SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year	VI/III	Program	B.Tech.
Subject Category: DC	Subject Code: ME-601	Subject Name:	Manufacturing Process

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	20	10	30	10	10	150	3	-	2	4

Prerequisites:(Only for open electives)

Course Objective:

- **Learn the fundamentals of lathe machine, their types and various operations which are performed on lathe**
- **Understanding of shaping and planning process, used machine and their application**
- **To understand the basic concepts of drilling, reaming and boarding and allied machines**
- **Learning of process of milling, grinding and finishing operations and their applications.**

Course Outcomes:

After completion of the course, students would be able to -

1. **Learn the various parts of the machine used in the manufacturing process**
2. **Understand the basic operations of the machines involved in metal cutting**
3. **Classifications of machines and machining operations**
4. **Determine the appropriate manufacturing process(es) for the product to be made**
5. **Measure the material removal rate and the power required in various metal cutting operations.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1							
CO2	3	2										
CO3	3	1										
CO4	3	2	2									
CO5	3	2			1							

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	***Lathe Machine and operations*** **Definition, working principle, Parts of the lathe, Lathe Accessories (work and tool holding devices), specifications of lathe, various types of lathe (Engine, Turret and Capstan lathe) , Automatic lathes, Operating conditions, Material Removal Rate, Lathe operations (Turning, Facing, Boring, Drilling, Reaming, Threading, Knurling, Grooving, Parting, Chamfering), Methods of taper turning, Thread cutting attachment.**	**8**	**CO1**
II	***Shaper & Planer Machine*** **Construction of shaper, working principle, Specifications and types of shaper machine, Quick return mechanism, work holding devices for shaping, Special operations performed by shaper, Machining time and material removal rate.** **Construction of planer, Types of planning machine, specifications, work holding devices for planning, Operations performed by planner (planning of horizontal, angled, vertical and curved surfaces).**	**8**	**CO2**
III	**Drilling Machine** **Drilling operations, Nomenclature of twist drill, Drill angles, Types of drilling machine, Cutting force and power required in drilling, Reaming operation, Types of reamer, Boring operations, Boring Machines types, Tapping, various type of taps.**	**8**	**CO3**
IV	**Milling and broaching Process** **Types of milling machine, Milling cutters, Arbors, Up and Down milling, Types of milling operations (straddle milling, form milling, gang milling, slotting, slitting), Indexing, Removal Rate.** **Types of work done on broaching machine. Simpletypes of broaches and their uses, Types of broaching machines**	**8**	**CO4**
V	**Grinding and Finishing** **Types of grinding machine (horizontal and vertical), centered and centerless grinding, electrochemical grinding, Grinding wheels and designation, dressing of grinding wheel.** **Honing and superfinishing, lapping, polishing, nano-polishing, deburring, Abrasive flow machining. Economics of grinding and finishing operations.**	**8**	**CO5**
Guest Lectures (if any)			
Total Hours:		**40**	
Suggestive list of experiments: (if any)			

Text Books-

1. **SeropeKalpakjian and Steven R. Schmid – ''Manufacturing Engineering and Technology' – Prentice Hall – 2013 – 7th Edition**
2. **PC Sharma "Production Technology" Publisher S Chand**
3. **Hazra&Choudhary, "Workshop Tevhnology Vol. II" Tata Mc Graw Hill**

Reference Books-

1. **H.N. Gupta, "Manufacturing Processes, New Age International Publisher**
2. **E. P. DeGarmo, J. T. Black, and R. A. Kohser, "DeGarmo's materials and processesin manufacturing," John Wiley & Sons, 2011.**
3. **S. Kalpakjian, and S. R. Schmid, "Manufacturing processes for engineering materials," 5 th Ed. Pearson education, India, 2010**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1. Dr. Pradeep Singh** **Name 2:-**
Checked and approved by	**Name 1.Prof. Sanjay Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA, M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DC	Subject Code:	ME-602	Subject Name:	Automotive Technology

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:(Only for open electives)

Course Objective:

This course, designed to equip students with the knowledge, skills, and ethical mindset to design, analyse, maintain, and innovate, will prepare them to thrive in the rapidly changing automotive industry.

