SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33005: METROLOGY AND INDUSTRIAL INSPECTION

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
04	02	00	03	01	-	30	70	40	60	200

PRE-REQUISITES: NA

COURSE OUTCOMES

After successful completion of this course students will be able to:

1. Describe the basic principles and working of measuring instruments as well as gauges along with their applications
2. Explain various precision measuring instruments to apply for the inspection of engineering parts
3. Describe the surface roughness and gear measuring instruments to inspect and analyze condition of surface roughness, and gear geometry
4. Evaluate and inspect an interchangeable assembly by gaining the knowledge about the concept of gauging, limits, fits, and tolerances
5. Illustrate the automatic inspection to create some planning, part design with allowance

COURSE CONTENTS

UNIT 1. Standard of Measurements: Principles of measurement, Line and end standards, Slip gauges, End bars, Wavelength standards, Primary, Secondary, Tertiary and working standards for length. Angle measurement, Angle gauges.

UNIT 2. Measuring Instruments: Linear measurement - Direct measuring tools, Comparators, Types, use and limitations, Optical Instruments, Projectors, Tool makers microscope, Sine bar, Angle gauge clinometers, Optical dividing head. Measurement and representation of Geometrical Features: Measurement of straightness, Flatness, Parallelism, Perpendicularity, Roundness, Cylindricity, Squareness and Symmetry, Interferometry and its applications.

UNIT 3. Measurement of Surface Roughness: Measurement of surface roughness, E & M System, Surface roughness in various manufacturing processes.
Measurement of Screw, Threads and Gears: Measurement of elements of screw, threads, pitch and effective diameter measurement and errors in screw threads elements and their effect, Inspection of gears, Various methods of measuring gear tooth thickness, Measurement of base pitch, PCD and profile, lead and roll testing

UNIT 4. Interchangeability: Concept of limits fits and tolerances, Types of fits, Universal and local interchangeability, Systems of limits, fits and tolerances, Selective assembly and matched fits, B.S., I.S.O. and I.S. systems. Design of limit gauges, Types and their manufacture. In process inspection and control

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UNIT 5. Manufacturing Analysis: Pre and Post Production Analysis, Process Planning, Part Print Analysis, Determination of Principle Processes, Blank making process, Determination of Functional surfaces of W/pc, Machining Allowances (limits of size for initial and intermediate W/pc dimensions). Work- piece control, Influence of Process Engineering on product design.
Computer Aided inspection, Visual system, Measuring machines, CMM basic principle.

IP 33005: METROLOGY AND INDUSTRIAL INSPECTION

PRACTICALS:

LIST OF EXPERIMENTS:

1. To determine the angle of a given V-Block
2. Locate the position of three drilled holes
3. Determination of radius of curvature of convex surface
4. To determine angle of dovetail slot
5. To determine the angle of conical hole
6. To determine the angle of conical hole
7. To determine the angle of taper plug gauge
8. To determine the diameter of small end of taper plug gauge
9. To determine the radius of curvature of concave surface
10. To determine the diameter of recessed hole
11. Study of tool maker's microscope
12. Study of optical projector

IP 33005: METROLOGY AND INDUSTRIAL INSPECTION

THEORY ASSESSMENT

(1) End Semester Exam: 70% weightage,
(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

PRACTICAL ASSESSMENT
(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)
(2) End semester practical viva: 60% weightage.

TEXT BOOKS RECOMMENDED:

S. NO	BOOK	UNIT
1	Gupta I. C., Metrology, Dhanpat Rai & Sons, New Delhi, India.	1-2
2	Jain R. K., Metrology, Khanna Publishers, New Delhi, India	1-5
3	Hume K. J., Engineering Metrology, McDonald, California, USA	1-3
4	Khare & Bajpayee, Dimensional Metrology, Oxford & IBH Publishing Co., New Delhi, India	1,3,4
5	Eery and Johnson, Process Engineering, Prentice Hall, NJ, USA	4,5

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REFERENCE BOOKS RECOMMENDED:

S. NO.	BOOK	UNIT
1	Kovan V K, Process Engineering, MIR publication Moscow, USSR.	1-5
2	Sharp K. W. B., Engineering Metrology, Sir Issac Pitman, London, UK	1-5

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B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPIC COVER
(Unit I)	1	Importance of Industrial inspection & History of Metrology
	1	Measurement terminology, Standards & Units.
	1	Types of standards & different between line & end standards
	1	Slip gauges definition, accuracy, wringing, set & manufacturing
	1	Wavelength standards & its importance & uses.
	1	Working standards for length
	1	Angle measurement – Definition, instruments, Sine bar
	1	Angle gauges & dividing head.
(Unit II)	1	Principle of measuring instrument for linear/direct measuring tools.
	1	Comparators their design type construction advantages and disadvantages.
	1	Projectors and tool maker microscope, clinometers.
	1	Definition concept & measurement of straightness, flatness, Parallelism, Perpendicularity.
	1	Roundness, cylinderecity & squareness.
	1	Interferometry and its applications.
	1	Use & application of automated inspection.
	1	Measurement and representation of geometrical features
(Unit III)	1	Introduction & factors affecting surface roughness.
	1	Surface texture controlling regions, order of irregularities. Element of surface texture and measurement.
	1	E & M systems for datum, surface roughness for various processes.
	1	Screw thread measurement.
	1	Element of screw, errors in screw thread & their measurement
	1	Inspection of gears, Gear terminology
	1	Types of gear, Elements of gear & methods of measuring gear tooth thickness
	1	Measurement of gear base pitch, effective diameter & profile
(Unit IV)	1	Interchangeability concept and its importance.
	1	Limits fits & tolerances & their classifications.
	1	System of limit fit & tolerances, selective assembly & matched fit & condition for success.
	1	Engineering standards (BS, ISO & IS systems).
	1	Limit & fit systems, Geometric tolerance.
	1	Limit gauge their type & manufacturing.
	1	Taylor's principle of gauge design.
	1	In process inspection & control.
(Unit V)	1	Role of manufacturing analysis.
	1	Pre & Post production analysis.
	2	Process planning steps, Post print analysis. Principle processes & blank making process.
	1	Functional surface & machining allowances.
	2	Work piece control First lecture, Work piece control Second lecture.
	1	Influence of process Engineering on product design
Total	40	

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B. TECH IPE III Year (4YDC)

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33002: INDUSTRIAL ENGINEERING

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu					
04	02	00	03	01	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

PRE- REQUISITES: NA

COURSE OUTCOMES:

Upon successful completion of the course the student should be able to:

1. Describe the evolution of industrial engineering and knowledge of evaluating productivity of an enterprise
2. Explain the method study for better selection of process and job that helps to smooth, effective and efficient production systems
3. Estimate the basic work content in a specific job and reducing work contents as well as ineffective time
4. Illustrate the appropriate wage and incentive plan for the employees of an organization
5. Explain the human factors and work design that are help to create best working equipment and man-machine systems.

COURSE CONTENTS

UNIT 1. Introduction: Place of Industrial Engineering in Industries and Business. History of development of Industrial Engineering, work of Taylor and Gilberth, Modern Industrial Engineering. Productivity: Productivity & Standard of living, productivity in individual enterprise, Reducing work content and ineffective time. Introduction to work-study and its applications.

UNIT 2. Method Study: Definition, Objectives and procedures, Selection of job, various recording techniques like outline process charts, Flow process charts, Man machine charts, Two handed process charts, String diagram, flow diagram, Multiple activity chart, Therbligs, SIMO chart, Cyclographs and Chrono cyclographs.

Critical examination, Development, Installation and Maintenance of improved methods. Principles of Motion economy and their application in work design. Micro-motion study, Memo motion study & their use in study of methods.

UNIT 3. Work Measurement:

a) Introduction: Definition, Objectives and procedure.

b) Time Study: Procedure, Methods of measuring time, selection of jobs, breaking a job into elements. Number of cycles to be timed, Rating and methods of rating, Allowances, Calculation of Standard time.

c) Work Sampling: Basic procedure, Design of work sampling study, conducting work sampling study and establishment of standard time.

d) Predetermined Motion time systems, MTM, Work factors system and other standard data systems MOST.

e) Job Evaluations: Purpose, Various types of job evaluation systems and their applications, Job classification, Wage curve, Salary structure and number of grades, Merit Rating.

