
2. Familiarization of task services function.
3. Familiarization of time delay function.

FLOATING SUBJECTS

Subject title : INDUSTRIAL MANAGEMENT

Semester : FLOATING SUBJECT

Period : 40 Periods

GENERAL OBJECTIVE :

1. To know the definitions and levels of management.
2. To understand the meaning of productivity.
3. To study the importance of quality circle.
4. To highlight the modern production management system.
5. To know the definition of TQM / TPM.
6. To understand the industrial and factories act.

Sl. No.	Major Topics	Time allotted
		Total Periods : 4
1	Evaluation of Management and Nature of Management.	2
2	Production and Productivity.	2
3	Inspection and quality control.	3
4	Modern Production Management System.	10
5	TQM / TPM.	5
6	Estimation and Costing.	10
7	Industrial Relating and Industrial Act.	8

SUBJECT CONTENT :

1.0 EVALUATION OF MANAGEMENT AND NATURE OF MANAGEMENT.

1.1 Management as function / discipline management and administration.

1.2 Levels of management, role and responsibility.

2.0 PRODUCTION AND PRODUCTIVITY.

2.1 Production and Productivity understanding, measures to increase productivity.

3.0 INSPECTION AND QUALITY CONTROL.

3.1 Quality control inspection and quality control, 7 QC tools, SQC and SPC.

3.2 Quality circles (QC) origin, structure and operation.

4.0 MODERN PRODUCTION MANAGEMENT SYSTEM.

4.1 KAIZEN understanding, objectives, responsibilities, operation of KAIZEN.

4.2 5 S understanding, steps of 5 S responsibilities.

4.3 KANBAN-JIT management system, introduction, production management system KANBAN philosophy and application.

4.4 POYA-YOKA mistake proofing principle steps / application, case studies.

4.5 Business Reengineering and process Reengineering principle, top management involvement, steps / application.

5.0 TQM / TPM.

5.1 TQM overview and history of TQM contribution of quality gurus, Deming's approach. Juran's quality, Ishikawa's company wide quality control steps to implement TQM, TPM importance and implementation.

5.2 Quality standards definitions, iso 9000 and QS 9000 quality standards its clauses, steps to implement.

6.0 ESTIMATION AND COSTING.

6.1 Importance of estimation and costing, definition sources of errors, costing definition importance.

6.2 Estimation of cost direct materials, indirect material, direct labor, indirect labor, other expenses, components of cost prime cost, factory cost, selling price problems.

6.3 Estimation methods of complete projects case studies.

7.0 INDUSTRIAL RELATION AND ACTS.

7.1 Employee's welfare facilities, labor participation in management, discipline, safety committee.

7.2 Industrial relations, industrial disputes, trade union act rights and liabilities.

7.3 Indian factories act definition, health provision, safety provisions welfare provision working hours, accidents, penalties, miscellaneous provisions.

7.4 Payment of wages act, workmen's compensation act, ESI, PF etc.

Reference Books :-

1. Industrial Engineering and Management - O.P. Khanna.

2. Hi Tech Industrial Management - B.C. Prabhakar.

Subject title : INDUSTRIAL EQUIPMENT MAINTENANCE

Semester : FLOATING SUBJECT

Period : 60 Periods

GENERAL OBJECTIVE :

1. To know about maintenance of Industrial Equipment.
2. To familiar with condition based maintenance.
3. To know the importance of calibration of Electronics equipment.
4. To understand the concept of reliability aspects of Electronics equipment.
5. To be familiar with Maintenance Management.

Sl. No.	Major Topics	Time allotted Total Periods : 60
1	Maintenance Management, Maintenance Planning and Maintenance Activity of a Machine Tools.	10
2	Maintenance of Power Transmission Systems.	10
3	Maintenance and Repair of Guide Surfaces.	7
4	Maintenance of Material Handling Equipments.	6
5	Condition based Maintenance.	8
6	Repair of A.C. and D.C. Machine.	6
7	Electronics Test Equipment Maintenance.	4
8	Fault Finding.	5
9	Reliability Aspects of Electronic Equipment.	4

SUBJECT CONTENT :

1.0 MAINTENANCE, MAINTENANCE PLANNING & MAINTENANCE ACTIVITY OF A MACHINE TOOLS.

1.1 Introduction, Objectives of Maintenance, Maintenance Policies, Types of maintenance scheduled, Proactive, Preventive, Breakdown.