Course Outcomes:

After completion of the course, students would be able to -

1. **Understand the basic layout of Automobiles, Chassis and frames.**
2. **Understand the Operation of transmission Suspension, Steering and Breaking system.**
3. **Understand the role of electronics and control systems, focusing on the most recent developments in automotive technology.**
4. **Understand the different types of batteries and analyse their performance parameters.**
5. **Understand the battery charging requirements and develop the complete battery model.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2			1	1	1				
CO2	3	3	2	1			l					
CO3	3	3	2	1	1	1		1			1	
CO4	3	2	1	1	1	1	l					
CO5	1	1			3		2	1		1		1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Chassis & Body Engg: Types, Technical details of commercial vehicles, types of Chassis, layout, types of frames, testing of frames for bending & torsion on unutilised body frame, vehicle body and their construction, driver's visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, front wheel and rear wheel drive, four-wheel drive.**	**8**	**1**
II	**Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out, condition for true rolling motion, centre point steering, directional stability of vehicles, power steering, slip angle, cornering power, oversteer & understeer.** **Transmission System: Function and types of clutches, clutch lining and bonding, double-declutching, types of gear Boxes, synchronised, gear materials, determination of gear ratio for vehicles, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, differential gearbox, rear axle construction.**	**8**	**2**
III	**Suspension system: Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs, location of shackles, power calculations, resistance to vehicle motion during acceleration and braking, power & torque curve, torque & mechanical efficiency at different vehicle speeds.** **Brakes: Principle of braking system, braking mechanism, mechanical and hydraulic brakes, power brakes, vacuum and air brakes.** **Wheels and Tyres: Wheel drum, tyre, materials and manufacturing of tyers, troubleshooting and maintenance.**	**8**	**3**
IV	**Electrical and Control Systems: construction and operation of lead acid battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, horn, wiper, Lighting system, headlight dazzling, exhaust gas recirculation, electronic control unit (ECU), turbocharging, Multi valve engines.** **Electric Vehicles: introduction & history; working concepts; main components of electric vehicles; infrastructures of electric vehicles; Challenges and future trends.**	**8**	**4**
V	**Types of Batteries: Lead Acid Batteries, Nickel-based Batteries: Introduction, Nickel-cadmium, Nickel metal hydride batteries, Sodium-based Batteries, Lithium Batteries, Metal-Air Batteries,** **Battery Charging and Modelling: Battery Charging, Battery chargers, Charge equalisation, The Designer's Choice of Battery, Use of Batteries in Hybrid Vehicles, Internal combustion/battery electric hybrids, Battery/battery electric hybrids, Combinations using flywheels, Complex hybrids, Battery Modelling, the purpose of battery modelling, Battery equivalent circuit, Modelling battery capacity, Simulation a battery at a set power, Calculating the Peukert Coefficient, Approximate battery sizing**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

1. **To study and prepare a report on the construction details, working principles, and operation of an automotive vehicle.**
2. **To study and prepare a report on the construction details and working principles of the operation of the Automotive Engine and Sub Systems.**
3. **To study and prepare a report on the construction details and working principles of the automotive transmission systems.**
4. **To study and prepare a report on the constructional details, working principles, and operation of the automotive drive lines and differentials.**
5. **To study and prepare reports on the constructional details of working principles of the operation of the Automotive Steering Systems.**
6. **To study and prepare a report on the construction details, working principles, and operation of the Automotive Suspension Systems.**
7. **To study and prepare a report on the construction details, working principles, and operation of the Automotive Brake systems.**
8. **To study and prepare a report on the construction details, working principles, and operation of Electric vehicle**
9. **To study and prepare a report on the construction details of battery technology in electric vehicles.**
10. **To study and prepare a report on battery thermal management and a complete model investigation.**

Text Books-

1. **Automobile Engg. TR Banga&Nathu Singh.**
2. **Barak (Ed.), T. Dickinson, U. Falk, J.L. Sudworth, H.R. Thirsk, F.L. Tye, "Electrochemical Power Sources: Primary & Secondary Batteries", IEE Energy Series 1, A. Wheaton & Co, Exeter, 1980.**
3. **Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.**