UNIT 4. Wage Incentives: Measured day work and wage incentives and Productivity, different types of wage incentive plans. Design of incentive plans managing incentive schemes, Supervisory incentives plans.

UNIT 5. Introduction to Ergonomics: Ergonomics as a multi-disciplinary field, components. Importance of ergonomics in equipment and work design. Concept of man-machine system; Types and characteristics of Man-machine systems.

IP 33002: INDUSTRIAL ENGINEERING

PRACTICALS:

LIST OF EXPERIMENTS:

1. To study various kind of stopwatches.
2. To measure elemental time for a cyclic activity with the help of different stopwatches
3. to find the time required to fill the board with the pins under different conditions
4. PIN Board study (Two board)
5. To assess job difficulty in putting the pins through cup and cone arrangement on an inclined plane.
6. Assessment of performance rating by dealing card.
7. Assessment of performance rating by walking distance (speed rating).
8. To do method study on an assembly operation of bulb holders.

IP 33002: INDUSTRIAL ENGINEERING

THEORY ASSESSMENT:

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

PRACTICAL ASSESEMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)

(2) End semester practical viva: 60% weightage.

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TEXT BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1.	I. L. O., Introduction to Work Study, 3rd Revised Edition, International Labor Organization, Geneva, Switzerland.	**1-5**
2.	Barnes R. M., Motion & Time Study: Design and measurement of Work, 7th ed., John Wiley and Sons, New York, USA.	**1-5**
3	Mundel, M.E., "Motion and Time Study", 5th ed., Prentice Hall, Eagle Wood Cliffs, New Jersey, USA. Sons, New York, USA.	**1-5**
4	Jhamb L.C. "Work Study and Ergonomics", Everest Publishing House, Pune, India	**1-5**

REFERENCE BOOKS RECOMMENDED:

1	Salvendy, G., "Hand Book of Industrial Engineering: Technology and Management", 3rd ed., John Wiley and Sons, New York, USA.	**1-5**
2	Maynard, H.B. and Zandin, K., Industrial Engineering Hand Book, 5th ed., McGraw Hill Book Company, New York, USA.	**1-5**

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B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Place of Industrial Engineering in business and industry.
	1	History of Industrial Engineering Definition of Industrial Engineering.
	1	Introduction concept and definition of productivity. its relation with standard of living.
	1	Partial, Total and total factor productivity. Factors influencing productivity. Productivity Models.
	1	Concept of work content, excess work content and in effective time.
	1	Reaching close to basic work content and improvement of productivity.
(Unit II)	1	Introduction and scope of method study.
	1	Recording Techniques: Symbols used in charts, flow diagram, outline process chart, and Man machine chart.
	1	Flow process charts: Man, material and equipment type. Examples. Multiple activities chart.
	1	String Diagram and two-handed process chart. Method improvement
	1	Therbiligs and their use in SIMO chart. Example of SIMO chart.
	1	Principles of motion economy as related to use of human body, arrangement of work place and design of tools and equipments.
	1	Micro motion study, cycle graph and chrono cycle graph. Memo motion study.
	1	Critical examination. Primary and secondary questions. Their use in development of new method. Installation and maintenance of improved methods.
(Unit III)	1	Definition, objectives and uses of work measurement. Overview of techniques of work measurement.
	1	Time study procedure equipment and steps. Breaking the job into elements. Types of elements.
	1	Concept of qualified worker and rating. Various types of rating. Factors affecting performance rating.
	1	Various types of allowances and computation of standard time,
	1	Work sampling. Determination of sample size and standard time using work sampling.
	1	Advantages and disadvantages of work sampling. Numericals
	1	Use of standard data for determination of standard time, PMTS, its types and various factors considered while using PMTS, advantages.
	1	MTM, its use and conventions for recording MTM data. MTM versions. Introduction to MOST.
(Unit IV)	1	Job evaluation procedure, objectives and definition. Job analysis, job description and specification.
	1	Job evaluation systems and merit rating.
	1	Measured day work: Definition, general concepts, duties and responsibilities of workers, supervisors and engineers.
	1	Establishing standards and reporting performance. Operating principles and advantages of Measured day work.
	1	Incentives: Definition and classification. Objectives of incentive scheme. Compassion of individual and group incentives. Steps to install an incentive scheme.
	1	Pre-requisites of a company's wage incentive plan. Characteristics of a good wage incentive plan.
	1	Straight piece rate methods. Their characteristics advantages and disadvantages.
	1	Differential piece rate methods. Taylor's differential piece rate system. Advantages and disadvantages. Merrick's differential piece rate system.

	1	Time and piece rate methods. Gnatt task and bonus scheme. Earnings under the method. An illustration of scheme.
	1	Efficiency based plans. Emerson's efficiency plan,
	1	Premium bonus schemes. Their advantages to the management. The Halsey system.
	1	The Rowan system: Its advantages characteristics maximum bonus earned. Its disadvantages. Illustration.
	1	The Bedaux Point System. Characteristics and illustration. Merits and suitability of scheme.
(Unit V)	1	Introduction: Ergonomics as a multi-disciplinary field, its components.
	1	Importance of ergonomics in equipment and work design.
	1	Concept of man-machine system;
	1	Types and characteristics of Man-machine systems.
	1	Solving of assignment problems. Review of syllabus and solution of difficulties.
Total	**40**	

IP-33XXX: Advance Welding, Casting and Forming Processes

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		MARKS
03	02	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

PRE-REQUISITES: NA

COURSE OUTCOMES:

1. Explain the fundamental of different welding processes along with their power sources.
2. To analyse and evaluate the defects of welding and weldability of metals.
3 Illustrate the fundamentals of various casting processes along with their characteristics.
4. To analyse and evaluate the design and solidification of casting.
5. Explain the various advance forming processes.

COURSE CONTENTS

UNIT 1 Power Sources for Arc Welding, Basic features of power sources, Factors for selection of power sources, Power sources for different welding processes, Metal transfer in Arc Welding, Arc-blow, Type of electrodes and their coatings, Electrodes for SMAW, MIG/MAG, TIG, SAW and their specification, fluxes for SAW, resistance welding, friction stir welding, ultrasonic welding, Laser beam welding, PAW etc.

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B. TECH IPE III Year (4YDC)

UNIT 2 Weldability of Metals, Distortion and Discontinuities in weldment, Testing, Inspection and Specifications: Definition, weldability of carbon & alloy steels, cast Iron, stainless steel, Aluminium and copper, Hydrogen induced cracking. Weldment distortion and its control, various discontinuities in Welds, Residual stresses in Weldments. Destructive and non-destructive methods of testing weldments, WPS, PQR and ASME section IX Welding.

UNIT 3 Casting Techniques Shell moulding – Basic operation, characteristics of shell moulded casting. Investment Casting – expandable pattern process. Pattern production, investment, pattern removal. Factor influencing casting quality characteristics of precision investment casting. Die-casting – Gravity die-casting, pressure-die casting, die-casting machines, casting techniques, characteristics of die – castings. Centrifugal casting -Fundamental principles, methods production techniques, characteristics of centrifugal casting. Squeeze casting, Vacuum mould casting, Evaporative pattern casting, steer casting, slush casting etc.

UNIT 4 Gating and Riser design & analysis, Solidification, Nucleation and grain growth, Solidification of pure metals, short and long freezing range alloys. Rate of solidification, macrostructure, and microstructure. Solidification Contraction; Fluidity and its measurement. Mould-metal interface reactions.

UNIT 5 Advance forming processes: Details of high energy rate forming (HERF) process, Electro-magnetic forming, explosive forming, Electro-hydraulic forming, Stretch forming, Contour roll forming etc.

IP-33XXX: Advance Welding, Casting and Forming Processes

ASSESSMENT:

Students will be assessed as following

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

PRACTICAL ASSESSMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)

(2) End semester practical viva: 60% weightage.

