V SEMESTER

MANAGEMENT AND ENTERPRENEURSHIP

Subject Code	:	**15MA51**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE-1

MANAGEMENT & ENTERPRENEURSHIP: Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management – Management as a science, art of profession – Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

12 Hours

MODULE - 2

PLANNING & ORGANIZING: Nature, importance and purpose of planning process – Objectives – Types of plans (Meaning only) – Decision making – Importance of planning – steps in planning & planning premises – Hierarchy of plans.

Nature and purpose of organization – Principles of organization – Types of organization – Departmentation – Committees- Centralization Vs Decentralization of authority and responsibility – Span of control.

10 Hours

MODULE - 3

STAFFING, DIRECTING & CONTROLLING:MBO and MBE (Meaning Only) Nature and importance of staffing–Process of Selection & Recruitment (in brief). Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – coordination, meaning and importance and Techniques of Co –Ordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

10 Hours

MODULE - 4

SMALL SCALE INDUSTRIES & INSTITUTIONAL SUPPORT: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI – Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)
Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

12 Hours

MODULE - 5

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. **Identification of business opportunities:** Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

8 Hours

TEXT BOOKS:

1. **Principles of Management** – P.C.Tripathi, P.N.Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** – Concepts, Application, Skill Development – Robers Lusier – Thomson –
2. **Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.
3. **Management** – Stephen Robbins – Pearson Education/PHI – 17th Edition, 2003.

Computer Aided Design and Manufacturing

Subject Code	:	**15MA52**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

INTRODUCTION: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.

7 Hours

MODULE - 2

HARDWARE FOR CAD & COMPUTER GRAPHICS: Basic Hardware structure. Working principles, usage and types of hardware for CAD – Input devices, output devices, memory, CPU, hardcopy and storage devices.

Software configuration of graphic system, function of graphics package, construction of geometry, wire frame and solid modeling, CAD/CAM integration. Desirable modeling facilities. Introduction to exchange of modeling data – Basic features of IGES, STEP, DXF, DMIS.

12 Hours

MODULE - 3

INTRODUCTION TO FINITE ELEMENT ANALYSIS: Introduction, basic concepts, discretization, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing, application to static analysis.

6 Hours

NC. CNC, DNC Technologies

NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC.

4 Hours

CNC TOOLING: Turning tool geometry, milling tooling system, tool presenting, ATC, work holding.

4 Hours

MODULE - 4

CAM PROGRAMMING: Overview of different CNC machining centers, CNC turning centers, high speed machine tools, MCE.

4 Hours

CNC PROGRAMMING: Part program fundamentals-steps involved in development of part program. Manual part programming, milling, turning, turning center programming.

4 Hours

CNC PROGRAMMING: Manual part programming- milling & turning.

4 Hours

MODULE-8

INTRODUCTION TO ROBOTICS: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications.

7 Hours

TEXT BOOKS:

1. **CAD/CAM Principles and Application** - P.N. Rao, Tata McGraw Hill.
2. **CAD/CAM** - Groover& Zimmers, PHI, 2003

REFERENCE BOOKS:

1. **Introduction to the Design and Analysis of Algorithms** – S.E. Goodman, S.T. Headetmiemi, McGraw Hill Book Company-1998.
2. **Principles of Interactive Computer Graphics** - Newman and Sproull, Tata McGraw Hill, 1995.
3. **NC Machine Programming and software Design** – Chno-Hwachang, Michel. A. Melkanoff, Prentice Hall, 1989.
4. **Numetical control and CAM -** Pressman RS and Williams JE, Johnwiley.
5. **Computer Graphics** - Steven Harrington, McGraw Hill Book Co.
6. **CAD/CAM** - Chris McMahon & Jimmie Browne – Pearson education Asia 2001.
7. **CAD/CAM** – Ibrahim Zeid, Tata McGraw Hill, 1999.
8. **Computer Aided Manufacturing** - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999.
9. **Introduction to Finite Elements in Engineering** - Tirupathi . R. Chandrupatla and Ashok D Bebgundu.

METAL FORMING

Subject Code	:	**15MA53**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

Classification of metal working processes, characteristics of wrought products, Advantages and limitations of metal working processes.

CONCEPTS OF TRUE STRESS & TRUE STRAIN: triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & von-mises yield criteria.

CONCEPTS OF PLANE STRESS & PLANE STRAIN: Brief description of methods of metal deformation analysis. Effects of temperature, strain rate, friction and lubrication, hydrostatic pressure in metal working, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

12 Hours

MODULE - 2

FORGING: Classification of forging processes. Forging machines and equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it, Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging.

ROLLING:

Classification of Rolling processes. Types of rolling mills, expression for Rolling load. Roll separating force. Frictional losses in bearing etc, power required rolling, Effects of front & back tensions, frictions, Roll diameter on rolling load, friction hill. Maximum possible reduction. Defects in rolled products.

12 Hours

MODULE - 3

DRAWING & EXTRUSION: Drawing equipment & dies expression for drawing loads by slab analysis power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation.

types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion, extrusion of seamless pipes & tube.

8 Hours

MODULE – 4

SHEET METAL FORMING & DEEP DRAWING: Forming methods dies & punches progressive die, compound die, combination die. Rubber forming, open back inclinable press (OBI press), piercing & blanking, bending, stretch forming, Roll bending & contouring.

Principles, stresses & deformation in drawn up. Die & punch design parameters. Total punch load, limiting drawing ratio. Effect of anisotropy on LDR, forming limit criteria & diagrams. Defects in deep drawn products.

10 Hours

MODULE- 5

POWDER METALLURGY & HIGH ENERGY RATE FORMING METHODS: Basic steps in powder metallurgy, Brief description of methods of production of metal powders, conditioning & blending of powders, compaction & sintering applications of powder metallurgy components.

Principles, advantages & applications. Explosive forming, Electro hydraulic forming, electromagnetic forming.

10 Hours

TEXT BOOKS:

1. **Materials and Processes in Manufacturing** - E.Paul, Degramo, J.T.Black, Ronald, A.K.Prentice-Hall of India 2002
2. **Manufacturing Engg., & Technology** - Serope Kalpakjain and Stevan.R.Schmid, Pearson Education Asia, 4th Edi. 2002.

