SHRI G. S. INSTITUTE OF TECHNOLOGY AND SCIENCE
DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING
B.E./B. TECH III Year
Semester –A
IP 33005: METROLOGY AND INDUSTRIAL INSPECTION

UNIT NO.	NO OF LECTURES	TOPICS COVERED
(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.E./B. TECH III Year

Semester-A

IP 33002: INDUSTRIAL ENGINEERING

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**	

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B.E./B. TECH III Year
Semester – A

IP33703: METAL CASTING AND WELDING ENGINEERING

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Basic features of power sources, Transformers, Generators, Rectifiers
	2	Factors for selection of power source, Power sources for SMAW, MIG, TIG, PAW, Pulse GMAW, Synergic GMAW.
	1	Arcing phenomenon, Metal transfer in Arc Welding, Arc-blow,
	2	Type of electrodes and their coatings, Electrodes for SMAW, MIG/MAG, TIG, SAW, PAW and their specification, fluxes for SAW.
(Unit II)	2	Distortion and Discontinuities in weldment, Testing, Inspection and Specifications
	2	Definition, weldability of carbon & alloy steels, cast Iron, stainless steel, Aluminium and copper
	2	Hydrogen induced cracking. Weldment distortion and its control,
	1	various discontinuities in Welds, Residual stresses in Weldments
	2	Trouble shooting. Destructive and non-destructive methods of testing weldments
	1	WPS, PQR and ASME section IX Welding. Adhesive Bonding
(Unit III)	1	**Design of Weldment**: Weld geometry, Eccentric loading design in torsion and bending,
	1	designing welding fixtures. Robotics and Automation in Welding
	1	Modes of Automation, Positioners
	1	Welding fixtures, Arc motion devices,
	2	seam tracking devices. Under water welding.
(Unit IV)	2	Steel Casting: Foundry practice for plain carbon steel, low alloy & high steel
	2	Cast Iron Castings: Foundry practice for grey, ductile & white cast iron & malleable iron.
	2	Nonferrous castings - foundry practice for Aluminum, Copper etc.
(Unit V)	1	Melting of casting iron, Steel &Nonferrous materials Cupola, Charge calculation
	1	Open Hearth furnace, Converter, Crucible furnace, Electric furnace,
	1	Direct are furnace, Induction furnace. Solidification of Casting
	1	Solidification of pure metals & alloys, solidification time, rate, properties related to freezing mechanisms
	2	Design of feeders and feed aids. Design of gating systems.
(Unit VI)	1	cast product development cycle, parting line analysis, core design and mould cavity layout
	1	Casting process planning.Foundry Mechanization: Modernization of foundries
	1	Moulding machines Material handling equipment's Foundry layout
	1	Heat Treatment of Casting: Stress relieving of casting
	2	Heat treatment for ferrous & non-ferrous casting.
Total	**40**	

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B.E./B. TECH III Year
Semester –A
ME 33014: PRIME MOVERS AND PUMPS

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 andcombustion,
	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 comparativestudies 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 theirconstructional details,characteristics and efi'c1enc1es,
	2	Fluid converter and fluid couplings,
	2	Their application and characteristics, application to machine tool drives
Total	**40**	

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B.E./B. TECH III Year

Semester - B
ME-33501: MECHATRONICS

SLOT S. 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 amplifierand 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 motorsand 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	OpAmp based PID controller. Combinatorial and sequential logic
	2	Simple logic networks Introduction of microcontrollers
Total	**40**	

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B.E./B. TECH III Year

Semester - B
IP-33515: QUALITY CONTROL & RELIABILITY ENGINEERING

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**	

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING

B.E./B. TECH III Year

Semester - B

IP-33503: PRINCILES OF MACHINE TOOLS

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**	

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B.E./B. TECH III Year

Semester - B

IP 33516: METAL CUTTING AND METAL WORKING ANALYSIS

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**	

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B.E./B. TECH III Year
Semester - B
IP 33007: COMPUTER AIDED DESIGN & MANUFACTURING