S.NO	BOOK
1.	Ravi B. Metal casting computer aided design and analysis, PHI
2.	Rao P. N., Manufacturing Technology.
3	Parmer R. S., Welding Engineering and Technology, Khanna Publishers
4	Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press
5	Jain P. L., Principle of Foundry Technology

REFERENCE BOOKS RECOMMENDED

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B. TECH IPE III Year (4YDC)

S.NO.	BOOK
1.	Campbell J, Metal Casting, Elsevier

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B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Power Sources for Arc Welding, Basic features of power sources
	2	Factors for selection of power sources, Power sources for different welding processes, Metal transfer in Arc Welding,
	2	Arc-blow, Type of electrodes and their coatings, Electrodes for SMAW
	2	Electrodes for SMAW, MIG/MAG, TIG, SAW and their specification
	1	fluxes for SAW, resistance welding, friction stir welding
	2	ultrasonic welding, Laser beam welding, PAW etc
(Unit II)	1	**Weldability of Metals,** Distortion and Discontinuities in weldment, Testing,
	2	Inspection and Specifications: Definition, weldability of carbon & alloy steels, cast Iron, stainless steel, Aluminium and copper
	2	Hydrogen induced cracking. Weldment distortion and its control, various discontinuities in Welds
	2	Residual stresses in Weldments. Destructive and non-destructive methods of testing weldments
	1	WPS, PQR and ASME section IX Welding
(Unit III)	2	**Casting Techniques Shell moulding –** Basic operation, characteristics of shell moulded casting. Investment Casting – expandable pattern process
	1	Pattern production, investment, pattern removal
	2	Factor influencing casting quality characteristics of precision investment casting. Die-casting – Gravity die-casting, pressure-die casting
	2	die-casting machines, casting techniques, characteristics of die – castings. Centrifugal casting -Fundamental principles, methods production techniques
	2	characteristics of centrifugal casting. Squeeze casting, Vacuum mould casting, Evaporative pattern casting, steer casting, slush casting etc.
(Unit IV)	2	**Gating and Riser design & analysis**, Solidification, Nucleation and grain growth
	2	Solidification of pure metals, short and long freezing range alloys
	2	Rate of solidification, macrostructure, and microstructure. Solidification Contraction
	2	Fluidity and its measurement, Mould-metal interface reactions
(Unit V)	2	**Advance forming processes**: Details of high energy rate forming (HERF) process

	2	Electro-magnetic forming, explosive forming, Electro-hydraulic forming
	1	Stretch forming, Contour roll forming etc.
Total	**40**	

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B. TECH IPE III Year (4YDC)

ME 33014: PRIME MOVERS AND PUMPS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
04	00	00	03	00	_	30	70	-	-	100

PRE- REQUISITES: NA

COURSE OUTCOMES

At the end of this course the student is expected to have:

1. Explain the basic concepts of working mechanism of an I.C. Engine along with supercharger and turbochargers etc. as well as ability to analyze its performance
2. Describe the concepts about the steam Engineering and steam turbines and apply to generate the electrical power or energy from steam
3. Describe the concept of gas dynamics as well as the applications of gas dynamics in steam and gas turbines
4. Explain the fundamentals and constructional details of fluid machines like Pelton Wheel, Francis Turbine, and Kaplan Turbine
5. Describe the working principle and constructional details of the roto-dynamic machines, pump, compressors and blowers.

COURSE CONTENTS

UNIT 1 Internal Combustion: Introduction, Classification of LC. Engines, Constructional details of two-stroke & four-stroke engines and rotary engines, important parameters of design of engines, Volumetric efficiency and scavenging, Fuel ~air cycle analysis.
Carburation and ignition systems of spark ignition engines. Carburetor details, TCI & CD1 ignition systems, Air fuel mixture & requirement, combustion process and detonation, compression ignition engines, injection systems for single and multi-cylinder engines, combustion and knocking. .
Fuel rating, alternative fuels, Supercharging and turbocharging, Cooling and lubrication system, Performance tests and characteristics of 1C Engines

UNIT 2 Steam Engineering: Rankine cycle, Reheat and regenerative cycles-Fuel and combustion, Industrial boilers, draught.
Steam turbines: Impulse and reaction turbines, Velocity diagrams, reheat factors, condensers and cooling, Elementary idea of governing.

UNIT 3 Gas Turbines and Gas Propulsion: Turbine cycles with intercooler and comparative studies constructional details of axial-flow and centrifugal compressors. Elementary of J et-propulsion and calculation of force, work and efficiency.

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B. TECH IPE III Year (4YDC)

UNIT 4 Theory of Fluid Machinery: Classification of rotor-dynamic turbines and pumps, Velocity triangles, Euler's equation-of work done .and efficiencies. Constructional details of Pelton, Francis and Kaplan turbines. Characteristics and specific speed, Governing.

UNIT 5 Pumps, Compressors and Blowers Positive displacement pumps Blowers and their constructional details, characteristics and efi'c1enc1es Fluid converter and fluid couplings, their application and characteristics, application to machine tool drives.

ME 33014: PRIME MOVERS AND PUMPS

ASSESSEMENT

Students will be assessed as following theory Paper:

(1) **End Semester Exam:** 70% Weightage,

2) **Continuous assessment:** 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage regularity 16. 5% weightage)

TEXT BOOKS RECOMMENDED:

SR. NO.	BOOKS	UNIT
1	Kumar, KL, Engineering Mechanics, Tata McGraw Hill, Publication India	1-5
2	Yahya, S.M., Pumps, Compressors and Fans, Tata McGraw Hill.	1-5
3	Kapoor, H.R., Thermal Engineering, Vol.1 & II, Tata McGraw Hill Publication	1-5

REFERENCE BOOKS RECOMMENDED:

SR. NO.	BOOKS	UNIT
1	Mathur &Mehta, Thermal Engineering, Vol. I & II, Jain Brothers Publication	1-5
2	Kumar, D.S., Fluid mechanics and Hydraulic Machines, S K Kataria & Sons Publication	1-5

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SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	Internal Combustion: Introduction, Classification of LC. Engines, Constructional details of two-stroke & four-stroke engines and rotary engines,
	2	important parameters of design of engines, Volumetric efficiency and scavenging, Fuel ~air cycle analysis,
	2	Carburation and ignition systems of spark ignition engines, Carburetor details, TCI & CD1 ignition systems,
	1	Air fuel mixture & requirement, combustion process and detonation, compression ignition engines,
	1	injection systems for single and multi-cylinder engines, combustion and knocking, Fuel rating, alternative fuels,
	2	Supercharging and turbocharging, Cooling and lubrication system, Performance tests and characteristics of 1C Engines
(Unit II)	2	Steam Engineering: Rankine cycle, Reheat and regenerative cycles-Fuel and combustion,
	1	Industrial boilers, draught, Impulse and reaction turbines
	2	Velocity diagrams, reheat factors,
	1	condensers and cooling, Elementary idea of governing
(Unit III)	1	Introduction on Gas Turbines and Gas Propulsion
	2	Turbine cycles with intercooler and comparative studies constructional details of axial-flow
	2	centrifugal compressors.
	2	Elementary of J et-propulsion and calculation of force,
	1	work and efficiency
(Unit IV)	2	Classification of rotor-dynamic turbines and pumps, Velocity triangles
	2	Euler’s equation-of work done .and efficiencies.
	2	Constructional details of Pelton, Francis and Kaplan turbines.
	2	Characteristics and specific speed, Governing
(Unit V)	2	Pumps, Compressors, and Blowers, Positive displacement pumps,
	2	Blowers and their constructional details, characteristics and efi'c1enc1es,
	2	Fluid converter and fluid couplings,
	2	Their application and characteristics, application to machine tool drives
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

B. TECH IPE III YEAR

IP330XX: MECHANICAL ESTIMATING AND COSTING

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
04	00	00	03	00	_	30	70	-	-	100

PRE-REQUISITES: Manufacturing Processes-I and Manufacturing Processes-II.

COURSE OUTCOMES:

After successful completion of this course students will be able:

1. To illustrate the basic concepts of estimation and costing.
2. To explain the components of costing and determine material cost of simple machine components.
3. To estimate the cost of various machining operations.
4. To describe the cost estimation in forging shop and foundry shop
5. To evaluate cost estimation of various welding, sheet metal components, forging and foundry components.