REFERENCE BOOKS:

1. **Mechanical Metallurgy (SI UNITs)** - G.E.Dieter, McGraw Hill 2001
2. **Manufacturing Science** - Amitabh Ghosh & A.K.Malik, East West Press 2001
3. **Deformation processing** - W.A.Backofen, Addissen Weslay, 1973
4. **Non-traditional Machining Processes** – Gary.F.Benedict, Marcel-Deeker Inc 2001
5. **Production Technology** - HMT, TMH 2001
6. **Principles of Industrial Metal working process** – G.W.Rowe, CBS Pub 2002.

ELEMENTS OF MACHINE DESIGN

Subject Code	:	**15MA54**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

DESIGN FOR STATIC STRENGTH & IMPACT LOADING: Design consideration: codes and Standards, Static strength; Static loads and factor of safety; Theories of failure – Maximum normal stress theory, maximum shear stress theory, Distortion energy theory; Failure of brittle materials, failure of ductile materials. Stress concentration, Determination of Stress concentration factor. Combined Stress concentration factor.

Derivation of instantaneous stress due to axial, bending and torsion loading, effect of inertia. Design of coupling: Design of rigid flange coupling & bushed pin type flexible coupling.

8 Hours

MODULE - 2

DESIGN FOR FATIGUE STRENGTH & DESIGN OF SHAFTS

Introduction, S – N diagram, Low cycle fatigue, High cycle fatigue, Endurance limit. Modifying factors –size effect, surface effect, Stress concentration effects; fluctuating stresses, Fatigue Strength under fluctuating stresses, Goodman and Soderberg relationship; Stress due to combined loading, cumulative fatigue damage.

Torsion of shafts, design for strength & rigidity, with steady loading, ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads.

12 Hours

MODULE - 3

DESIGN OF GEARS:

Spur Gears: Definitions,stresses in gear tooth, Lewis equation, form factor, Design for trength, dynamic and wear load**.**

Bevel Gears: Definitions, formative number of teeth, design for strength, dynamic and wear load.

12 Hours

MODULE - 4

COTTER JOINT & KNUCKLE JOINTS, KEYS AND COUPLINGS:

Design for cotter and knuckle joints, Keys: types of keys, design of keys

Couplings: Rigid and Flexible couplings: Flange coupling, Bush and pin type coupling.

12 Hours

MODULE - 5

LUBRICATION AND BEARINGS: Mechanisms of Lubrication – Viscosity, bearing modulus, coefficient of friction, minimum oil film thickness-Heat Generated, Heat dissipated, bearing materials, lubricants and properties. Examples of journal bearing and thrust bearing design, Ball and Roller Bearings: Bearing life, equivalent bearing load, selection of bearings of different types.

8 Hours

TEXT BOOKS:

1. **Mechanical Engineering design**-Joseph Edward Shigley, Tata McGraw Hill, New Delhi 1986
2. **Machine Design** – V L. Maleev and Hartman, CBS Publishers & Distribution, Delhi, 1983.

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** - K. Mahadevan and balaveera Reddy, CBS Publication.
2. **Design Data Hand Book Vol.l & Vol.2** –Dr.K. Lingaiah, Suma Publications, Bangalore.
3. **Design Data Hand Book** – Prof. H.A. Patil, Shri Shastri Prakashan, Belgaum.

REFERENCE BOOKS:

1. **Machine Design** – Robert. L., Norton – Pearson Education Asia, New Delhi, 2001
2. **Theory and Problems of Machine Design, Hall** - Holowinko, Laughlin, -Schums Outline series, 2002
3. **Elements of Machine design** –N. C. Pandey and C. S. Shah, 2002 – Chorotar Publishing House
4. **Design of Machine Elements** – V.B. Bahandri, - Tata McGraw Hill Publishing Co. Ltd., New- Delhi.
5. **Machine Component & Design** – William Orthwan, Jaico Publishing Co.
6. **Fundamentals of design** – Benerad J Hamroack, Bo – Jacobson & Steven R. Schmid.
7. **Fundamentals of Machine Design Component** – Robert C. Juvinall and Kurt M. Marshek – John & sons
8. **Machine Design** – R. K. Jain, Khanna Publications, New Delhi.

PROFESSIONAL ELECTIVE -I
PRODUCT DESIGN

Subject Code	:	**15MA551**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

INTRODUCTION TO PRODUCT DESIGN & PRODUCT DESIGN PRACTICE AND INDUSTRY: Asimow's Model: definition of Product Design, Design by Evolution, Design by Innovation, Essential Factors of Product Design, Production-Consumption Cycle, Flow and Value Addition in the Production – Consumption Cycle, The Morphology of Design (The seven phases), Primary Design Phases and flowcharting, Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly.

Induction, Product Strategies, Time to Market, Analysis of the Product, The Three S's, Standardization, Renard Series (Preferred Numbers), Simplification, The Designer and His Role, The Designer: Myth and Reality, The Industrial design Organization, Basic Design Considerations, Problems faced by industrial! Designer, Procedure adopted by Industrial Designers, Types of Models designed by Industrial Designers, what the Designer contributes, Role of Aesthetics in Product Design, Functional Design Practice.

12 Hours

MODULE - 2

REVIEW OF STRENGTH, STIFFNESS AND RIGIDITY CONSIDERATIONS IN PRODUCT DESIGN: Principal Stress Trajectories (Force-Flow Lines), Balanced Design, Criteria and Objectives of Design, material Toughness: Resilience, Designing for Uniform Strength, Tension vis-à-vis Compression.

DESIGN FOR PRODUCTION –METAL PARTS: Producibility Requirements in the Design of Machine Components, Forging Design, Pressed Components Design, Casting Design, Design for Machining Ease, The Role of Process Engineer, Ease of Location and Clamping, Some Additional Aspects of Production Design, Die Casting and Special Casting and Special Casings, Design for Powder Metallurgical Parts, Expanded Metals and Wore Forms.

8 Hours

MODULE - 3

DESIGNING WITH PLASTICS, RUBBER, CERAMICS AND WOOD: Approach to Design with Plastics, Plastics, Plastic Bush Bearings, Gears in Plastic, Fasteners in Plastic, Rubber Parts, Design Recommendations for Rubber Parts, Distortion in Rubber, Dimensional Effects, Tolerances, Ceramics and Glass Parts, Production Design Factors for Ceramic Parts, Special Considerations for Design Glass Parts, dimensional Factors and Tolerances, Wood.

6 Hours

MODULE - 4

ECONOMIC FACTORS INFLUENCING DESIGN & DESIGN OPTIMIZATION: Product Value, Design for Safety, Reliability and Environmental Considerations, Manufacturing Operations in relation to Design, Economic Analysis, Profit and Competitiveness, Break-even Analysis, Economics of New Product Design (Samuel Eilon Model).