Reference Books-

1. **Srinivasan S; Automotive engines; TMH.**
2. **Automobile Engg. GBS Narang.**
3. **Kripal Singh, Automotive Engineering Khanna Pub.**
4. **Newton & Steeds, Automotive Engineering.**
5. **James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology Explained**
6. **MehrdadEhsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 30 sessional marks and 60 semester End-term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid-semester, 20 marks to be awarded for day-to-day performance and Quizzes/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by the Board of Studies on	**Date:**
Approval by the Academic Council on	**Date:**
Compiled and designed by	**Name 1. Dr. Gopal Kumar Deshmukh**
Checked and approved by	**Name 1. Dr. Ashish Manoria**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-II	Subject Code:	ME-603(A)	Subject Name:	Mechatronics and Automation

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites☹Only for open electives)

Course Objective:

Study of Mechatronics and Automation is driven by several fundamental objectives, reflecting the multidisciplinary nature of these fields and their impact on various industries. Studying 7echatronics and automation equips individuals with the knowledge and skills needed to design intelligent, integrated systems, automate processes for efficiency and cost-effectiveness, and contribute to advancements in technology and innovation. The combination of these fields is particularly powerful in addressing the challenges of modern engineering and manufacturing

Course Outcomes:

After completion of the course, students would be able to –

1. **Understand the Control System.**
2. **Analyze the Sensors and Transducers**
3. **Analyze the Hydraulic and Pneumatics system and Circuits**
4. **Understand the Robotics ,Actuators and programmable Logic Controllers.**
5. **Analyze the Automation and industry 4.0.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2		3	3							
CO2	3			3								
CO3	3		3									
CO4	3				3							
CO5	3		3	2	3							

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Mechatronics Systems: elements of 8echatronics systems, measurements systems , control systems, transfer functions, procedure for determining the transfer functions of a control systems, representation of a control system by block diagrams, modeling a control system, transient and steady state response, time response of a first order control systems, time response of second order control systems**	**8**	**1**
II	**Sensors and Transducers, characteristics parameters used in transducers, displacement sensor, position sensors, proximity sensor, motion sensors, light sensors, liquid flow sensor , digital transducers, Incremental optical encoders, absolute optical encoders.**	**8**	**2**
III	**Hydraulic and Pneumatic Actuating systems, Hydraulic systems, Pneumatic systems, control valves, components of electro pneumatic systems, Pneumatic and Hydraulic circuits.**	**8**	**3**
IV	**Robotics and Programmable Logic Controllers :Degree of freedom of robotic system, robot joints, robot coordinates, robot characteristics, robot languages , classification of robots, application of robots, robot vision.** **Mechanical and electrical actuating systems, D.C. motors, A.C. motors, stepper motors, servomotor, programmable logic controllers, PLC programming, applications of PLC.**	**12**	**4**
V	**Automation: introduction, Principles and Strategies of Automation, safety Monitoring, maintenance and repair Diagnostics, error Detection and Recovery, levels of automations, Merits and Demerits of automation. Automated Guided Vehicles (AGV's) , Automated Storage and Retrieval System (ASRS),** **Automatic identification methods and Industry 4.0: Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies. Industry 4.0 strategy.**	**14**	**5**
Guest Lectures (if any)		**Yes-2**	
Total Hours		**50**	

Suggestive list of experiments:

1. **Obtain the speed torque characteristics of AC Servo Motors.**
2. **Obtain the speed torque characteristics of DC Servo Motors.**
3. **Calibration of LVDT KIT**
4. **Determination of force using strain gauge Kit.**
5. **Determination of Angle using Capacitive Pickup.**
6. **Determination of Pressure using Strain Gauge.**
7. **Measurement of Temperature using Thermocouples.**
8. **Study of ASRS.**
9. **Study of Hydraulic and Pneumatic Actuator systems.**
10. **Study of PLC.**

Text Books-

1. **Mechtronics, K P Ramchandran , Wiley India Pvt. Ltd.**
2. **Robotics : Introduction to Robotics by Saeed B Niku, Pearson Education Asia**