COURSE CONTENT:

1. **UNIT 1: Introduction to Estimation and Costing:** Estimation - Definition, Importance and Aims- Qualities and functions of an Estimator- Sources of errors in estimation- Constituents of Estimation- Costing – Definition, Aims and types. Difference between costing and estimating- - Depreciation and obsolescence: Definition, types, different methods of calculating depreciation- numeric examples.

2. **UNIT 2: Cost and Profit Analysis:** Material - Direct material, indirect material and examples- Calculation of Material cost - Labor - direct, indirect labor and examples - Calculation of labor cost - Expenses - direct, indirect expenses and examples- Classification of expenses - factory, administrative, selling and distribution expenses - Fixed and variable expenses - Components of cost - prime cost, factory cost, office cost, total cost - Block diagram to show the relationship between elements and components of cost -Determination of selling price - Break even analysis - break event chart, Estimation of materials cost of step pulley, Spindle lathe center, Rivets, Fly wheel, Crankshaft, Chain link, Wedge and Gib-headed key.

3. **UNIT 3: Cost Estimation in Machine Shop:** The terminology associated with machine shop estimation- Definition of cutting speed, feed, depth of cut- Procedure of estimating cost of machined part for following operations: Lathe operations (Facing, outside/inside turning, boring, drilling on lathe, grooving and threading). Drilling operations (Drilling, reaming, tapping)-Shaping operations- Milling operations (Face milling, side and face cutting, end

milling)- Cylindrical grinding operations (Plain cylindrical grinding)- For given machined part, estimate material cost and machining cost.

4. **UNIT 4: Cost Estimation in Welding Shop and Sheet Metal Shop:** Estimation in welding shop - gas welding cost, arc welding cost - production cost of given welding job- the types of welding costs- the factors affecting the welding cost.
   Estimation in sheet metal shop - Sheet material and gauge number, Sheet metal joints - Estimate the material required for preparation of container open on one side, Cylindrical drum, funnel and tray.

5. **UNIT 5: Cost Estimation in Forging Shop and Foundry Shop:** Cost terminology associated with forging shop- The procedure for calculating material cost of a product for forging shop- Procedure for estimating forging cost- forging losses to be considered while estimating -Estimation of forging cost.
   Estimation in foundry shop- Pattern allowances- The procedure for calculating material cost of a product for foundry shop - Procedure for estimating cost of pattern making. -Procedure for estimating foundry cost of components such as C.I pulley and C.I. wheel and estimate foundry cost.

IP330XX: MECHANICAL ESTIMATING AND COSTING

THEORY ASSESSEMENT

Students will be assessed as following theory Paper:

(1) **End Semester Exam:** 70% Weightage,

3) **Continuous assessment:** 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage regularity 16. 5% weightage)

TEXT BOOKS RECOMMENDED:

S.NO.	BOOK	UNIT
1	T. R. Banga and S.C. Sharma, Mechanical estimation and costing,17th Ed, 2019, Khanna publishers.	1-5
2	R. L. Shrimali and P.C. Jain, Mechanical estimation and costing, 1st Ed, 1980, J. K. Publishing House.	1-5
3	B. P. Sinha, Mechanical Estimating and Costing, Tata McGraw Hill Pub. Co. Ltd.	1-5
4	Process Planning & Cost Estimation Edited by Dennis Lock, B & H Ltd	1-5

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

REFERENCE RECOMMENDED:

S.NO.	BOOK	UNIT
1	Process Planning & Cost Estimation, 2nd Ed, 2009, R. kesavan, C. Elanchezhian, B. Vijaya Ramanath, New Age International (P) Limited.	1-5
2	Estimating and Costing for the Metal Manufacturing Industries, 1st Ed, 2019, Robert Creese, M. Adithan and B. S. Pabla, Marcel Dekker, Inc, New York Basel.	1-5
3	Singh and Khan, Mechanical Estimating and Costing, Khanna publishers.	1-5

ONINE RESOURCES RECOMMENDED:

S.NO.	ONLINE WEB LINK	UNIT
1	https://nptel.ac.in/courses/103/103/103103039/	1-5
2	https://nptel.ac.in/content/storage2/courses/110101004/downloads/Lecture%20Notes/module12/lec1.pdf	1-5
3	https://onlinecourses.nptel.ac.in/noc21_mg90/preview	1-5
4	http://www.calculatoredge.com/	1-5

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOTS. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Estimation - Definition, Importance and Aims- Qualities and functions of an Estimator
	1	Sources of errors in estimation- Constituents of Estimation- Costing – Definition,
	2	Aims and types. Difference between costing and estimating- - Depreciation
	2	Obsolescence: Definition, types, different methods of calculating depreciation- numeric examples.
(Unit II)	2	Material - Direct material, indirect material and examples- Calculation of Material cost
	2	Labor - direct, indirect labor and examples - Calculation of labor cost - Expenses - direct, indirect expenses and examples
	2	Classification of expenses - factory, administrative, selling and distribution expenses - Fixed and variable expenses - Components of cost - prime cost, factory cost, office cost, total cost
	2	Block diagram to show the relationship between elements and components of cost -Determination of selling price
	2	Break even analysis - break event chart, Estimation of materials cost of step pulley, Spindle lathe center, Rivets, Fly wheel, Crankshaft, Chain link, Wedge and Gib-headed key.
(Unit III)	1	The terminology associated with machine shop estimation- Definition of cutting speed, feed, depth of cut
	2	Procedure of estimating cost of machined part for following operations: Lathe operations (Facing, outside/inside turning, boring, drilling on lathe, grooving and threading)
	2	Drilling operations (Drilling, reaming, tapping)-Shaping operations-Milling operations (Face milling, side and face cutting, end milling)
	2	Cylindrical grinding operations (Plain cylindrical grinding)
	1	For given machined part, estimate material cost and machining cost.
(Unit IV)	1	Estimation in welding shop - gas welding cost, arc welding cost
	2	production cost of given welding job- the types of welding costs- the factors affecting the welding cost.
	1	Estimation in sheet metal shop - Sheet material and gauge number, Sheet metal joints
	2	Estimate the material required for preparation of container open on one side, Cylindrical drum, funnel and tray.
(Unit V)	2	Cost terminology associated with forging shop- The procedure for calculating material cost of a product for forging shop
	2	Procedure for estimating forging cost- forging losses to be considered while estimating -Estimation of forging cost

	2	Estimation in foundry shop- Pattern allowances- The procedure for calculating material cost of a product for foundry shop
	2	Procedure for estimating cost of pattern making.
	2	Procedure for estimating foundry cost of components such as C.I pulley and C.I. wheel and estimate foundry cost.
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP-33452: INDUSTRIAL TRAINING (SEMINAR I)

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
0	4	0	0	02	-	-	-	40	60	100

PRE-REQUISITES: NA

COURSE OUTCOMES:

This course is designed to enable students in their learning for the following-

1. Discuss the practical application of engineering concepts.
2. Explain the industry culture and industry safety norms.
3. Connect and communicate effectively with superiors and colleagues.
4. Develop the ability to work as a team member.
5. Discover continuous learning in life.

COURSE CONTENTS

The students are required to work in industry and gain exposure to various departments of the company.

PRACTICALS,

LIST OF PRACTICALS

The students are required to work in industry and gain exposure to various departments of the company

ASSESSMENT:

The students are assessed on the basis of following criteria-

1. PPT presentation and its quality: 40% weightage.
2. Evaluation of training report submitted and question answers: 20% weightage.
3. Attendance: 40% weightage.

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

ME 33501: MECHATRONICS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
04	-	00	03	-	_	30	70	-	-	100

PRE-REQUISITES: Basic Electronics Engineering (EI 23017), Mathematics III (MA23003)

COURSE OUTCOMES:

After successful completion of this course students will have:

1. Apply the knowledge or skill, techniques or modern tools of mechatronics engineering such as use of appropriate computer languages and application software
2. Explain the different data collection devices in measurement systems.
3. Devlop the problem solving skills, including the ability to identify the problems, conduct experiments, gather data, analyze data, and produce results
4. Explain the working and problems of control systems as well as ability to use measurement techniques and operating measuring instruments along with their fundamentals
5. Design and implement state space-based controller designs to regulate and control various processes and systems.