Introduction, Siddal's Classification of Design Approaches, Optimization by differential Calculus, Lagrange Multipliers, Linear Programming (Simplex Method), Geometric Programming, Johnson's Method of Optimum Design.

12 Hours

MODULE - 5

HUMAN ENGINEERING CONSIDERATIONS IN PRODUCT DESIGN: Introduction, Human being as Applicator of Forces, Anthropometry: man as Occupant of Space, The Design of Controls, The Design of Displays, Man/Machine Information Exchange.

MODERN APPROACHES TO PRODUCT DESIGN: Concurrent Design, Quality Function Deployment (QFD).

7 Hours

VALUE ENGINEERING AND PRODUCT DESIGN: Introduction, Historical Perspective, What is Value? Nature and Measurement of Value, Maximum Value, Normal Degree of Value, Importance of Value, The Value Analysis Job Plan, Creativity, Steps to Problem-solving and Value analysis, Value Analysis Test, Value Engineering Idea Generation Check-list, Cost Reduction through Value Engineering Case Study on Tap Switch Control Assembly, material and Process Selection in Value Engineering.

7 Hours

TEXT BOOKS:

1. **Product Design and Manufacturing** - A.C. Chitale and R.C. Gupta, PHI.
2. **Product Design & Development** – Karl T. Ulrich & Steven D., Epinger Tata Mc Graw Hill, 3red Edition, 2003

REFERENCE BOOKS:

1. **New Product Development** - Tim Jones, Butterworth Heinmann, Oxford, UIC1997.
2. **New Product Development -** Design & Analysis by Roland Engene Kinetovicz, John Wiley and Sons Inc., N.y. 1990.
3. **Product Design for Manufacture and Assembly** - Geofferry Boothroyd, Peter Dewhurst and Winston Knight.
4. **Successful Product Design** - Bill Hollins, Stwout Pugh, Butterworth, London 1990.
5. **Design for Assembly, a Designer's Hand book** - Boothroyod & Dewhurst P., University of Massachusets, Amherst, 1983.
6. **Product Design** - Kevin otto and Kristini wood Pearson Education 2000

MACHINE TOOL DESIGN

Subject Code	:	**15MA552**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

PRINCIPLES OF MACHINE TOOL DESIGN: General requirements of machine tool design - design process machine tool layout general requirements of machine tool design – design process machine tool layout.

05 Hours

MACHINE TOOL DRIVES AND MECHANISMS: Working and auxiliary motion. Drives- Electric drives, Hydraulic transmission, Kinematic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, stepless regulation of speeds and feeds.

07 Hours

MODULE - 2

CUTTING FORCE ANALYSIS AND POWER REQUIREMENT: In Turning, Milling, Drilling, Shaping and Broaching operation with simple problems. General requirements of machine tools - Centre lathe, Milling machine.

07 Hours

MODULE - 3

DESIGN OF MACHINE TOOL STRUCTURES, GUIDE WAYS AND POWER SCREWS: Functions-Requirements-Design criteria Material used – static and dynamic stiffness – Profile and basic design procedure for machine tool structures. Design of beds, columns, housing, bases, tables, cross-rails, arms saddle, carriages.

07 Hours

Function and types of guide ways – Design and lubrication of slide ways - aerostatic slide ways -antifriction guide ways, combination guide ways - protecting devices, design of power screws.

06 Hours

MODULE - 4

DESIGN OF SPINDLE AND SPINDLE BEARINGS:

Functions-Requirements and materials for spindle compliance and machining accuracy. Design of spindles, antifriction bearing, Hydrodynamic and Hydrostatic bearing, Air lubricated bearing.

06 Hours

MODULE - 5

DYNAMICS OF MACHINE TOOLS: Concept of dynamic cutting process, Physical causes of chatter and vibrations, Types of Chatter. Stability chart, chatter vibration in Lathe, Drilling machine, Grinding machine and

Milling machine. Different methods for avoiding machine tool chatter and vibration.

07 Hours

CONTROL SYSTEMS IN MACHINE TOOLS: Functions, requirements and classification. Control system for speed and feeds centralized control pre selective control, control system for forming and auxiliary motions – Mechanical control– Ergonomic consideration and compatibility – Automatic control system – Electric Hydraulic and pneumatic systems.

07 Hours

TEXT BOOKS:

1. **Machine Tool Design**, N.K. Mehta, 2nd Ed., Tata McGraw Hill 2001
2. **Principles of Machine Tools**, Sen and Bhattacharaya Oxford IBM Publishing 2000

REFERENCE BOOKS:

1. **Machine Tool Design Volume – II and III**, N. Acharkan MIR Publications 2000
2. **Design of Machine Tools**, S. K. Basu and D. K. Pal 2000
3. **Principles of Machine Tool Design,** Koensberger 1993

MAINTENANCE ENGINEERING

Subject Code	:	**15MA553**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

INTRODUCTION TO MAINTENANCE SYSTEM: Definition, Scope, Objective, functions and Importance of maintenance system, Type of maintenance system, Break down maintenance system, Preventive maintenance, Predictive maintenance, design out maintenance, corrective maintenance, planned maintenance, total productive maintenance, condition monitoring. Problems on selection of methods like preventive or breakdown maintenance.

8 Hours

MODULE - 2

ECONOMICS IN MAINTENANCE: Repair, replacement, Repair complexity, Finding out most optimal preventive maintenance frequency. Numerical treatment required.

8 Hours

MODULE - 3

MAINTENANCE OF MACHINERY & MAINTENANCE PLANNING: Causes of machine failure, performance evaluation, complete overhauling of Machines tools. Maintenance planning and scheduling. Repair order control manpower requirement, Maintenance job analysis spare parts control.

Planning of maintenance junctures manpower allocation, Long range planning, short range planning. Planning techniques and procedures. Estimation of maintenance work. Maintenance control.

12 Hours

MODULE - 4

INDUSTRIAL SAFETY & SAFETY STANDARDS: Economic importance of accidents, Types of safety organizations, Analysis of accident records, accident investigations, Analysis of accident Safety standards for Mechanical equipment.

Safety standards for Electrical equipment and systems. Chemical hazards, material handling, exhaust systems, welding, Plant house keeping-building, Aisles, passages, floors, tool cribs, washrooms, canteens.

12 Hours

MODULE - 5

COMPUTERS IN MAINTENANCE & INDUSTRIAL POLLUTION CONTROL: Features and benefits of Computer aided maintenance. Application of computers to maintenance work.