Reference Books-

1. Mechatronics, W. Boltan, Pearson Education.

2. Mechatronics, N P Mahalik,Tata McGraw-Hill Publishing Limited

3. Modern Control Systems, Katsuhiko Ogata, Prentice Hall

4.Hydraulics and Pneumatics: A Technician's and Engineer's Guide" by Andrew Parr

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr.Ravindra Mohan Saxena**
Checked and approved by	**Name 1Dr. Pankaj Agarwal**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-II	Subject Code:	ME-603 (B)	Subject Name:	Computer Integrated Manufacturing

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites☹Only for open electives)

Course Objective:

This course provides a simple understanding of the basic components of Computer Inegrated Manufacturing The course contains CIM, automation, control Strategies for automation, CAM, NC/DNC/CNC systems, Robot Technology, AS/RS, AGV systems, Group technology,FMS and Expert system.

Course Outcomes:

After completion of the course, students would be able to –

1. **A knowledge of automated process in a modern manufacturing environment.**
2. **An understanding of using automation, control strategies towards numerical control, robotics, automated storage and retrieval system, CIM, expert systems in manufacturing.**
3. **An understanding of 10anufacturin manufacturing/ production strategies such as group technology , agilemanufaturing, FMS**
4. **Design and analysis of part program of cnc ,PLC, AS/RS, FMS, Robot programming**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2	1	2	1	3		3	3
CO2	3	2	1	1	3		2		3		3	2
CO3	3	2	1	1	3	1	3		3		3	1
CO4	2	3	3	3				1	3			1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Introduction- Introduction, Modern manufacturing, Integration and rationalization, Elements of CIM system, CIM hardware and software, Implementating CIM, Advantages and limitations**	**6**	**1**
II	**Automation and Production Systems- History of automation, Building block of automation technology, Types of automation systems, Automation production economics, Viability appraisal for automated production** **Control Strategies for Automation System- Control process, Electrical and Mechanical Analogies, Laplace Transform, Transfer Function, Linear and Non-linear systems, Adaptive Control, Logical Sequence Control, PLCs and Networking for Automation**	**10**	**2**
III	**Computer Aided Manufacturing- Introduction, CAM hierarchy, Elements of CAM systems, CNC machine types, Classification, File Formats, Controllers, Hierarchical controls, Tooling on CNC, Fixtures on CNC, Rationale for CAD/CAM, NC, DNC, CNC and Adaptive control, Methods of Part-programming, CAM softwares**	**8**	**3**
IV	**.Robot, Automated Material Handling and Storage system- Robot anatomy, Robot Configuration, Robot control systems, Accuracy, Repeatability, End effectors, Robot programming, Robot languages, Robot applications, Automated material handling and storage system, Design of system, Automated guided vehicle systems, Automated retrieval systems.**	**8**	**4**
V	**Group Technology(GT),Computerized Manufacturing Planning System- Introduction, Part families, Part 11anufacturing11 and coding, Production flow analysis, Machine cell design, Celluar manufacturing systems, Agile 11anufacturing, Flexible manufacturing systems(FMS), Types of flexibility and uncertainty.** **Expert Systems- Introduction to expert systems, Need and classification,Artifial Intelligence**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

1. **Study of equipment available in CIM lab.**
2. **Study of Process Planning and Part Programming.**
3. **Study of Preparatory Functions (G- Codes)**
4. **Study of Miscellaneous Functions (M- Codes)**
5. **Preparation of a part program for given parts on CNC Lathe machine.**
6. **Preparation of a part program for given part on CNC Milling machine.**
7. **Study and part program preparation of AS/RS.**
8. **Study and Location setting of AGV.**
9. **Study and Location setting of Robotic Arm.**
10. **Study of working of the FMS by using CNC Lathe, CNC Milling, Transfer Conveyor, Robotic Arm,AS/RS, and AGV.**

Text Books:

1. **Production System & CIM by Groover: PHI**
2. **Automation Production Systems and Cmputer Integrated Manufacturing by Mikell P Groover: PHI**
3. **Principle of Automation and Advanced Manufacturing Systems By Dr K C Jain and Sanjay Jain**
4. **Robotics- Control, Sensing, Vision and Intelligence by K S Fu, RC Gonzalez and C S E Lee: Tata McGraw Hills**
5. **CAD/CAM: Principles and Applications by P N Rao: Tata McGraw Hills**
6. **CIM: Principle of Computer Integrated Manufacturing by J B Waldner: John Wiley & Sons**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Prof Sanjay Jain and Prof Neeraj Sen**
	Name 1.Dr Sanjay Katarey