COURSE CONTENTS:

UNIT 1 Open loop and control systems: Dynamic modelling of simple mechanical, electrical, electromechanical, thermal and fluid systems. Transfer function and block diagram representation of control system. Zero order, first order and second order systems and their dynamic response, Routh Hurwitz stability criteria, Introduction to Bode plot and root locus method. System modelling using MATLAB.

UNIT 2 Measurement Systems: Generalized measurement system. Sensors and transducers, intermediate elements, indicating and recording elements. Static and dynamic characteristics of measuring instruments. Amplitude linearity, phase linearity, bandwidth, frequency response. Proximity sensors and switches, potentiometers, optical encoders, electrical strain gages, load cells, thermocouples, piezoelectric accelerometers, pressure and flow sensors, semiconductor sensors.

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

UNIT 3 Signal Conditioning & Data Acquisition: Amplification. Filters. Operational amplifier and its applications. Analog to digital conversion. Data acquisition. Interfacing with micro-controller and micro-processor.

UNIT 4 Actuators: Electro-mechanical actuators, solenoids and relays, types of electric motors and their characteristics, speed control of electric motors. Stepper motors and their control. Electro-hydraulics and electro-pneumatic actuators, Servomotor.

UNIT 5 Controllers: Basic control actions. Proportional, integral and derivative control. Op Amp based PID controller. Combinatorial and sequential logic. Simple logic networks Introduction of microcontrollers.

ME 33501: MECHATRONICS

THEORY ASSESSMENT

Students will be assessed as following:

1) End Semester Exam: 70% Weightage,

2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage regularity 16. 5% weightage)

PRACTICAL ASSESSMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)

(2) End semester practical viva: 60% weightage

TEXT BOOKS RECOMMENDED:

S. NO.	BOOKS	UNIT
1	Beckwith and Buck, Mechanical Measurement	1-5
2	K Ogata, Modern Control Theory	1-5
3	Nakra & Choudhary, Instrumentation, Measurement and Analysis	1-3, 5

REFERENCE BOOKS RECOMMENDED:

S. NO.	BOOKS	UNIT
1	Bolton, Mechatronics	1-5

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOTS. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Open loop and control systems: Dynamic modelling of simple mechanical
	1	electrical, electromechanical, thermal and fluid systems
	2	Transfer function and block diagram representation of control system.
	2	Zero order, first order and second order systems and their dynamic response, Routh Hurwitz stability criteria,
	2	, Introduction to Bode plot and root locus method. System modelling using MATLAB
(Unit II)	2	Measurement Systems: Generalized measurement system. Sensors and transducers, intermediate elements, indicating and recording elements
	2	Static and dynamic characteristics of measuring instruments, Amplitude linearity, phase linearity, bandwidth
	2	frequency response. Proximity sensors and switches, potentiometers, optical encoders, electrical strain gages, load cells,
	2	thermocouples, piezoelectric accelerometers, pressure and flow sensors, semiconductor sensors
(Unit III)	2	Signal Conditioning, & Data Acquisition
	2	Amplification. Filters. Operational amplifier and its applications
	2	Analog to digital conversion. Data acquisition
	2	Interfacing with micro-controller and micro-processor
(Unit IV)	2	Actuators: Electro-mechanical actuators
	2	solenoids and relays, types of electric motors and their characteristics
	2	speed control of electric motors. Stepper motors and their control
	2	Electro-hydraulics and electro-pneumatic actuators, Servomotor
(Unit V)	2	Controllers: Basic control actions. Proportional
	2	integral and derivative control
	2	Estimation in foundry shop- Pattern allowances- The procedure for calculating material cost of a product for foundry shop
	2	Op Amp based PID controller. Combinatorial and sequential logic
	2	Simple logic networks Introduction of microcontrollers
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP-33515: QUALITY CONTROL & RELIABILITY ENGINEERING

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
04	02	00	03	01	-	30	70	40	60	200

PRE-REQUISITES: NA

COURSE OUTCOMES:

After successful completion of this course students will have:

1. Illustrate the concepts and fundamentals of quality control and cost of quality
2. Explain and apply of the statistical tools to improve the process quality
3. Discuss utilization and selection of acceptance sampling plans as well as quality measurement techniques
4. Illustrate the quality measurement to improve the quality level of an organization
5. Explain the concept of reliability in engineering

COURSE CONTENT

UNIT 1 Basic Concept of Quality Control & Product quality. Inspection & Quality Control. Quality System, Quality cost concept, function of Quality control Department.

UNIT 2 Statistical Quality Control: Statistical concept, Frequency distribution, Process capability, variables and attributes, Theory of control charts, Control charts for variables - X bar and R charts, Applications of control charts for variables.
Control Charts for Attributes: p, np, C and demerit control charts and their applications.

UNIT 3 Acceptance Sampling: Fundamental concepts, OC Curve - construction of OC curve, Evaluation of Parameters affecting OC curve, Sampling plans - Single, Double, Multiple & sequential sampling plans, Dodge Roming, MIL-STD-105D, Indian standard sampling tables, selection of sampling plan.

UNIT 4 Quality Measurement: Quality assurance, Quality Circle, Zero defect concepts, Quality audit, Introduction to ISO 9000, Six Sigma Quality System.

UNIT 5 Reliability: Definition, Failure pattern of complex product, measurement of reliability, Mean Time between failure and mean repair time, Failure mode and effect analysis, Hazard analysis, system reliability- components in series, parallel & mixed system.

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP-33515: QUALITY CONTROL & RELIABILITY ENGINEERING

PRACTICALS

LIST OF PRACTICALS:

1. To study various statistical concepts, statistical ways of representing data tables, graphs from measure of central tendency and dispersion.

2. To study the various tools and techniques of quality improvement.

3. To simulate the condition for the following phenomenon in a process using a Schewhart's bowl. Draw x bar and R chart for Normal, Trend, shift and Dispersion.

4. To study various p and no chart.

5. To study and draw c-chart for given casting.

6. To study the variation in process capability and control limit by varying the sample size.

IP-33515: QUALITY CONTROL & RELIABILITY ENGINEERING

THEORY ASSESSMENT:

Students will be assessed as following

(1) End Semester Exam: 70% weightage,
(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

PRACTICAL ASSESSMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)
(2) End semester practical viva: 60% weightage.

TEXT BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	Grant E. L. & Worth, L., "Statistical Quality Control", 7th ed., Tata McGraw Hill, New Delhi, India.	**1-5**
2	Balagurusamy, E., "Reliability Engineering", Tata McGraw Hill, New Delhi, India	**1-5**
3	Mahajan, M., "Statistical Quality Control", 2nd ed., Dhanpat Rai and Sons Publishers, New Delhi, India	**1-5**

REFERENCE BOOKS RECOMMENDED:

S. NO.	BOOK	UNIT
1	Grayana, R., Chua, C.H., DeFeo J., "Juran's Quality Planning Analysis for	**1-5**

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

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B. TECH IPE III Year (4YDC)

	Enterprise Quality", 5th ed., Tata McGraw Hill, New Delhi, India.	