Dust control –Fiber collectors, mechanical dust collectors, wet type collectors, Electro static precipitators, Noise pollution Control – Noise measurement and control. Industrial vibration and its control.

12 Hours

TEXT BOOKS:

1. **Maintenance Engineering and Management** - R.C.Mishra and K.Pathak, Prentice Hall of India, 2002
2. **Maintenance Engineering Hand book** - Morrow.

REFERENCE BOOKS:

1. **Hand book of Maintenance Management** - Frank Herbaty
2. **Hand book of Industrial Engg & Management** - W. Grant Lreson & Eugene L-Grant
3. **Industrial Pollution Control Handbook** - LUND
4. **Industrial Maintenance** - H P Garg
5. **Maintenance Engineering Hand book** - Lindrey Higgins, Mc Graw Hill, 6^{th} edition, 2003
6. **Plant Engineering Hand book** – Staniar

SURFACE ENGINEERING

Subject Code	:	**15MA554**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

FRICTION: Topography of Surfaces – Surface features – Properties and measurement – Surface interaction –Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact.

8 Hours

MODULE - 2

WEAR: Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting Wear- Laws of wear – Theoretical wear models – Wear of metals and non metals – International standards in friction and wear measurements.

8 Hours

MODULE - 3

CORROSION: Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors.

12 Hours

MODULE - 4

SURFACE TREATMENTS: Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying, Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings.

12 Hours

MODULE - 5

ENGINEERING MATERIALS

Introduction – Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Applications – Bio Tribology Nano Tribology.

12 Hours

REFERENCE BOOKS:

1. G.W.Stachowiak & A.W .Batchelor , **"Engineering Tribology"**, Butterworth-Heinemann, UK,
2005
2. Rabinowicz.E, **"Friction and Wear of materials"**, John Willey &Sons ,UK,1995
3. Halling, J. (Editor) – **"Principles of Tribology "**, Macmillian – 1984.
4. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta & B.B.Ahuja ,**"Fundamentals of Tribology"**, Prentice –Hall of India Pvt Ltd , New Delhi, 2005
6. Fontana G., **"Corrosion Engineering"**, McGraw Hill, 1985

OPEN ELECTIVE-I
MECHATRONICS

Subject Code	:	**15MA561**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE- 1

INTRODUCTION: Definition of Mechatronics, Multi-disciplinary scenario, origins. Evaluation of Mechatronics, An over view of mechatronics. Design of Mechtronics system. Measurement system and function of main elements of measurement systems. Need for mechatronics in industries. Objectives, advantages and disadvantages of mechatronics. Microprocessor based controllers. Principle of working of automatic camera, engine management system, automatic washing machine.

10 Hours

MODULE - 2

REVIEW OF TRANSDUCERS AND SENSORS: Definition and classification of transducers. (No detailed discussions on different type of transducers) Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensory and Hall effect sensors.

8 Hours

MODULE - 3

ELEMENTS OF CNC MACHINES – Structure, guideways –Friction, Autifriction and Frictionless guideway, Merits and demerits.

Drives – Recirculating ball screw and nut. Advantages and disadvantages over Conventional screw and nut. Concept of stick-slip phenomenon, Concept of Preloading of ball nuts. Roller screw – planetary roller screw, recirculating roller screw. Spindle and spindle bearings in machine tool. Various types of loads encountered by spindle and spindle bearing. Types of bearings- friction, antifriction and frictionless bearing. Merits and demerits of each. Selection of spindle and spindle bearing, preloading of bearings, different method of preloading in detail.

14 Hours

MODULE - 4

ELECTRICAL & HYDRAULIC ACTUATORS : Actuator and actuator system. Classification of actuator system with examples. Mechanical switches. Concept of bouncing Methods of Preventing bouncing of mechanical switches. Solenoids, Relays. Solid state switches – Diodes, Thyristors, Triacs, Transistors, Darlington pair. Electrical actuator. Principle,

construction and working of AC, DC motors, stepper motors, permanent magnet motors, servomotors, Servo systems and control.

Valves – Classifications, Pressure Control Valves – Pressure relief valves, Pressure regulating/reducing valves, Pressure sequence valve. Flow control valves – Principle, needle valve, globe valve. Direction control valve – Sliding spool valve, solenoid operated. Symbols of hydraulic elements. Hydraulic cylinders – constructional features, classification and applications. Hydraulic motors – Types, vane motors and piston motors, applications.

14 Hours

MODULE - 5

SINGLE CONDITIONING: Concept, necessity, op-amps, protection, filtering, wheat stone bridge – Digital Signals – Multiplexer. Data acquisition – Introduction to digital signal processing – Concepts and different methods.

6 Hours

TEXT BOOKS:

1. **Principles, Concepts and applications** - Mechatronics –- Nitaigour and Premchand Mahilik – Tata McGraw Hill – 2003
2. **Mechatronics** – W. Bolton, Pearson Education Asia – 2nd

REFERENCE BOOKS:

1. **Introduction to mechatronics and measurement systems** – David G. Alciatore & Michel BiHistand – Tata McGraw Hill -2003
2. **Mechatronics** – H.D. Ramachandra –Sudha Publication- 2003
3. **Mechatronics** - HMT Ltd. – Tata McGraw Hill – 2000.
4. **Mechatronics System design** - Devadas Shetty and Richard A. Kark – Thomas learining -1997.

THEORY OF ELASTICITY

Subject Code	:	**15MA562**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE-1

DEFINITION AND NOTATION:

Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr's Diagram, Maximum Shear Stress, Boundary Conditions.

6 hours

MODULE-2

STRAIN AT A POINT: Compatibility Equations, Principal Strains, Generalised Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress-Plane Strain Problems.

7 hours

MODULE-3

TWO DIMENSIONAL PROBLEMS:

Cartesian co-ordinates – Airy's stress functions – Investigation of Airy's Stress function for simple beam problems – Bending of a narrow cantilever beam of rectangular cross section under edge load – method of Fourier analysis – pin ended beam under uniform pressure.

7 Hours

GENERAL EQUATIONS IN CYLINDRICAL CO-ORDINATES:

Thick cylinder under uniform internal and / or external pressure, shrink and force fit, stress concentration.

6 Hours

MODULE-4

STRESSES IN AN INFINITE PLATE:

Stresses In An Infinite Plate (with a circular hole) subjected to uniaxial and biaxial loads, stress concentration, stresses in rotating discs and cylinders.