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-II	Subject Code:	ME-603 (C)	Subject Name:	MODERN MANUFACTURING TECHNOLOGY(AI,IOT,DIGITAL MANUFACTURING)

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:(Only for open electives)

Course Objective:

The students are expected to understand special machining process, micromachining process etc, also students to know the fundamental of manufacturing and Industry 4.0,gain the knowledge of machine learning and data analytics. Students also understand the basics of AI in area of Manufacturing science.

Course Outcomes:

After completion of the course, students would be able to -

1. **To produce useful research output in machining of various material.**
2. **Application of knowledge to manage shop floor problem.**
3. **Emerging technologies to address IoT challenges.**
4. **Apply the smart factory concept in manufacturing industry.**
5. **Understand and apply the AI tool in manufacturing.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1			2	1					1
CO2	2			2			2		2			1
CO3	1	2	1	2		1						
CO4	2		2		2			2				3
CO5	2		1		1	2		1				3

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**MICRO MACHING AND NANO FABRICATION** **Theory of micromachining-Chip formation-size effect in micromachining-microturning, micromilling, microdrilling-Micromachining tool design-Micro EDM-Microwire EDM-Nano fabrication:LIGA, Ionbeametching,Moleculamanufacturingtechniques– Atomicmachining-Nanomachiningtechniques– Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum dot fabrication techniques – MOCVD – Epitaxy techniques.**	**5**	**1**
II	**RAPID PROTO TYPING AND SURFACE MODIFICATION TECHNIQUES** **Introduction – Classification – Principle advantages limitations and applications- Stereo lithography – Selective laser sintering –FDM, SGC, LOM, 3D Printing-Surface modification Techniques: Sputtering- CVD-PVD-Diamond like carbon coating-Plasma Spraying Technique.-Diffusion coatings-Pulsed layer deposition.**	**5**	**2**
III	**INTERNET OF THINGS FOR MANUFACTURING** **Technology of the IoT and applications,.IoT data management requirements, Architecture of IoT, Issues in implementing IoT, Technological challenges, Design challenges in IoT -Standardization, Security and privacy, Infrastructure, Analytics, Design principles for connected devices -Embedded devices, physical design, online components, embedded coding system. Informed Manufacturing plant – Elements, IoT implementation in Transportation and logistics, Energy and utilities, Automotive Connected supply chain, Plant floor control automation, remote monitoring, Management of critical assets,** **Applications HCI and IoT world -Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges**	**12**	**3**
IV	**SMART MANUFACTURING** **Industry 4.0:Basicprincipals and technologies of smart factory, Digitalization and Networked economy, Globalization and Emerging Issues, Artificial Intelligence nad Augmented reality in manufacturing ,human Robot collaboration, standards of industry 4.0 and cloud application, cloud Manufacturing and the connected factory, data analytics, Introduction and Importance and characteristics of Big data, Size of big data, Types of analytics ,model complexity, Over and Under fitting, Data management with Python** **Application in factory AND assembly line, food industry etc.**	**9**	**4**
V	**An Introduction to Implementing AI in Manufacturing** **Introduction, Potential of AI, challenges , Evolution of Artificial Intelligence ,Opportunities for Artificial Intelligence in Manufacturing ,Hierarchical Approach to Manufacturing Systems, Artificial Intelligence for Manufacturing System Optimization Modeling and Performance Analysis, Artificial Intelligence for Manufacturing**	**9**	**5**

	Applications of Human–Robot Collaboration ,Artificial Intelligence For Process Monitoring, Diagnostics, Prognostics, Practical Implementation of Artificial Intelligence in Manufacturing, Challenges and Opportunities for Future		
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

Text Books-

1. **Serope Kalpakjian., "Manufacturing Engineering and Technology" Pearson Education,2001**
2. **2.Adrian McEwan and Hakim Cassimally, "Designing the internet of things", Wiley, 2013**