1.2 Organizational set up and Maintenance Departments, Maintenance Planning, Planning & Scheduling, Repair Cycle, Repair Complexity, Equipment History Card, Master Schedule Card, Work Order, Work Report, Controlling Maintenance and Reliability.

1.3 Spare Parts Planning – Codification of spares, Preservation of Past Data, Practice to use standard spares, Effective Purchase Procedures, Classification of spare parts – ABC Analysis.

1.4 Utilization of Human Resources in Maintenance, Maintenance work specification, work measurement, maintenance organization, training of maintenance personnel, planning of spares inventory, assessment of spare parts requirement.

1.5 Example of engine lathe and milling machine overhaul, inspection and checking.

2.0 MAINTENANCE OF POWER TRANSMISSION SYSTEM.

2.1 Introduction of Maintenance of Power Transmission Devices.

2.2 Maintenance of bearings, clutches, brakes and couplings installation and alignments.

2.3 Maintenance of power transmission elements like belt drives, chain drives and gear drives.

2.4 Trouble in hydraulic systems and their causes, technical environment required for assembly of hydraulic transmission.

2.5 Pumps and its repair.

2.6 Maintenance of portable electric tools.

2.7 Maintenance of portable pneumatic tools.

2.8 Maintenance of air compressors.

3.0 MAINTENANCE AND REPAIR OF GUIDE SURFACES.

3.1 Introduction Methods of measuring the extent of wear, sprit level, straight edge, smearing technique.

3.2 Hydrostatic Procedure – Setting of Universal Bridge – Checking the Guide ways; Straightness, Spiral Twist.

3.3 Parallelity – Methods of Repairing in general, Scraping, Grinding – Lathe Bed, Guides; using Stellon Compound, Machining, Using Hylam Packings.

3.4 Compound Slide Guides – Repair of Column Guides of Horizontal Milling Machines.

4.0 MAINTENANCE OF MATERIAL HANDLING EQUIPMENTS.

4.1 Maintenance of rope – wire rope and fiber rope.

4.2 Maintenance of hoist equipment.

4.3 Wrench and EOT Crane.

4.4 Maintenance of belt conveyors.

4.5 Maintenance of hydraulic and pneumatic conveyors.

5.0 CONDITION BASED MAINTENANCE.

5.1 Condition monitoring – Methods of load monitoring, temperature monitoring, lubrication monitoring, leak detection, corrosion monitoring.

5.2 OFF – Load monitoring – crack detection, vibration monitoring.

5.3 Lubrication monitoring – debris deposited, debris in suspension, condition of used oil, Ferro graph.

5.4 Thermal monitoring, location of temperature measurement, temperature monitoring devices, sensors, optical pyrometer, radiation pyrometer.

5.5 Vibration and noise monitoring – causes, measurement, noise signals, signature analysis.

6.0 REPAIR OF A.C. AND D.C. MACHINE.

6.1 Repair of A.C. Machines – starting of induction motor, sparking at slip rings, abnormal heating of the bearings, oil leakage and oil splashing from bearings.

6.2 Dismantling and assembling of induction motor, adjustment, testing and repair of A.C. machines.

6.3 Main faults of D.C. motors, brush sparking, commutator overheating, armature overheating of pole coils, motor fails to start, Dismantling and assembly of D.C. motors, adjustment, testing of assembled motor after repair.

6.4 Repair of transformers, dismantling of transformers, repair of windings, testing of transformers.

7.0 ELECTRONICS TEST EQUIPMENT MAINTENANCE.

7.1 Trouble shooting and servicing of Electronics test equipment.

* Power Supply.
* Function Generator.
* Pulse Generator.
* Oscilloscope.
* Digital Test Equipment like.
* Micro Processors / Micro Controllers kits.
* Automatic Test Equipment etc.

7.2 Calibration of Electronics test equipment.

8.0 FAULT FINDING.

8.1 Fault detection techniques, watchdog techniques.

8.2 Parity and error coding checks, common hardware faults.

8.3 Micro Processor Systems.

8.4 Emulation and Simulation.

9.0 RELIABILITY ASPECTS (Only Theory).

9.1 Reliability predictions.

* Failure rate.
* MTTF.
* MTBF.
* Availability.
* Maintainability.
* MTTR.