7 Hours

UNIQUENESS THEOREM:

Principle of super position, reciprocal theorem, saint venant principle.

6 hours

MODULE-5

TORSION OF CIRCULAR, ELLIPTICAL AND TRIANGULAR BARS:

membrane analogy, torsion of thin open sections and thin tubes.

6 Hours

THERMAL STRESSES:

Thermo elastic stress strain relationship, Equations of equilibrium Thermal stresses in thin circular discs and in long circular cylinder, sphere.

7 Hours

Text books:

1. **Advanced mechanics of solids**, l. S. Srinath, tata mc. Graw hill, 2003
2. **Theory of elasticity**, s. P. Timoshenko and j. N gordier, mc.graw Hill international, 3rd edition, 1972

References books:

1. **Theory of elasticity**, dr. Sadhu singh, khanna publications, 1988
2. **Elasticity, theory**, applications & numericals, martin h sadd, Elsevier. 2005
3. **Applied elasticity**, seetharamu & govindaraju, interline publishing
4. **Applied elasticity**, c.t. wang sc. D. Mcgraw hill book co.1953

KNOWLEDGE MANAGEMENT

Subject Code	:	**15MA563**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE -1

KNOWLEDGE INFLUENCES:INTRODUCTION: External influences on organizations, Changing nature of management, Types of organizations, Strategic management in organizations, Knowledge management, Knowledge management an emerging concept, Model of strategic knowledge management.

7 hours

INTRODUCTION TO KEY CONCEPTS: What is Management? Knowledge Management and business strategies, Knowledge intensive firms and Knowledge workers, Learning and Knowledge Management.

6 hours

MODULE - 2

KNOWLEDGE CREATION AND LOSS: Innovation dynamics and knowledge processes, characterizing innovation processes, innovation as an interactive process, knowledge creation and Nonaka, the social dynamics of innovation networking processes, forgetting and unlearning knowledge.

7 hours

DEVELOPING AND MANAGING KNOWLEDGE REPOSITORIES: Effective knowledge repositories, mapping the content structure, repository quality control, case studies (not for examination)

6 hours

MODULE - 3

DESIGN KNOWLEDGE MANAGEMENT SYSTEM: Introduction, Structure preserving design, Step 1: design system architecture, Step 2: identify target implementation platform, Step 3: specify architectural components, Step 4: specify application within architecture, design of prototypes, distributed architecture.

7 Hours

SOCIO-CULTURAL ISSUES: Introduction, significance of cross community knowledge processes, characterizing cross community knowledge processes,identity, knowledge, trust and social relations, classification of boundary types, facilitating/managing knowledge between communities

6 Hours

MODULE - 4

KNOWLEDGE LEADERSHIP: Introduction, contributions of disciplines to Knowledge Leadership, the generic attributes of knowledge leader, specific knowledge leadership roles, leading knowledge teams, leading a knowledge network, recruiting and selecting knowledge leaders.

6 hours

MODULE - 5

INFORMATION AND COMMUNICATION TECHNOLOGIES AND KNOWLEDGE MANAGEMENT: Introduction, linking knowledge management and ICTs, objectivist perspectives on ICT – enabled knowledge management, practice based perspectives on ICT enabled KM, the importance of accounting for socio cultural factors in ICT enabled KM, debates regarding the role of ICTs in KM processes.

7 hours

TEXT BOOKS:

1. **Knowledge Management,** Shelda Debowski, Wiley India, 2007.
2. **Knowledge Management in Organizations,** Donald Hislop**,** 2nd Ed., Oxford Universities Press, 2009

REFERENCE BOOKS:

1. **Knowledge Engineering and Management,** Guus Schreiber, et al, Universities Press India Pvt. Ltd., 2003
2. **Knowledge Management - Classic and contemporary works,**Daryl Morey, et. al., 2007

MACHINE SHOP

Subject Code	:	**15MAL57**	IA MARKS	:	20
Number of Lecture Hrs / Week	:	01	Exam Hours	:	03
No of Practical Hours / Week	:	02	Exam Marks	:	80

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper Cutting of Gear Teeth using Milling Machine

PART –C For demonstration

Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder.
Demonstration of surface milling /slot milling

One Model from Part – A : 40 Marks
One Model from Part – B : 20 Marks
Viva – Voce :20 Marks
Total : 80 Marks

COMPUTER AIDED DESIGN & MANUFACTURING LABORATORY

Subject Code	:	**15MAL58**	IA MARKS	:	20
Number of Lecture Hrs / Week	:	01	Exam Hours	:	03
No of Practical Hours / Week	:	02	Exam Marks	:	80

PART - A

Modelling and simulation of Machining process of simple machine parts using CAM packages – minimum six models.

PART - B

1. Study of Finite element analysis package
2. 1d, 2d, structural problems
3. Evaluation of displacement – stress and strain,

4. Problem involving beams and trusses.

Suggested Packages:

1. Solid edge, Solid works, UNI Graphics, ANSYS, NISA, NASTRAN

VI SEMESTER
ENGINEERING ECONOMICS

Subject Code	:	**15MA61**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

INTRODUCTION: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and analysis, Tactics and Strategy. Engineering Economics Decision maze. Law of demand and supply, Law of returns.

7 Hours

MODULE - 2

INTEREST AND INTEREST FACTORS: Interest rate, Simple interest, compound interest, Cast-flow diagrams, Exercises and Discussion.

6 Hours

MODULE - 3

PRESENT & EQUIVALENT ANNUAL WORTH COMPARISONS: Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay-back comparison, Exercises, Discussions and Problems.

Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

14 Hours

MODULE - 4

RATE OF RETURN CALCULATIONS: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts.

4 Hours

BRIEF DISCUSSION ON DEPRECIATION AND TAX CONSIDERATIONS: Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, Corporate income tax.

4 Hours

ESTIMATING AND COSTING: Components of cost such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

7 Hours

MODULE - 5

INTRODUCTION, SCOPE OF FINANCE, FINANCE FUNCTIONS & FINANCIAL RATIO ANALYSIS : Statements of Financial Information : Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account.

Introduction, Financial Planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting.