Reference Books-

1. **Bandyopadhyay. A.K., Nano Materials, New age international publishers, New Delhi, 2008, ISBN:8122422578.**
2. **Bharat Bhushan, Handbook of nanotechnology, springer, Germany, 2010.**
3. **Jain V.K., 'Introduction to Micro machining' Narosa Publishing House, 2011**
4. **Code Halos: How the Digital Lives of People, Things, and Organizations are Changing the Rules of Business, by Malcolm Frank, Paul Roehrig and Ben Pring, published by John Wiley & Sons.**
5. **Internet of Things: A Hands-On Approach by Vijay Madisetti, ArshdeepBahga, VPT; 1st edition 2014**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Neeraj Sen**
Checked and approved by	**Name 1.Dr Sanjay Katarey**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-III	Subject Code:	ME-604(A)	Subject Name:	Industrial Engineering and Management

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10				100	3	1		4

Prerequisites:(Only for open electives)

Course Objective:

Course Outcomes:

After completion of the course, students would be able to -

1. **Able to perform Method Study and Time Study in a real time application using Modern Tools**
2. **Able to analyze Ergonomics and human factor demands of Industrial Environment**
3. **Able to prepare Planning related to Manufacturing**
4. **Able to suggest Jigs and fixtures as per job requirement**
5. **Able to analyze production process performance**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			3	2				2	3	1	
CO2	3	2	2	2		3	1	1	1		2	
CO3	3	1	2						2	2	1	
CO4	3											
CO5	3	2		3	1				2	2	3	2

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Productivity: Concept of production, types of production, concept of productivity, production Vs productivity, factors influencing productivity, Moslow's theory of hierarchy of needs, productivity Vs standard of living.**	**8**	**1**
II	**Method Study: Introduction to work study, definition of method study, basic steps of method study, process chart, recording techniques, diagrams and templates, Therblig, micro-motion study, SIMO chart, memo-motion study, principles of motion economy.**	**8**	**2**
III	**Time Study: Procedure of work measurement, apparatus required for time study, Rating, measuring the job, elements, allowances, standard time , synthetic data , analytical estimating, PMTS, work factor, MTM, activity sampling , applications, numerical problems.**	**8**	**3**
IV	**Human Factors Engineering: Introduction to ergonomics and human factorsEngineering, physiological basis of human performance, Biomechanics, Psychology of work and work load perception, Physical work environment, Basis of ergonomic problem identification, Safety**	**8**	**4**
V	**Production Planning and control: Types of production function of production planning and control, organization of production planning and control, pre-planning operation, planning of productive capacity plant, requirements of special tooling like jigs and fixtures. Routing, loading, scheduling, dispatching and follow-up, production control in intermittent manufacture and continuous manufacturing, bar chart, operation chart, flow chart, Gantt chart, sequencing, numerical problems**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

Text Books-

1. **Benjamin .W. Neibel, Motion and Time Study, Richard D. Irwin Inc., Seventh Edition, 1982.**
2. **Barnes, R.M. Motion and Time study, John Wiley, 1980.**
3. **Stephen Konz, Work Design, Publishing Horizon Inc., Second Edition, 1979.**
4. **Industrial Engineering and Production Management by Jain, Verma&Kartikeya, Dreamtech Publication 2013.**
5. **Jain and Agrawal, Production Planning & Control and Industrial Management, Khanna publishers**

Reference Books-

1. **Buffa, sarin, Modern Production/Operations Management, 8/e, John Wiley & Sons**

2. **Bridger R.S., Introduction to Ergonomics, McGraw Hill, 1995**
3. **ILO, Work Study, ILO Publication.**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh**
Checked and approved by	**Name 1.Prof. Sanjay Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-III	Subject Code:	ME-604(B)	Subject Name:	Production Planning and Control

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10				100	3	1		4

Prerequisites:(Only for open electives)

Course Objective:

Course Outcomes:

After completion of the course, students would be able to -

1. **Explain production systems and their characteristics.**
2. **Evaluate MRP and JIT systems against traditional inventory control systems.**
3. **Evaluate basics of variability and its role in the performance of a production system.**
4. **Analyze aggregate planning strategies.**
5. **Apply forecasting and scheduling techniques to production systems**
6. **Apply theory of constraints for effective management of production systems**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			3	2				2	3	1	
CO2	3	2	2	2		3	1	1	1		2	
CO3	3	1	2						2	2	1	
CO4	3											
CO5	3	2		3	1				2	2	3	2
CO6	3	2		3	1				2	2	3	2