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	Basic Concept of Quality Control & Product Quality
	1	Inspection & Quality Control, Quality System
	2	Quality cost concept, function of Quality control Deptt.
	1	Function of Quality Deptt.
(Unit II)	1	Statistical Quality Control : Statistical Concept
	1	Frequency distribution
	2	Process capability, variables and attributes
	1	Theory of Control Charts
	2	Control charts for variables, X bar and R-charts
	1	Applications of control charts for variables
	2	Controls charts for attributes, p,np C and demerit control charts
(Unit III)	2	Acceptance Sampling, Fundamental concepts
	2	OC-Curve – Construction of OC curve
	2	Sampling plans – Single, Double, Multiple & Sequential sampling plans.
	2	Dodge Roming, MIL-STD-105D, Indian standard sampling tables
	1	Selection of sampling plan
(Unit IV)	1	Quality assurance
	1	Quality circle
	1	Introduction to ISO 9000
	2	Six Sigma Quality System
	1	Zero defect concept
(Unit V)	1	Reliability: Definition
	1	Failure pattern of complex product
	1	Measurement of reliability
	1	Mean Time between failure and mean repair time
	2	Failure mode and effect analysis
	3	System reliability, Components in series, parallel & mixed system
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP-33503: PRINCILES OF MACHINE TOOLS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
						THEORY		PRACTICAL		TOTAL MARKS
T	P	Tu	T	P	Tu	CW	END SEM	SW	END SEM	
04	00	00	03	00	-	30	70	-	-	100

PRE-REQUISITES: NA

COURSE OUTCOMES:

After successful completion of course the student is likely to have

1. Illustrate the basic concept and features of machine tool construction
2. Explain different design aspects for machine tool elements
3. Describe the kinematic structures and speed regulation of machine tools
4. Identify the different kinematic features of the gear generating machines
5. Illustrate the existing and innovative ideas for automation in Machine Tools

COURSE CONTENTS

UNIT 1 Basic Features and Kinematics of Machine Tools: Classification of machining operations and machine tool used for them. Basic features of machine tool construction. Classes of machine tool motions, Drive systems, Conversion of motion, Rotation to rotation and rotation to translation.

UNIT 2 Strength, Rigidity .and Design Analysis: Kinematic structures of machine tools, elementary, complex and compound structure. Strength, Rigidity and Design Analysis of Machine Tool Spindle etc. Elements compliance of machine tool. Force analysis, Bearing Slides and guide ways of machine tools, Hydrostatic bearings.

UNIT 3 Speed regulation, stepped regulation, cone pulley, change gear drive, gear box drive constructional features of sliding, clutched & clutch drives, Norton sample as regulation by electrical, mechanical friction and hydraulic system drives. Principles of speed regulation, selection of speed & feeds speed loss in stepped regulation. Design of gear boxes for speeds and feeds.

UNIT 4 Kinematic features of gear, shapers, Hobbers & bevel gear generating machines.

UNIT 5 Automation in Machine Tool: Capstan and turret lathes and their process layouts, Single spindle automates, multiple spindle automates. There types and construction. CAM design for single spindle automates. Indexing and Bar feeding and clamping arrangement.

ASSESSMENT

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

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B. TECH IPE III Year (4YDC)

Students will be assessed as following:

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage

TEXT BOOKS RECOMMENDED:

S. NO	BOOK	UNIT
1	Sen & Bhattacharya, Machine tool.	**1-2**
2	Basud S. K., Design of Machine Tools, Oxford IBH.	**3-4**
3	Mehta N. K., Machine Tool Design, T.M.H Publication	**2,3,4,5**

REFERENCE BOOKS RECOMMENDED:

S. NO.	BOOK	UNIT
1	G. C. Sen and A. Bhattacharya, Principles of Machine Tools, New Central Agency Pvt. Ltd.	**1-5**
2	N. K. Mehta, Machine Tool Design and Numerical Control, McGraw Hill Education	**1-5**
3	S. K. Basu and D. K. Pal, Design of Machine Tools, Oxford and IBH Publishing	**1-5**
4	Nicholas Lisitsyn, Alexis V Kudryashov, Oleg Trifonov, Alexander Machine Tool Design, University Press of the Pacific	**1-5**

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	Classification of machining operations and machine tool used for them.
	2	Basic features of machine tool construction
	2	Classes of machine tool motions Drive systems
	2	Conversion of motion, Rotation to rotation and rotation to translation.
(Unit II)	2	Kinematic structures of machine tools,
	2	elementary, complex and compound structure
	2	trength, Rigidity and Design Analysis of Machine Tool Spindle etc
	1	Elements compliance of machine tool
	2	Force analysis, Bearing Slides and guide ways of machine tools,
	1	Hydrostatic bearings.
(Unit III)	1	stepped regulation, cone pulley, change gear drive
	2	gear box drives constructional features of sliding
	2	clutched & clutch drives, Norton sample as regulation by electrical, mechanical friction and hydraulic system drives
	1	Principles of speed regulation
	2	selection of speed & feeds speed loss in stepped regulation. Design of gear boxes for speeds and feeds.
(Unit IV)	2	**Kinematic features** of gear
	2	shapers, Hobbers
	2	bevel gear generating machines
(Unit V)	1	Capstan and turret lathes and their process layouts
	1	Single spindle automates
	1	multiple spindle automates
	1	There types and construction.
	2	CAM design for single spindle automates. Indexing and Bar feeding and clamping arrangement.
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33516: METAL CUTTING AND METAL WORKING ANALYSIS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
04	02	01	03	01	-	30	70	40	60	200

PRE-REQUISITES: NA

COURSE OUTCOMES:

After successful completion of this course students will be able to have:

1. Understanding and insight of cutting tool geometry and the properties of cutting tool materials along with their characteristics
2. Ability to identify and utilize fundamentals of metal cutting operations as well as identify the problems and application the fundamental concepts to solve problems arising in metal removal process
3. Knowledge of mechanism of metal cutting in contrast to forces on the tools, friction and heat produced during metal cutting and ability to estimate the economics of machining
4. Ability to analyze the deformation behavior, test of formability and stress-strain analysis during metal working processes, which let them to analyze various metal working processes like rolling, wire drawing, extrusion etc.
5. Learn about the different formability testing techniques and apply to test in their practices

COURSE CONTENTS

UNIT 1 Tool materials, their types and applications. Geometry of cutting tools like single point, drills, reamers, dies, taps, milling cutters for various cutting operations. Mechanisms of tool wear, Measurement of tool wear. Tool Life and methods of improving tool life.

UNIT 2 Orthogonal and oblique cutting. Mechanics of cutting, Shear angle relationship, Merchant circle and force analysis for orthogonal cutting, Friction and heat in metal cutting, distribution of heat, Machinability and economics of machining.

UNIT 3 Deformation behavior of metals. Stress and strain analysis, Yield criteria, Flow lines and plastic deformation of metal, slab method, slip line field, Upper and lower bound holographs in sheet metal working,

UNIT 4 Force analysis for strip rolling, Wires drawing and extrusion

UNIT 5 Formability test, forming limit diagrams and their applications.

IP 33516: METAL CUTTING AND METAL WORKING ANALYSIS

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

PRACTICALS

LIST OF PRACTICALS:

1. Measurement of cutting forces, feed force and thrust force on the central lathe machine with the help of strain gauge type tool dynamometer.
2. Measurement of thrust force and torque on the drill machine with the help of strain gauge type tool dynamometer and calculation of power required for the same
3. Measurement of longitudinal forces, transverse force and vertical force on milling machine with the help of strain gauge tool dynamometer
4. Measurement of drawing forces on the wire drawing setup for mild steel, copper and aluminum wire and its analysis
5. Study of Erichen cupping test machine and measurement of d/h ratio, major and minor strain and failure analysis for given sheet.
6. Study of milling cutter
7. Study of single point cutting tool, drill and reamer

IP 33516: METAL CUTTING AND METAL WORKING ANALYSIS

THEORY ASSESSMENT

(1) End Semester Exam: 70% weightage,
(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage.

PRACTICAL ASSESSMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)
(2) End semester practical viva: 60% weightage.

