Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz + Assignment	End Sem	Lab Work	L	T	P	
	APS-1121	Computer Integrated Manufacturing	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	An understanding of CIM, Advance modeling techniques, NC/CNC/DNC.
CO2	An understanding of material handling and storage systems.
CO3	An understanding of Robotics technology, Automated inspection and testing, Sensor technology CMM.
CO4	An understanding of Group technology, FMS..
CO5	An understanding of Artificial Intelligence and CIM systems.

UNIT-I

CIM: Evolution, hardware and software of CIM, Concurrent engineering, Advance modeling techniques, Numerical control, Computer Numerical Control Direct Numerical Control and Adaptive Control.

UNIT-II

Materials handling and Storage Systems: Types of material handling systems, Storage systems, performance, Automated storage and retrieval systems, carousel storage systems.

UNIT-III

Interfacing: Handling and Storage with Manufacturing, Robotics technology, Control systems, Programming and applications, Automated inspection and testing, Sensor technologies, Coordinate measuring machines, Machine vision.

UNIT-IV

Cellular manufacturing: Group Technology, Flexible manufacturing systems, Introduction, configurations, workstations, planning, Applications and benefits, control systems.

UNIT-V

Artificial Intelligence and CIM systems.

BOOKS RECOMMENDED

1. Paul Ranky, "Computer Integrated Manufacturing", Prentice Hall, 2005
2. Donatas T I Junclis, Keith E Mekie, "Manufacturing High Technology Hand Book", Marcel Decker.
3. Mikell P Groover,"Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 2007.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

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	APS-1122	Finite Element Analysis	60	20	10+10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Learn the basic concepts and methods of finite element analysis.
CO2	Apply the shape functions, matrices, and coordinate systems to finite element problems.
CO3	Solve different problems (field, steady state, heat transfer, fluid flow, vibrations, metal cutting and metal forming) through the finite element approach.
CO4	Solve structural and elasticity problems through the approach of finite element analysis.
CO5	Evaluate higher order elements and numerical methods of finite element analysis.

UNIT-I

Basic concepts: Different methods in Finite Element Methods, Steps involved in FEM.

UNIT-II

Interpolation Polynomials: Linear elements Shape function, Element and Global matrices, two dimensional elements, triangular and rectangular elements, Local and Global coordinate systems.

UNIT-III

Field problems, Steady state problems, Torsional problem, Fluid flow and Heat transfer problems, Acoustic vibrations; Application in manufacturing problems, metal cutting and metal forming.

UNIT-IV

Finite element Solution of structural problems, two dimensional elasticity problems, Axisymmetric problem.

UNIT-V

Higher Order Elements and Numerical Methods: Evaluation of shape functions, Numerical Integration, Gauss Legendre quadrature, Solution of finite element equations, Cholesky decomposition, Skyline storage, Computer implementation, Use of FEM software.

BOOKS RECOMMENDED

1. Larry J Segerlind,"Applied Finite Element Analysis", John Wiley, 1984
2. Bathe KJ,"Finite Element Procedures", Prentice Hall, 1996.
3. J.N.Reddy,"An Introduction to the Finite Element Method", Second Edition, McGRAW Hill, New York, 1993.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz + Assignment	End Sem	Lab Work	L	T	P	
	APS-1123	Computer Aided Process Planning	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Justify the need of process planning, production planning and concurrent engineering.
CO2	Apply the part design representations for process planning.
CO3	Learn the implementation of process planning and process engineering along with process capability analysis.
CO4	Learn the implementation of computer aided processing planning.
CO5	Understand the basics of integrated process planning systems.

UNIT-I

Introduction: The Place of Process Planning in the Manufacturing cycle, Process Planning and Production Planning, Process Planning and Concurrent Engineering; CAPP, Group Technology.