9.2 Practical reliability considerations.

Reference Books :

1 **Industrial Maintenance by HP - Chand & Co**
2 **Testing of Machine Tools Pergamon Press - Dr. George Schiesinger**
3 **Management of Industrial Maintenance - A. Kelly & M.J. Harris**
4 **Maintenance Engineering - L.C. Morrow**
5 **Material Handling Equipment - Alexandrov MIR Pub**
6 **Mechanical Equipment Maintenance - ITB Manual**
7 **Trouble shooting Electric Equipment - R.S. Khandpur**
8 **Installation Servicing & Maintenance - S.N. Bhattacharya**

Subject title : AUTOMATED PRODUCTION SYSTEMS

Semester : FLOATING SUBJECT

Period : 60 Periods

GENERAL OBJECTIVE :

1. To understand the concept of high volume production system and its applications.
2. To know the process of automated inspection.
3. To understand material handling, storage and group technology.
4. To know the benefits of SPMs and their application for mass production.
5. To know fuzzy logic and control.
5. To know PCB assembly.

MAJOR TOPICS

1. Introduction to automation.
2. High volume productivity.
3. Material handling and storing.
4. Group technology.
5. Automated inspection.
6. Spms and accessories adopted for mass production.
7. Fuzzy logic.
8. Advanced machining process.
9. Pcb assembly.

Sl. No.	Topics	Periods
1.0	**Introduction to Automation.**	**2**
1.1	Automation – Definition, types, programmable automation, reasons for and arguments against automation.	2
2.0	**High Volume Production Systems.**	**7**
2.1	Detroit type automation – automated flow line, methods of work transport, transfer mechanism, control function, automation for machining operation.	3

2.2	Assembly system and line balancing assembly systems, manual line and method of line balancing.	3
2.3	Automated assembly systems – types, part feeding devices.	1
3.0	**Material Handling and Storage.**	**7**
3.1	Automated material handling – function, types of material handling equipment, analysis, conveyor systems, applications.	3
3.2	Automated storage systems – performance automated storage / retrieval systems, carousal storage system, interfacing handling and storage with manufacturing.	3
4.0	**Group Technology**	**5**
4.1	Group Technology – Part families, parts classification and coding, cellular manufacturing – cell design, benefits of group technology.	5
5.0	**Automated Inspection.**	**7**
5.1	Automated inspection principle and methods, sensor technologies for automated inspection, coordinate measuring machine.	4
5.2	Other contact inspection methods, machine vision other optical inspection methods, other non contact inspection methods.	3
6.0	**SPMs and Accessories Adopted for Mass Production.**	**4**
6.1	SPM – Introduction, Benefits, Technology adopted for production.	1
6.2	Accessories adopted for mass production like hoppers, chutes, linear feeding arrangements.	3
7.0	**Fuzzy Logic**	**5**
7.1	Fuzzy logic and genetic algorithms in manufacturing – ANN tool wear monitoring – Fuzzy control of machine tools.	5
8.0	**Advance Machine Process.**	**8**
8.1	Introduction, Chemical etching, Ultrasonic machining, Electro Chemical Machining / Grinding.	3
8.2	Electrical discharge machining, wire cut EDM.	2
8.3	Plasma arc machining, laser beam machining, TEM, water jet machining, abrasive machining.	3

9.0	**Printed – Circuit – Board Assembly.**	**15**
9.1	Introduction, Terminology.	1
9.2	Assembly process for PCBs.	2
9.3	SMD technology.	2
9.4	Estimation of PCB assembly costs.	2
9.5	Worksheet and Database for PCB Assembly cost Analysis – instructions.	2
9.6	PCB assembly – Equations and data for total operation cost – Manual – Auto Insertion Machine – Robot Insertion Machine.	6

Reference Books :-

1	**Manufacturing and Engineering Technology.**	**-**	**Serope Kalkpakjian and Steven R. Schmid**
2	**Automation Production Systems & Computer Integrated Manufacturing.**	**-**	**M.P. Groover**
3	**Intelligent Manufacturing Systems.**	**-**	**Andrew Kusiak**
4	**Assembly Automation and Product Design Second Edition – Taylor and Francis.**	**-**	**Geoffrey Boothroyd**

THE END