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Introduction to Production Systems: Production Systems: Classification & Characterization, Overview of Production Planning and Control issues, Review of EOQ & inventory control systems**	**8**	**1**
II	**Material Requirement Planning: Dependent Demand & Material Requirement Planning, Structure of MRP system, MRP Calculations, Planning Issues, Implementation Issues.**	**8**	**2**
III	**Just in Time Production Systems: Just-in-Time System: Evolution, Characteristics of JIT Systems, Continuous Improvement, Kanban System, Strategic Implications of JIT System. Push and pull production systems.**	**8**	**3**
IV	**Aggregate Planning: Aggregate Planning: Purpose & Methods, Reactive and Aggressive Alternatives, Planning Strategies, LP Formulation, Master Production Scheduling.Flow Shop, Job Shop Dispatching**	**8**	**4**
V	**Forecasting Methods: Demand Forecasting: Principles and Methods, Judgment methods, Causal methods, Time-series methods** **Theory of Constraints: Concept of bottleneck, Local and global optima, Five steps of TOC approach, Performance measures.**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

Text Books-

1. **Krajewski L.J. and Ritzmen L.P., "Operations Management: Strategy and Analysis", 9th Edition, Pearson Education, 2010.**
2. **Chase R.B. Jacobs F.R. and Aquilano N.J., "Operations Management for Competitive Advantage", 11th Edition, Tata McGraw Hill Book Company, New Delhi, 2010.**

Reference Books-

1. **Hopp W. J. and Spearman M. L. "Factory Physics: Foundations of Manufacturing Management", McGraw Hill International Edition, 3rd Edition, 2008.**
2. **Mukhopadhyay S.K., "Production Planning and Control", 2nd Edition, PHI, Eastern Economy Edition, 2013.**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh**
Checked and approved by	**Name 1.Prof. Sanjay Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DE-III	Subject Code:	ME-604(C)	Subject Name:	Reliability Engineering and TPM

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10				100	3	1		4

Prerequisites:(Only for open electives)

Course Objective:

Course Outcomes:

After completion of the course, students would be able to -

1. **learn basic Concepts of Reliability and reliability distribution**
2. **analyze various reliability models**
3. **apply reliability testing methods**
4. **learn reliability centred maintenance**
5. **analyze failure modes and effects**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1			1	1			1	1
CO2	1	2	3	3			1	1			2	
CO3	1	2	2	3			1	1			1	1
CO4	1	2	2	3			1	1			1	1
CO5	1	2	2	3			1	1			1	1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Basic Concepts of Reliability: Probability distributions used in maintenance engineering- Binomial, Poisson, Exponential, Normal, Log-normal, Gamma and Weibull distribution; failure rate, hazard rate, failure modes, MTTR, MTBF, MTTF**	**8**	**1**
II	**System Reliability Models: System reliability–n-component series systems, m-component parallel systems and combined system; standby systems; K-out-of-m systems; redundancy techniques in system design; event space, decomposition (Key Stone), cut and tie sets, Markov analysis, reliability and quality, unreliability, maintainability, availability**	**8**	**2**
III	**Reliability Testing: Introduction, testing requirements, testing methods: Marginal Testing, Non- destructive testing, reliability tester, acceleration models, SWOT analysis**	**8**	**3**
IV	**Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM, Terro technology, Six Big Losses autonomous Maintenance. Reliability centered maintenance: concept, methodology, benefits**	**8**	**4**
V	**Failure Modes and Effects Analysis (FMEA) Failure Modes and Effects Analysis (FMEA) Failure Modes, Effects and Criticality Analysis (FMECA):Overview, elements of FMECA applications and benefits, risk, evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

Text Books-

1. **Ebeling CE; An Introduction To Reliability & Maintainability Engg; TMH**
2. **Srinath L.S; Reliability Engineering; East West Press.**
3. **Naikan; Reliability engg and life testing; PHI**
4. **Kapur KC and Lamberson LR; Reliability in Engineering Design; Wiley India**
5. **Telang AD and Telang A; Comprehensive Maintanance Management; PHI**
6. **Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.**
7. **Dhillon; EnggMaitainability- How to design for Reliability and easy maintenance; PHI**
8. **Davidson John; The Reliability of mechanical system; Institution of Mech. Engineers, London**