UNIT-II

Part Design Representation: Design Drafting, Dimensioning, Conventional tolerancing, Geometric tolerancing, CAD input / output devices, topology, Geometric transformation, Perspective transformation, Data structure, Geometric modelling for process planning, GT coding, The optiz system, The MICLASS system.

UNIT-III

Process Engineering and Process: Planning: Experienced; based planning, Decision table and decision frees, Process capability analysis, Process Planning, variant process planning, Generative approaches, Forward and Backward planning, Input format, AI.

UNIT-IV

Computer Aided Process Planning: Systems: Logical Design of a Process Planning, Implementation considerations, manufacturing system components, production Volume, No. of production families, CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT-V

An Integrated Process Planning Systems: Totally integrated process planning systems, An Overview, Modulus structure, Data Structure, operation, Report Generation, Expert process planning.

BOOKS RECOMMENDED

1. Gideon Halevi and Roland D. Weill,"Principles of Process Planning: A logical approach", Chapman & Hall, 1995.
2. Tien- Chien Chang, Richard A. Wysk, "An Introduction to automated process planning systems", Prentice Hall, 1985.
3. Chang, T.C."An Expert process Planning System", Prentice Hall, 1985.
4. Nanua Singh, "Systems Approach. To Computer intergrated Design and Manufacturing", John Wiley & Sons, 1996.
5. Rao, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co.2000.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz + Assignment	End Sem	Lab Work	L	T	P	
	APS-1124 (A)	Reliability & TPM	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Conceptualize the basics of reliability, availability and maintainability.
CO2	Perform failure analysis based different distribution functions and graphical procedure.
CO3	Predict the reliability of various systems.
CO4	Apply the concepts of failure mode and effect analysis.
CO5	Learn the concepts of total productive maintenance and maintenance management.

UNIT-I
Introduction: Reliability function, MTBF, MTTF, mortality curve, availability, Maintainability.

UNIT-II
Failure Data Analysis: Repair time distributions, exponential, normal, log Normal, gamma, and Weibull, reliability data requirements, Graphical evaluation.

UNIT-III
Reliability Prediction: Failure rate estimates, Effect of environment and stress, Series and Parallel systems, RDB analysis, Standby· Systems, Complex Systems.

UNIT-IV
Reliability Management: Reliability demonstration testing, Reliability growth testing, Duane curve, Risk assessment, FMEA, Fault tree

UNIT-V
Total Productive Maintenance: Causes of Machine Failures, Downtime Maintenance policies, Restorability predictions, Replacement models, Spares provisioning, Maintenance management, Cleanliness and House Keeping.

BOOKS RECOMMENDED

1. Paul Kales, "Reliability for Technology, Engineering and Management", Prentice Hall, New Jersey, 1998
2. Modarres,"Reliability and Risk Analysis", Meral Dekker Inc, 1993.
3. Gopalakrishnan.P and Banerji A.K "Maintenance and Spare Parts Management", Prentice Hall of India, New Delhi, 1996.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz + Assignment	End Sem	Lab Work	L	T	P	
	APS-1124 (B)	Project Management	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Understand the basics of project management cycle including materials, product mix, plant capacity, location and site, machinery, civil works, project charts and layouts.
CO2	Learn the concepts of cash flow and management of investment in any project.
CO3	Learn the financial and economic appraisal of projects through mathematical programming.
CO4	Apply the risk analysis and network techniques to project management.
CO5	Understand the basics of software project management, risk management and different issues.

UNIT-I

Project development cycle: Objectives of investment decision making, Technical analysis, Materials and inputs, production technology, product mix, plant capacity, location and site, machinery and equipment, structures and civil works, project charts and layouts.

UNIT-II

Project cash flows: Investment criteria, Net Present Value, Cost Benefit Ratio, Internal Rate of Return, Payback period, Accounting Rate of Return.

UNIT-III

Costing: Financial and economic appraisal of single project, multiple projects and Constraints, method of ranking, mathematical programming approach, LP, ILP and goal programming model.