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	1	Importance & content of the subject. Introduction & Books
	1	Modeling definition in terms of CAD, Types of models.
	1	Wireframe modeling, surface & solid modeling, Wireframe models
	1	Parametric representation of analytical & synthetic curves, Surface models
	1	Solid modeling. Difference between wireframe, surface &solid modeling.
	1	Boundary representation & constructive solid geometry.
	1	Parametric & variational modeling.
	1	Feature based modeling.
(Unit II)	1	Introduction & definition of voxel based modeling, Volumetric modeling & voxel definition.
	1	Representative technique of voxel models – Exhaustive enumeration.
	1	Octee& array representation of volumetric model.
	1	Voxellization of geometrical models & definition of rendering.
	1	Voxellization techniques.
	1	Rendering of volumetric data.
	1	Volume & surface rendering.
	1	Volumetric modeling applications in CAD & other applications.
(Unit III)	1	Introduction to data exchange between CAD/CAM systems.
	1	Translators &there types.
	1	IGES
	1	STEP
	1	ACIS & DXF
	1	Surface representation standards, STL.
	1	Use of CAD system to generate IGES, STEP & DXF file.
	1	Virtual reality, Makeup language.
(Unit IV)	1	FEM introduction, Nodes & steps of FEA.
	1	Stresses &equilibrium. Boundary conditions.
	1	Strain-Displacement & Stress-Strain relationship.
	1	Analysis Engineering problems.
	1	Continuous & discrete system, Solution by differential formulation.
	1	Variational formulation, Potential energy &equilibrium (The Rayleigh ritz Method)
	1	Principal of minimum potential energy, Temperature effects.
	1	Discretization &piecewise approximation.
(Unit V)	1	Coordinate & Shape function.
	1	Element stiffness matrix, Global matrix.
	1	Assembly of matrix & load vector.
	1	Properties of 'K', Solution of FE equations. Quadratic shape function.
	1	Post processing, Convergence requirements.
	1	Treatment of distributed loads, application to structural mechanicsproblems, Longitudinal/Bar axial problems.
	1	Beam problems, Plane stress/strain problems. Iso parametric formulation.
	1	Axis symmetric problem, Weighted residual approach.
TOTAL	**40**	

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B.E./B. TECH III Year

Semester - B

IP 33701: ADVANCED MACHINING PROCESSES

SLOT S. NO.	NO OF LECTURES	TOPIC COVER
(Unit I)	1	Introduction of subject, lesson plan, books, course content
	1	Unconventional Machining importance and classification
	2	Principles of Abrasive Jet Machining its process parameters, applications & limitations
	2	Ultrasonic Machining principles and process parameters & Metal removal rate, transducer
	2	USM cutting tool design, velocity transformers, Economic consideration & numerical
(Unit II)	1	Chemical machining types and principles and uses.
	1	Chemical milling, engineering, blanking, process parameters
	1	Electrochemical machining principles, & parameters & element
	1	EDM Metal removal rate & electrochemistry
	2	Dynamics & hydrodynamic of EDM process optimization, Electrolytes, ECG,ECH
	1	Numerical
(Unit III)	1	Mechanism of Electrical discharge machining EDM
	1	M R Rate of EDM
	1	Circuit & elements of EDM
	1	Accuracy & Surface finish, tool material
	1	Application & limitation of EDM
	2	Analysis for optimization and numerical.
(Unit IV)	1	Thermal machining process & types
	1	LBM features and metal removal rates
	1	LBM cutting aspects and accuracy
	1	Applications & limitation of LBM & Micro drilling
	2	EBM theory & forces & process capability
	1	Plasma and machining & generation & forces.
	1	PAM metal removal rate, accuracy and application.
(Unit V)	1	Plastic types and its uses and compositions
	1	Molding deferent methods
	1	Injection molding methods
	1	Compressors molding methods
	1	Transfer & extrusion molding methods
	1	Calendaring and blow molding
	1	Lamination & Reinforcements
	1	Dies & mold design for rubber & plastic parts
Total	**40**	

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B.E./B. TECH III Year

Semester - B
IP33702: MANUFACTURING ANALYSIS

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.E./B. TECH III Year

Semester - B

IP33507: CIM and Automation

SLOT S. NO.	NO OF LECTURES	TOPICS COVERED
(Unit I)	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 II)	2	Basic Elements of an Automated System, Advanced Automation Functions
	2	Levels of Automation; Industrial Control Systems: Discrete, Continuous, and Computer Process Control
	2	Elements for Automation and Process Control: Sensors, Actuator, 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 III)	1	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
	2	Automated Storage Systems, Analysis of Storage Systems; Automatic Identification and Data Capture: Overview of Automatic Identification Methods
	1	Bar Code Technology, Radio Frequency Identification, AIDC Technologies
	2	Overview of Manufacturing Systems, Automation Strategies, Automated Flow Lines,
	2	Automation for Machining Operations Design & Fabrication Consideration
	2	Control Functions, Buffer Storage, Methods of Work Part Transport, Transfer Mechanism.
(Unit IV)	2	Concept, Part Family Formation, Part Classification and Coding System Types, OPITZ System
	2	Production Flow Analysis, Composite Part Manufacturing and Machine Cell Formation. Computer Aided Process Planning and its types
		Flexible Manufacturing Systems: Concept, Component and Types. Automated Storage and Retrieval Systems, Flexibility Analysis, FMS Scheduling
	2	Computer Aided Quality Control: Introduction of Computer Aided Quality Control (CAQC).
(Unit V)	1	Stereo-Lithography, Selective Photo-curing,
	1	Selective Sintering, Fused Deposition Modeling
	1	Laminated Object Manufacturing, 3D Printing
	1	Application of RP Techniques, Emerging in RP, RP Methodology
Total	**40**	