TEXT BOOK RECOMMENDED:

S. NO.	BOOK	UNIT
1	Juneja B. L., Machining Process, C.B.S.	1-5
2	Rowe, Industrial Manufacturing Process, Arnold.	1-5
3	Surendra Kumar, Metal forming, L.C.U.E.	1-5
4	Pandey & Shah, Modern Machine Processes, T.M.S.	1-5

REFERENCE BOOKS RECOMMENDED:

S. NO.	BOOK	UNIT
1	Pandey & Singh, Production Engineering Science, Standard Publishers.India	1-5
2	Avitzur, Metal working, T.M.H.	1-5

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

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B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	Tool materials, their types and applications.
	2	Geometry of cutting tools like single point, ,
	1	drills
	2	reamers, dies, taps,
	1	milling cutters for various cutting operations
	1	Mechanisms of tool wear
	1	Measurement of tool wear
	1	Tool Life and methods of improving tool life
(Unit II)	1	Orthogonal and oblique cutting.
	2	Mechanics of cutting
	2	Shear angle relationship
	2	Merchant circle and force analysis for orthogonal cutting
	2	Friction and heat in metal cutting
	2	distribution of heat
	2	Machinability and economics of machining
(Unit III)	2	Deformation behavior of metals
	2	Stress and strain analysis
	2	Yield criteria, Flow lines and plastic deformation of metal
	2	slab method, slip line field
	2	Upper and lower bound holographs in sheet metal working
(Unit IV)	2	Force analysis for strip rolling
	2	Wires drawing and extrusion
(Unit V)	2	Formability test
	2	forming limit diagrams and their applications
Total	40	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33511: ADVANCED MACHINING PROCESSES

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
04	02	00	03	01	-	30	70	40	60	200

PRE-REQUISITES: NA

COURSE OUTCOMES:

This course is designed to enable students to have,

1. Explain the fundamentals and working principles of different advanced machining processes
2. Illustrate the advanced machining processes for machining of different Advanced Engineering Materials
3. Describe the capabilities for creating desired features along with machining quality as well as productivity
4. Machining performance characteristics and analysis for optimization of process performance
5. Illustrate the different plastics composites and different molding methods

COURSE CONTENTS

UNIT 1 Modern Machining Process: Introduction and classification. Abrasive Jet Machining: Fundamental principles, process parameters, Metal removal rate, effect of parameters, application & limitations. Ultrasonic Machining: Fundamental principles, process parameters, cutting tool design, tool feed mechanism, transducer, Design of velocity transformers, Mechanics of cutting, Effect of parameters, Economic considerations, application & limitations.

UNIT 2 Chemical Machining: Chemical milling, chemical engraving, chemical blanking, fundamental principles and process parameters. Electrochemical Machining: Classification, fundamental principles, elements of process, Metal removal rate, electro-chemistry of process, Dynamics and hydrodynamics of process, optimization analysis, choice of electrolytes. Electrochemical Grinding: Fundamental principles, electro-chemical and process parameters, electrochemical deburring and honning.

UNIT 3 Electrical Discharge Machining: Mechanisms of metal removal, Basic circuitry, Evaluation of metal removal rate, Machining accuracy, Surface finish, Analysis for optimization, tool material, dielectric fluid, application & limitation.

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

UNIT 4 Laser Beam Machining: Features, metal removal, thermal analysis, cutting speed and accuracy, application & limitation, Micro-drilling by laser. Electron Beam Machining: Theory, forces in machining, process capability. Plasma Arc Machining: Non-thermal generation of plasma, mechanics of metal removal, various parameters, accuracy and surface finish, applications.

UNIT 5 Plastics: Composition of plastic materials, Molding methods - Injection molding, compression molding, transfer molding, extrusion molding, Calendaring, Blow molding, Laminating & Reinforcing, Welding of plastics. Dies and Mould Design for Plastics and rubber Parts: Compression molding, transfer molding, blow molding.

IP 33511: ADVANCED MACHINING PROCESSES

ASSESSMENT

Students will be assessed as following

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

TEXT BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	Pandey P. C. & Shan H. S., Modern Machining Process, Tata McGraw Hill	1-5
2	Dr. Bhattacharya Amitabh, New Technology, The Institution of Engineers Publication.	1-5
3	V.K. Jain, Advanced Machining Processes, Allied Publishers, India	1-5

REFERENCE BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	William J. Patton, Plastic Technology Theory, Design & Manufacturing, Reston Publishing Company.	1-5

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPIC COVER
(Unit I)	1	Introduction of subject, lesson plan, books, course content
	2	Unconventional Machining importance and classification
	3-4	Principles of Abrasive Jet Machining its process parameters, applications & limitations
	5-6	Ultrasonic Machining principles and process parameters & Metal removal rate, transducer
	7-8	USM cutting tool design, velocity transformers, Economic consideration & numerical
(Unit II)	9	Chemical machining types and principles and uses.
	10	Chemical milling, engineering, blanking, process parameters
	11-12	Electrochemical machining principles, & parameters & element
	13	EDM Metal removal rate & electrochemistry
	14-15	Dynamics & hydrodynamic of EDM process optimization, Electrolytes, ECG,ECH
	16	Numerical
(Unit III)	17	Mechanism of Electrical discharge machining EDM
	18	M R Rate of EDM
	19	Circuit & elements of EDM
	20	Accuracy & Surface finish, tool material
	22	Application & limitation of EDM
	23-24	Analysis for optimization and numerical.
(Unit IV)	25	Thermal machining process & types
	26	LBM features and metal removal rates
	27	LBM cutting aspects and accuracy
	28	Applications & limitation of LBM & Micro drilling
	29-30	EBM theory & forces & process capability
	31	Plasma and machining & generation & forces.
	32	PAM metal removal rate, accuracy and application.
(Unit V)	33	Plastic types and its uses and compositions
	34	Molding deferent methods
	35	Injection molding methods
	36	Compressors molding methods
	37	Transfer & extrusion molding methods
	38	Calendaring and blow molding
	39	Lamination & Reinforcements
	40	Dies & mold design for rubber & plastic parts
Total	**40**	

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33702 MANUFACTURING ANALYSIS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
04	00	00	03	00	-	30	70	00	00	100

PRE-REQUISITES: NA

COURSE OUTCOMES:

After successful completion of this course students will have:

1. Analyze the performance of a manufacturing system at its different phases
2. Connect and communicate different engineering groups
3. Explain the product and process engineering to monitor the productivity and production quality
4. Select an appropriate material and manufacturing process and knowledge of computer aided process planning and control.
5. Evaluate the dimensions, tolerance stacks of the engineering parts by applying dimensional and tolerance analysis

COURSE CONTENTS:

UNIT 1: Introduction of Manufacturing Analysis: Pre and Post Production Analysis, Qualification of Analyst. Composition of effective Planning Group, Coordination of Engg. Functions, Communication between Engg. Groups, Phases of Analysis.

UNIT 2: Product Engg. and Process Engg., Part Print Analysis, Determination of Principle Processes, Blank making process, Determination of Functional surfaces of W/pc, Machining Allowances (limits of size for initial and intermediate W/pc dimensions).

UNIT 3: Selection of Manufacturing Processes, Influence of Process Engg. on product design. Workpiece Control.

UNIT 4: Group Technology: Concept, Parts classification and coding system, Production Flow Analysis, Machine cell design, Computer Aided Process Planning.
Selection of materials (considering function and cost), Effect of process on material cost.
Selection of tooling, Selection of equipment (considering cost and design factors).

UNIT 5: Dimensional Analysis: Flatness, Parallelism, Squareness, Concentricity etc. (ways to designate these).
Tolerance Analysis: Tolerance stacks (Design and Process tolerance stacks).
Tolerance Charts: Purpose and layout, conversion of tolerances, developing the tolerance chart.