10 Hours

TEXT BOOKS:

1. **Engineering economy -** RIGGS J.L., , McGraw Hill, 2002
2. **Engineering economy** - THUESEN J.G., , PHI, 2002

REFERENCE BOOKS:

1. **Engineering economy –** TARACHAND.
2. **Industrial Engineering and Management** - OP KHANNA, Dhanpat Rai & Sons.
3. **Financial Management** - I M PANDAY, Vikas Publishing House
4. **Engineering economy -** PAUL DEOARMO, , Macmillan Pub, Co., 2001

COMPUTER INTEGRATED MANUFACTURING

Subject Code	:	**15MA62**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE -1

INTRODUCTION: brief introduction to cad and cam – manufacturing planning, manufacturing control- introduction to cad/cam – concurrent engineering-cim concepts – computerised elements of cim system –types of production – manufacturing models and metrics – mathematical models of production performance – simple problems – manufacturing control – simple problems – basic elements of an automated system – levels of automation – lean production and just-in-time production.

10 Hours

MODULE - 2

PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING: Process planning – computer aided process planning (capp) – logical steps in computer aided process planning – aggregate production planning and the master production schedule – material requirement planning – capacity planning- control systems-shop floor control-inventory control – brief on manufacturing resource planning-ii (mrp-ii) & enterprise resource planning (erp) – simple problems.

12 Hours

MODULE - 3

CELLULAR MANUFACTURING: Group technology(gt), part families – parts classification and coding – simple problems in opitz part coding system – production flow analysis – cellular manufacturing – composite part concept – machine cell design and layout – quantitative analysis in cellular manufacturing – rank order clustering method – arranging machines in a gt cell – hollier method – simple problems.

12 Hours

MODULE - 4

FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS):

Types of flexibility – fms – fms components – fms application & benefits – fms planning and control– quantitative analysis in fms – simple problems. Automated guided vehicle system (agvs) – agvs application – vehicle guidance technology – vehicle management & safety.

8 Hours

MODULE - 5

INDUSTRIAL ROBOTICS: Robot anatomy and related attributes – classification of robots- robot control systems – end effectors – sensors in robotics – robot accuracy and repeatability – industrial robot applications – robot part programming – robot accuracy and repeatability – simple problems.

10 Hours

Textbooks:

1. Mikell.p.groover **"Automation, Production Systems And Computer Integrated Manufacturing"**, prentice hall of india, 2008.
2. Radhakrishnan p, subramanyan s.and raju v., **"CAD/CAM/CIM"**, 2nd edition, new age international (p) ltd, new delhi, 2000.

References:

1. Kant vajpayee s, **"Principles Of Computer Integrated Manufacturing"**, prentice hall india, 2003.
2. Gideon halevi and roland weill, **"Principles Of Process Planning – A Logical Approach"** chapman & hall, london, 1995.
3. Rao. P, n tewari &t.k. Kundra, "**Computer Aided Manufacturing**", tata mcgraw hill publishing company, 2000.

ADDITIVE MANUFACTURING

Subject Code	:	**15MA63**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

MODULE-1

INTRODUCTION TO ADDITIVE MANUFACTURING & CLASSIFICATION OF AM PROCESSES: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM. Liquid polymer system, discrete particle system, molten material systems, solid sheet system.

8 Hours

MODULE-2

AM PROCESS CHAIN: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

8 Hours

MODULE-3

DESIGN FOR AM: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers etc.

12 Hours

MODULE-4

GUIDELINES FOR PROCESS SELECTION & Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control.

7 Hours

POST PROCESSING OF AM PARTS:

Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

7 Hours

MODULE-5

AM APPLICATIONS: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries.

10 Hours

TEXT BOOKS:

1. **Stereo lithography and other RP & M Technologies -** Paul F. Jacobs - SME, NY 1996.
2. **Rapid Manufacturing -** Flham D.T & Dinjoy S.S - Verlog London 2001.
3. **Rapid automated -** Lament wood - Indus press New York.

REFERENCE BOOKS:

1. **Wohler's Report 2000 -** Terry Wohlers - Wohler's Association -2000.

STATISTICAL QUALITY CONTROL

Subject Code	:	**15MA64**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

MODULE-1

INTRODUCTION: Quality Dimensions – Quality definitions – Inspection - Quality control – Quality Assurance – Quality planning - Quality costs – Economics of quality – Quality loss function

6 Hours

MODULE-2

CONTROL CHARTS: Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- $\bar{X}$, R and S charts, attribute control charts - p, np, c and u- Construction and application.

12 Hours

MODULE-3

SPECIAL CONTROL PROCEDURES: Warning and modified control limits, control chart for individual measurements, multi-vari chart, X - chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

10 hour

MODULE-4

STATISTICAL PROCESS CONTROL: Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

12 Hours

MODULE-5

ACCEPTANCE SAMPLING: The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL-STD-414E & IS2500 standards.

12 Hours

REFERENCE BOOKS:

1. Douglas C Montgomery, **Introduction to Statistical Quality Control**, John Wiley, Seventh Edition, 2012.
2. Grant E.L. and Leavensworth, **Statistical Quality Control**, TMH, 2000.
3. IS 2500 Standard sampling plans.

PROFESSIONAL ELECTIVE -II
FINITE ELEMENT METHODS

Subject Code	:	**15MA651**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

INTRODUCTION TO FEM: Need for use of FEM – Advantages and Disadvantages of FEM. Matrix algebra – Terminologies relating to matrices, Methods of solution of linear algebraic equations. Eigen values and eigen vectors, Simple numeric Gaussian Quadrature – 1 Pt, 2pt and 3pt formula.

8 Hours

MODULE - 2

BASICS OF THEORY OF ELASTICITY: Definition of stress and Strain, Stress – strain relations; strain – displacement Relations in 2D and 3D Cartesian and polar coordinates. Continuum methods.

Variation methods Rayleigh-Ritz methods applied to simple problems on axially loaded members, cantilever, simply supported and fixed beam, with point loads and UDL Galerkin method as applied to simple elasticity problem.

12 Hours

MODULE - 3

FEM: Basic definitions-displacement method Nodal degrees of freedom-different coordinate systems Shape functions- Lagrangian polynomial; complete Formulation of bar-truss-beam-triangular-quadrilateral Tetrahedral –hexahedral elements – boundary conditions – SPC and MPC. Methods of handling boundary conditions – elimination method-penalty method. Simple numericals,

6 Hours

Iso parametric – sub parametric-super parametric elements. Convergence criteria – requirements of convergence of displacement model. Higher order

elements in bar-triangular- quadrilateral elements. Tetrahedral and hexahedral elements (no Formulation)-Pascal Triangle-Pascal pyramid. Introduction to axis symmetric problems-formulations of axis symmetric triangular elements.