UNIT-IV

Portfolio theory and capital asset pricing model approaches to risk analysis, Network techniques for project management; PERT, CPM.

UNIT-V

Introduction to Software Project Management (SPM); Software Metrics, Software quality, Risk management in SPM, Emerging issues.

BOOKS RECOMMENDED

1. Prasanna Chandra, "Projects Planning, analysis, Financing, Implementation and Review Management",V Edition Tata McGraw Hill, 2004.
2. Wysocki, "Effective Project Management with CD" John Wiley 2nd edition 2000.
3. Choudhary, S. "Project management", Tata Mcgraw Hill 27th reprints 2007.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz + Assignment	End Sem	Lab Work	L	T	P	
	APS-1124 (C)	Industrial Automation	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Understand advanced control functions, safety diagnostics, and evaluating the merits, limitations, and levels of automation.
CO2	Optimize material handling and storage systems, transport equipment, storage performance, and location strategies.
CO3	Apply automatic identification methods, bar code technology, radio frequency identification (RFID), and other AIDC technologies.
CO4	Analyse industrial control systems, continuous and discrete control systems, design automation solutions using sensors, actuators, and data conversion devices.
CO5	Apply Industry 4.0 concepts, IoT techniques, cloud computing, machine learning in smart manufacturing.

UNIT-I
Principles and Strategies of Automation: Power to Accomplish the Automated Process, program of Instruction, Control System, Advanced automation Functions: safety Monitoring, maintenance and repair Diagnostics, error Detection and Recovery, levels of automations, Merits and Demerits of automation.

UNIT-II
Material Handling systems and Design: Introduction to Material Handling, Material Transport Equipment, analysis of Material Transport Systems, Storage systems-Storage System Performance and Location Strategies, Conventional Storage Methods and Equipment, Automation Storage Systems, Engineering Analysis of Storage Systems.

UNIT-III
Automatic identification methods: Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies.

UNIT-IV
Industrial control systems: Process Industries Vs Discrete Manufacturing Industries, Levels of Automation in the two industries, Variables and Parameters in the two industries. Continuous Vs Discrete control-Continuous Control System, Discrete Control System. Control system components-Sensors, Actuators, Analog-to-Digital Convertors, Digital-to-Analog Convertors, Input/output Devices for Discrete Data.

UNIT-V
Industry 4.0: Introduction, IoT Techniques, Cloud computing, machine learning, Digital Twin.

BOOKS RECOMMENDED

1. Groover M. P., "Automation production Systems and Computer Integrated Manufacturing", Pearson Education, 2013.
2. Krishna Kant, "Computer Based Industrial Control", Prentice Hall of India, New Delhi, 2010.
3. Tiess Chiu Chang and Richard A. W., "An Introduction to Automated Process Planning Systems", Tata McGraw-Hill Publishing Company, New Delhi, 2012.
4. Klafter, R.D., Chmielewski, T. A. and Negin M., "Robot Engineering-An Integrated Approach", Prentice Hall of India, New Delhi, 2012.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

II-SEM M.E. APS	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
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	APS-1125 (A)	MIS/ERP	60	20	10+10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Understand about MIS as a strategic tool.
CO2	Understand about various types of system and its concepts.
CO3	Know about Planning and Control of Information system.
CO4	Evaluate various information system and ERP.
CO5	Know about the ERP implementation.

UNIT-I

Management Information System (MIS) definition, Objectives and benefits, MIS as strategic tool, obstacles and challenges for MIS, functiona1 and cross functional systems, hierarchical view of CBIS, structured and unstructured decision, Operation and mgt support, Decision process and MIS, info system components and activities, Value chain and MIS support.

UNIT-II

System concepts: types, definition, characteristics, feedback (Pull) and :feed forward (Push) control, system stress and entropy, computer as closed system, law of requisite variety, open and flexible (Adaptive) systems, work system model and comparison with input-process-output model, five views of work system: structure, performance, infrastructure, context and risk and their effect on product performance.