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

IP 33702 MANUFACTURING ANALYSIS

THEORY ASSESSMENT

Students will be assessed as following

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

TEXT BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	Kovan V. K., Process Engineering, Mir Publishers, Moscow.	1-5
2	Balakishan B., Fundaments of Manufacturing Engineering, Mir Publishers, Moscow.	1-5

REFERENCES RECOMMENDED:

S.NO	BOOK	UNIT
1	Eary and Johnson, Process Engineering, Prentice Hall.	1-5
2	Wilson F.W., Manufacturing Planning and Estimating Handbook, McGraw Hill Book Co.	1-5

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Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	Internal functions of manufacturing company, Manufacturing cycle.
	1	Difference between Pre-production and post-production analysis, manufacturing analyst qualification.
	2	Composition of an effective planning groups, coordination of engineering functions, communication between engineering groups.
	2	Phases of analysis
	1	Pre-production analysis
	2	Post-production analysis
(Unit II)	1	Product engineering.
	1	Process engineering
	2	Introduction to part print analysis, Establishing general characteristics of part print.
	2	Functional surfaces of work piece, determining areas used for processing.
	1	Specifications, Nature of the work to be performed.
(Unit III)	1	Computer Aided Process Planning
	1	Selection of Materials
	1	Analysing Cost and function
	1	Selection of Manufacturing Process
	1	Selection of tooling
(Unit IV)	1	Group Technology Concepts
	2	Part Classification and Coding
	1	Coding Structures
	2	Numerical of GT
	1	Practice Session
	1	Production Flow Analysis
	1	Cell Manufacturing
	2	Computer Aided Process Planning
(Unit V)	1	Dimensional Tolerance
	1	Flatness, Parallelism
	1	Concentricity, Squareness
	1	Tolerance stacks design
	2	Tolerance Chart Introduction
	1	Importance of Tolerance Chart
TOTAL	**40**	

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B. TECH IPE III Year (4YDC)

IP33XXX-CAD, CIM and Automation

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		MARKS
03	02	-	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

PRE-REQUISITES: NA

COURSE OUTCOMES

1. To learn the concept of volumetric and geometric modeling as well as difference between surface and solid modelling
2. To learn the NC & CNC Programming in CAM as well as various programing of CNC Machines like AIP, APT & CAPP etc.
3. To learn the fundamentals of various control systems and sensing actuation system for automation.
4. To demonstrate fundamental knowledge of FMS Systems, Group Technology, and RP.
5. To identify fundamental tools for manufacturing systems and material handling.

COURSE CONTENTS

UNIT 1: CAD/CAM Analysis: CAD system architecture. Geometric Modeling in CAD, Wire¬frame models, parametric representation of Analytical and Synthetic Curve: Surface Models:Parametric Representation of Analytical and Synthetic Surfaces. Solid Modeling: Boundary Representation, Constructive Solid Geometry. Finite Elements Methods, Analysis problems in engineering, Types of analyses. **CNC Programming:** G and M codes. CNC canned cycles for CNC lathe and milling machine. Absolute and Incremental Programming. Computer assisted Part Programming, The APT System, Continuous Path Part Programming, Geometry Statements and Motion statements in APT.

UNIT 2: Computer Integrated Manufacturing (CIM): Definition CIM Wheel Concept, Evolution of CIM, CIM & Systems View of Manufacturing and CIM; Sequential Engineering & Concurrent Engineering; Overviews of Manufacturing Industries, Production Systems, and Plant Layouts; Fundamentals of Manufacturing Automation, Functions in Manufacturing.

UNIT 3: Automation and Control Technologies: Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation; Industrial Control Systems: Discrete, Continuous, and Computer Process Control; Elements for Automation and Process Control: Sensors, Actuator, Analog- Digital Conversions, Input / Output Devices for Discrete Data; Introduction of CNC Technology and its Applications; Industrial Robotics: Robot Anatomy, Robot Classification, Essential Features and Characteristics, and Common Configuration; Discrete Control and Programmable Logic Controllers (PLCs): Discrete Process Control, Ladder Logic Diagrams, PLCs, Programmable Automation Controllers.

UNIT 4: a) Automated Manufacturing Systems: Overview of Manufacturing Systems, Automation Strategies, Automated Flow Lines, Automation for Machining Operations

Design & Fabrication Consideration; Control Functions, Buffer Storage, Methods of Work Part Transport, Transfer Mechanism b). Material Handling and Identification: Material transportation System: Overview of Material Handling, Material Transport Equipment. Analysis of Material Transport Systems; Storage Systems: Introduction to Storage Systems: Conventional Storage Methods and Equipment, Automated Storage Systems, Analysis of Storage Systems; Automatic Identification and Data Capture: Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification, AIDC Technologies.

UNIT 5: Group Technology, FMS & RP: Concept, Part Family Formation, Part Classification and Coding System Types, OPITZ System, Production Flow Analysis, Composite Part Manufacturing and Machine Cell Formation. CAPP and its types. Flexible Manufacturing Systems: Concept, Component and Types. Automated Storage and Retrieval Systems, Flexibility Analysis, FMS Scheduling. Computer Aided Quality Control: Introduction of Computer Aided Quality Control.

Rapid Prototyping (RP): Stereo-Lithography, Selective Photo-curing, Selective Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, 3D Printing, Application of RP Techniques, Emerging in RP, RP Methodology.

ASSESSMENT:

Students will be assessed as following

(1) End Semester Exam: 70% weightage,

(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)

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PRACTICAL ASSESSMENT

(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)

(2) End semester practical viva: 60% weightage.

TEXT BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, Pearson	**1-5**
2	Volume graphics, Chen M and A E Kaufmann, Yagel R, Springler-Verlag	**2**
3	Principals and applications of CAD/CAM, P.N Rao McGraw Hill USA	**1-5**

REFERENCE BOOKS RECOMMENDED:

S.NO	BOOK	UNIT
1	"CAD/CAM" by Ibrahim Zeid, Tata McGraw Hill.	**1-5**
2	Computer graphics: Principles and practice, Foley, Van Dam, Feiner and Huges,	**1,3**

SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE

Department of Industrial and Production Engineering

B. TECH IPE III Year (4YDC)

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	2	**CAD/CAM Analysis:** CAD system architecture. Geometric Modeling in CAD, Wire¬frame models, parametric representation of Analytical and Synthetic Curve: Surface Models:Parametric
	2	Representation of Analytical and Synthetic Surfaces. Solid Modeling: Boundary Representation, Constructive Solid Geometry
	1	Finite Elements Methods, Analysis problems in engineering, Types of analyses
	2	**CNC Programming:** G and M codes. CNC canned cycles for CNC lathe and milling machine, Absolute and Incremental Programming, Computer assisted Part Programming
	1	The APT System, Continuous Path Part Programming, Geometry Statements and Motion statements in APT
(Unit II)	1	Definition CIM Wheel Concept, Evolution of CIM
	1	CIM & Systems View of Manufacturing and CIM
	2	Sequential Engineering & Concurrent Engineering; Overviews of Manufacturing Industries, Classes of machine tool motions Drive systems
	2	Production Systems, and Plant Layouts, Fundamentals of Manufacturing Automation, Functions in Manufacturing
(Unit III)	1	Basic Elements of an Automated System, Advanced Automation Functions
	2	Levels of Automation; Industrial Control Systems: Discrete, Continuous, and Computer Process Control; Elements for Automation and Process Control: Sensors, Actuator
	2	Analog- Digital Conversions, Input / Output Devices for Discrete Data; Introduction of CNC Technology and its Applications
	2	Industrial Robotics: Robot Anatomy, Robot Classification, Essential Features and Characteristics, and Common Configuration
	2	Discrete Control and Programmable Logic Controllers (PLCs): Discrete Process Control, Ladder Logic Diagrams, PLCs, Programmable Automation Controllers.
(Unit IV)	1	**a) Automated Manufacturing Systems:** Overview of Manufacturing Systems, Automation Strategies, Automated Flow Lines
	2	Automation for Machining Operations Design & Fabrication Consideration; Control Functions, Buffer Storage, Methods of Work Part Transport, Transfer Mechanism
	1	b). Material Handling and Identification: Material transportation System: Overview of Material Handling, Material Transport Equipment
	2	Analysis of Material Transport Systems; Storage Systems: Introduction to Storage Systems: Conventional Storage Methods and Equipment, Automated Storage Systems
	1	Analysis of Storage Systems; Automatic Identification and Data Capture: Overview of Automatic Identification Methods
	1	Bar Code Technology, Radio Frequency Identification, AIDC

		Technologies.
(Unit V)	2	**Group Technology, FMS & RP:** Concept, Part Family Formation, Part Classification and Coding System Types, OPITZ System,
	2	Composite Part Manufacturing and Machine Cell Formation. CAPP and its types. Flexible Manufacturing Systems: Concept, Component and Types, Production Flow Analysis
	2	Automated Storage and Retrieval Systems, Flexibility Analysis, FMS Scheduling. Computer Aided Quality Control: Introduction of Computer Aided Quality Control.
	2	**Rapid Prototyping (RP):** Stereo-Lithography, Selective Photo-curing, Selective Sintering, Fused Deposition Modeling, Laminated Object Manufacturing,
	1	3D Printing, Application of RP Techniques, Emerging in RP, RP Methodology
Total	**40**	