8 Hours

MODULE - 4

DYNAMIC ANALYSIS: Formulation- element mass matrices for 1D element, computation of eigen value and vector for simple one Dimensional analysis.

8 Hours

MODULE - 5

One dimensional steady state heat conduction Formulation of 1D element-simple numerical using 1D Element.

Structure of a commercial FE package Preprocessor- Solver – Post processor

10 Hours

TEXT BOOKS:

1. **Finite Element Method** - J.N. Reddy — Tata Mc Graw Hill edition
2. **Introduction to Finite elements in Engineering** - Tirupathi .R. Chandrupatla and Ashok D. Belegundu, Pearson education, 2002

REFERENCE BOOKS:

1. **Optimization concepts & Applications in Engineering** Tirupathi.R. Chandrupatla and Ashok. D. Belegundu, Pearson education, 2002.
2. **A First Course in Finite Element methods** - Daryl.L.Logon, Thomson Learning 3rd edi., 2001
3. **Fundamental of Finite Element method** - Hutton – Mc Graw Hill, 2004
4. **Concepts & applications of FEA** - Robert Cook et.al – Jonh wiley & sons 2002
5. **Finite element analysis** - Chandrupatla, University Press, 2002

QUALITY ASSURANCE

Subject Code	:	**15MA652**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

MODULE - 1

INTRODUCTION TO QUALITY: Definition of Quality, Quality function, Dimensions of quality, Quality engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality Costs – Four categories costs and hidden cost. Brief discussion on sporadic and chronic quality problems. Introduction to Quality Function Deployment.

6 Hours

QUALITY ASSURANCE: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc., structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality audit program.

7 Hours

MODULE - 2

STATISTICAL PROCESS CONTROL – Chance and Assignable causes of variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts Frequency distribution and Histogram. Probability distributions –Hypergeometric, Binomial, Poisson and Normal distribution. Case studies on application of SPC.

PROCESS CAPABILITY: Basic definitions, standardized formula, relation to product tolerance and Six-Sigma concept of process capability.

12 Hours

MODULE - 3

CONTROL CHARTS FOR VARIABLES: Control charts for X- bar and Range(R), Statistical basis of the charts, development and sue of X- bar and r charts, interpretation of charts

Control charts for X-bar and standard deviation (S), development and use of X-bar and S Charts.

BRIEF DISCUSSION ON: Pre-Control X-bar and S control charts with variable sample size, control charts for individual measurements, cusum charts, moving-range charts.

8 Hours

MODULE - 4

CONTROL CHARTS FOR ATTRIBUTES: Control chart for fraction non – conforming (defectives) – development of control chart, brief discussion on variable sample size.

Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size.

Choice between variables and attributes control charts. Guidelines for implementing control charts.

6 Hours

INSPECTION AND TEST – SAMPLING PLANS: Inspection planning – locating inspection stations, interpretation of quality characteristics, sensory characteristics etc. Automated inspection, inspection accuracy, Concept of accepting sampling, economics of inspection. Brief introduction on measurement system analysis (MSA).

OPERATING CHARACTERISTIC CURVES: Construction and use. Acceptance plans – single, double and multiple sampling. Determinations of average outgoing quality, average outgoing quality level, average total inspection, production risk and consumer risk.

7 Hours

MODULE - 5

ISO QUALITY SYSTEM: ISO/QS9000 Quality Systems – History of ISO9000 standards, QS9000 quality standards, goals and their standards.

6 Hours

TEXT BOOKS:

1. **Introduction to Statistical Quality Control** - D.C. Montgomery, 3rd Edition, John Wiley and Sons
2. **Quality Planning and Analysis** - J.M. Juran and Frank M. Gryna, 3rd Edition, TATA McGraw-Hill

REFERENCE BOOKS:

1. **Statistical Quality Control** - Grant and Leavenworth, McGraw-Hill.

2. **The QS9000 Documentation Toolkit** - Janet L. Novack and Kathleeen C. Bosheers," Prentice Hall PTR
3. **ISO 9000 A Manual for total Quality Management** - Suresh Dalela and Saurabh, S. Chand and Company Ltd, RamNagar, New Delhi.
4. **ISO 9000 Concepts, Methods and Implementation** - Tapan.P.Bagchi, Wheeler Publishing. A Division of AH Wheeler & Co. Ltd, New Delhi.

JIGS AND FIXTURES

Subject Code	:	**15MA653**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE - 1

LOCATING AND CLAMPING PRINCIPLES:

Objectives of tool design- function and advantages of jigs and fixtures – basic elements – principles of location – locating methods and devices – redundant location – principles of clamping – mechanical actuation – pneumatic and hydraulic actuation standard parts – drill bushes and jig buttons – tolerances and materials used.

8 Hours

MODULE - 2

JIGS AND FIXTURES:

Design and development of jigs and fixtures for given component- types of jigs – post, turnover, channel, latch, box, pot, angular post jigs – indexing jigs – general principles of milling, lathe, boring, broaching and grinding fixtures – assembly, inspection and welding fixtures – modular fixturing systems- quick change fixtures.

10 Hours

MODULE - 3

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES:

Press working terminologies – operations – types of presses – press accessories – computation of press capacity – strip layout – material utilization – shearing action – clearances – press work materials – center of pressure- design of various elements of dies – die block – punch holder, die set, guide plates – stops – strippers – pilots – selection of standard parts – design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

12 Hours

MODULE - 4

BENDING AND DRAWING DIES:

Difference between bending and drawing – blank development for above operations – types of bending dies – press capacity – spring back – knockouts – direct and indirect – pressure pads – ejectors – variables affecting metal flow in drawing operations – draw die inserts – draw beads- ironing – design and development of bending, forming, drawing, reverse redrawing and combination dies – blank development for axisymmetric, rectangular and elliptic parts – single and double action dies.

12 Hours

MODULE - 5

OTHER FORMING TECHNIQUES:

Bulging, swaging, embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine blanking dies – recent trends in tool design- computer aids for sheet metal forming analysis – basic introduction – tooling for numerically controlled machines- setup reduction for work holding – single minute exchange of dies – poka yoke.