UNIT-III

Planning and control Concepts: terminologies, difficulties in planning, system analysis and development plan-purpose and participants, info planning, (SDLC) system development life cycle for in-house and licensed s/w, system investigation, analysis of needs, design and implementation phases, training of Operational personnel, evaluation, Control and Maintenance of Information systems.

UNIT-IV

E-business components and interrelationship, Evolution of. Enterprise Resource Planning (ERP) from MRP, Supply chain management (SCM) and Customer relationship management (CRM), Integrated data model, strategic and operational issues in ERP, Business Process Re-Engineering (BPR), significance and functions, BPR, information technology and computer NW support to MIS

UNIT-V

ERP Implementation, role of consultants, vendors and users, customization, methodology of ERP implementation and guidelines for ERP implementation, ERP modules.

BOOKS RECOMMENDED

1. Davis and Olson, MIS, TMH
2. James O'Brian, MIS, TMH
3. Business Process Re-Engineering, Jayaraman, TMH.
4. ERP by V.K. Garg, PHI
5. ERP by Alex Leon, and manuals of SAPP.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

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	APS-1125 (B)	Work Design and Ergonomics	60	20	10 + 10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Conceptualize the scope of work study including motion and time study.
CO2	Apply motion study through process chart, flow diagram, assembly process chart, man and machine chart, two handed process chart, micro motion and memo motion study.
CO3	Apply the methods of work measurement based on motion time standards.
CO4	Apply the physiological methods of work measurement.
CO5	Incorporate the principles of ergonomics to work system design.

UNIT-I
Introduction to work study; Productivity, scope of motion and time study, Work methods design.

UNIT-II
Motion study, process analysis, process chart, flow diagram, assembly process chart, man and machine chart, two handed process chart, Micro motion and memo motion study.

UNIT-III
Work measurement and its methods, Work sampling, determining time standards from standard data and formulas, predetermined motion time standards, work factor system, methods time measurement.

UNIT-IV
Analytical Estimation, Measuring work by physiological methods, heart rate measurement, measuring oxygen consumption, establishing time standards by physiology methods.

UNIT-V
Motion economy, Ergonomics practices, human body measurement - layout of equipment, -seat design, design of controls and compatibility, environmental control, vision and design of displays, Design of work space, chair table

BOOKS RECOMMENDED

1. Barnes, Ralph. M. "Motion and Time Study: Design and Measurement of Work",John Wiley & Sons, New York, 1990
2. McCormick, E.J."Human Factors in Engineering and Design", McGraw Hill
3. ILO,"Introduction to Work study", Geneva, 1974.

BOS Meeting - 18.12.2024

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

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	APS-1125 (C)	Additive Manufacturing	60	20	10+10	-	-	3	1	-	4

Course Outcomes:
On completion of the course, the students will be able to:

CO1	Understand the working principle and process parameters of AM processes.
CO2	Apply the suitable process for fabricating a given product.
CO3	Create part using design tools for AM.
CO4	Explore the applications of AM processes in various fields.
CO5	Use suitable post processes based on product application.

UNIT-I

Types of Manufacturing: Introduction of Subtractive, Formative, Additive Manufacturing Additive Manufacturing: AM evolution, Distinction Between AM & CNC machining, Advantages of AM. AM process chain: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup.

UNIT-II

Classification of AM processes: Liquid polymer system, discrete particle system, molten material systems, solid sheet system such as: Steriolithography, Fused Deposition Modeling, Solid Based Curing, Selective Laser sintering, Laminated Object Modeling.

UNIT-III

Design for AM: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports,

UNIT-IV

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

UNIT-V

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.

Future Directions of AM: Introduction, new types of products and employment and digiproneurship.

BOOKS RECOMMENDED

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
3. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, 2006.
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.