10 Hours

TEXT BOOKS:

1. Joshi, P.H**. "Jigs and Fixtures",** Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Joshi P.H **"Press tools – Design and Construction"**, wheels publishing, 1996

REFERENCES:

1. Venkataraman. K., **"Design of Jigs Fixtures & Press Tools"**, Tata McGraw Hill, New Delhi, 2005.
2. Donaldson, Lecain and Goold **"Tool Design"**, 3rd Edition, Tata McGraw Hill, 2000.
3. Kempster, **"Jigs and Fixture Design"**, Third Edition, Hoddes and Stoughton, 1974.
4. Hoffman **"Jigs and Fixture Design"**, Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India. 6. Design Data Hand Book, PSG College of Technology, Coimbatore

MATERIAL HANDLING EQUIPMENTS

Subject Code	:	**15MA654**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE -1

INTRODUCTION: Objectives of material handling system, Principal groups of materials handling equipment and classification, Scope of Material Handling, Criteria for selection of Material Handling Equipment's, Basic kind of material handling problems, Various methods to analyze material Handling problems

8 Hours

MODULE - 2

CONVEYOR DESIGN: Introduction to apron conveyors , Pneumatic conveyors, Belt Conveyors, Screw conveyors and vibratory conveyors and their applications, Design of Belt conveyor- Belt selection procedure and calculation of drop energy, Idler design.

12 Hours

MODULE - 3

DESIGN OF HOISTS: Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear -Brakes: shoe, band and cone types.

10 Hours

MODULE - 4

DESIGN OF CRANES: Hand-propelled and electrically driven E.O.T overhead Traveling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius ; fixed post and overhead traveling cranes; Stability of stationary rotary and traveling rotary cranes.

12 Hours

MODULE - 5

DESIGN OF BUCKET ELEVATOR:

Introduction, Types of Bucket Elevator, Design of Bucket Elevator- loading and bucket arrangements, Cage elevators , shaft way, guides, counter weights.

10 Hours

REFERENCE BOOKS:

1. Conveyor Equipment Manufacturer's Association, **"Belt conveyors for bulk materials"** 6th edition, The New CEMA Book

2. Rudenko N., **"Materials handling equipment"**, Elnvee Publishers, 1970

3. Ishwar G Mulani and Mrs. Madhu I Mulani, **"Engineering Science and application design for belt conveyor"**, Madhu I. Mulani, 2002.

4. Spivakovsy A.O. and Dyachkov V.K., **"Conveying Machines, Volumes I and II"**, MIR Publishers, 1985.

5. Alexandrov, M., **"Materials Handling Equipments",** MIR Publishers, 1981.

6. Boltzharol, A.,**"Materials Handling Handbook"**, The Ronald press company 1958.

OPEN ELECTIVE -II

MICROPROCESSOR & MICROCONTROLLERS

Subject Code	:	**15MA661**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

MODULE - 1
THE 8086 MICROPROCESSOR:
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

8 Hours

MODULE - 2
8086 SYSTEM BUS STRUCTURE:
8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

10 Hours

MODULE - 3
I/O INTERFACING:
Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

12 Hours

MODULE - 4
MICROCONTROLLER:

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set – Addressing modes - Assembly language programming.

12 Hours

MODULE - 5

INTERFACING MICROCONTROLLER:

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

10 Hours

TEXT BOOKS:

1. **The 8051 Microcontroller and Embedded Systems – using assembly and C ”-**, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006

2. Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012,
ISBN 978-1-25-900613-5.

REFERENCE BOOKS:

1. The 8051 Microcontroller Architecture, Programming & Applications”, 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.

2. The 8051 Microcontroller”, V.Udayashankar and MalikarjunaSwamy, TMH, 2009

3. Microcontrollers: Architecture, Programming, Interfacing and System Design,Raj Kamal, “Pearson Education, 2005

SENSORS

Subject Code	:	**15MA663**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE-I

Definition, principle of sensing & transduction , classification of sensors.

MECHANICAL AND ELECTROMECHANICAL SENSORS: Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes. Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis. LVDT: Construction, material, output input relationship, I/O curve, discussion. Proximity sensor.

12 Hours

MODULE - 2

CAPACITIVE SENSORS: variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

12 Hours

MODULE - 3

THERMAL SENSORS: Material expansion type: solid, liquid, gas & vapor Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification.

Thermo emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type. Radiation sensors: types, characteristics and comparison.Pyroelectric type.

12 Hours

MODULE - 4

MAGNETIC SENSORS: Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics.

8 Hours

MODULE - 5

RADIATION SENSORS: LDR, Photovoltaic cells, photodiodes, photo emissive cell types, materials, construction, response. Geiger counters, Scintillation detectors.

8 Hours

TEXT BOOKS:

1. **Sensor & transducers**, D. Patranabis, 2nd edition, PHI
2. **Instrument transducers,** H.K.P. Neubert, Oxford University press.
3. **Measurement systems: application & design**, E.A.Doebelin, Mc Graw Hill.

DATA MINING

Subject Code	:	**15MA664**	IA MARKS	:	20
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	80

MODULE -1

DATA WAREHOUSING: Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

8 Hours

MODULE - 2

BUSINESS ANALYSIS : Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

8 Hours

MODULE -3

DATA MINING: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

12 Hours

MODULE - 4

ASSOCIATION RULE MINING AND CLASSIFICATION:

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

12 Hours

MODULE - 5

CLUSTERING AND TRENDS IN DATA MINING:

Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

12 Hours

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

REFERENCES:

1. **Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining",** Person Education, 2007.

2. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.

3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.

4. Daniel T.Larose, **"Data Mining Methods and Models",** Wiley-Interscience, 2006.

NON DESTRUCTIVE TESTING LABORATORY

Subject Code	:	**15MAL67**	IA MARKS	:	20
Number of Lecture Hrs / Week	:	01	Exam Hours	:	03
No of Practical Hours / Week	:	02	Exam Marks	:	80

Objective:

To provide the knowledge on types, working principles and advantages of NDT. To enable the students to choose the NDT procedure for a given part.

1. Visual inspection.
2. Radiography.
3. Liquid (Dye) penetrant method.
4. Magnetic particles.
5. Eddy current testing.
6. Ultrasonic Inspection.
7. Acoustic Method.

ADDITIVE MANUFACTURING LABORATORY

Subject Code	:	**15MAL68**	IA MARKS	:	20
Number of Lecture Hrs / Week	:	01	Exam Hours	:	03
No of Practical Hours / Week	:	02	Exam Marks	:	80

Objective:
To create awareness of rapid prototyping machine and it’s functionalities and how it helps create products in lesser time.

Create part models using CAD packages and then export the models onto the 3D Printing machine and create the prototype.
For example model individual parts of a plummer block and assemble it once the all parts are completed.
Create following parts:

1. Block Base
2. Hexagonal Nut
3. Bolts
4. Cap
5. Bearing top half
6. Bearing bottom half.