Reference Books-

1. **Patrick D.T and O.'Connor; Practical Reliability Engineerin; John Wiley and Sons**
2. **Modarre M; Reliability and Risk Analysis, Marcel Dekker Inc CRC Press**
3. **Balaguruswamy; Reliability Engg; TMH**

Modes of Evaluation and Rubric	
There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.	
Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh**
Checked and approved by	**Name 1.Prof. Sanjay Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DLC	Subject Code:	ME- 606	Subject Name:	LAB-III

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			Total Marks				
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
-	-	-	30	20	10	50	-	-	4	2

Prerequisites:(Only for open electives)

Course Objective:

The main learning objective of this course is all about learning and completing the exposure required for effective usage of the Ansys Workbench Software.

Course Outcomes:

After completion of the course, students would be able to perform-

1. **Meshing of geometries analysis**
2. **Static Structural analysis**
3. **Modal analysis**
4. **Thermal, Thermo-structural analysis**
5. **buckling analysis**
6. **experiments on dynamics**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3				2			3
CO2	3	3	3	1	3				2			2
CO3	3	3	3	1	3				2			2
CO4	3	3	3	1	3				2			2
CO5	3	3	3	1	3				2			2

Contents:

UNITs	Descriptions	Hrs.	CO's
	Hands on exposure will be provided on some of the elective subjects that are included in V and VI semester under departmental category. Objective of this is to provide introductory exposure to subjects which could not be included as regular subjects. **Practical sessions includes industrial and academic examples for learning how to apply Ansys Workbench software for efficiently performing different kinds of Simulations, HyperMesh**	**30**	

Guest Lectures (if any)		
Total Hours		

Suggestive list of experiments: (if any)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Text Books-

1.

Reference Books-

1.

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh** **Name 2:**
Checked and approved by	**Name 1.Prof. Sandeep Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		VI/III	Program		B.Tech.
Subject Category	DLC	Subject Code:	ME-607	Subject Name:	Internship II & Seminar

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
				30	20		50	0	0	4	2

Prerequisites:(Only for open electives)

Course Objective:

The course objectives are designed to seamlessly align with the educational goals of the program, offering learners a structured framework for experiential learning. By integrating theoretical knowledge with practical application, these objectives aim to equip students with hands-on experience, enhance their professional skills, and provide insights into industry practices. The structured framework ensures that students engage meaningfully in their internship, fostering a dynamic learning environment that contributes to their overall academic and professional development.

Course Outcomes:

After completion of the course, students would be able to –

1. **CO1:Demonstrate the application of engineering principles and technical skills in a real-world setting.**
2. **CO2:Exhibit professional conduct and ethical behaviour in engineering practice.**
3. **CO3:Plan, execute, and complete engineering projects within specified timelines.**
4. **CO4:Communicate technical information and collaborate within a multidisciplinary team.**
5. **CO5:Apply critical thinking skills to analyze and solve engineering problems.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		**3**		**3**								**3**
CO2								**3**				
CO3											**3**	**3**
CO4									**3**	**3**	**3**	
CO5		**3**		**3**								**3**

Contents:

UNITs	Descriptions	Hrs.	CO's
I	**Applied Engineering Knowledge and Skills**	**4**	**1**
II	**Professional and Ethical Behavior**	**4**	**2**
III	**Project Management and Execution**	**4**	**3**
IV	**Communication and Teamwork**	**4**	**4**
V	**Critical Thinking and Problem-Solving**	**4**	**5**
Guest Lectures (if any)			
Total Hours		**20**	

Modes of Evaluation and Rubric

Performance Indicator	Poor (50% OF A/B/C/D/E)	Fair (60% A/B/C/D/E)	Good (80% A/B/C/D/E)	Excellent (100% A/B/C/D/E)	PO's
[A] Timeline scheduled. [MARKS= 10% OF MAXIMUM MARKS]	**Not scheduled and not followed**	**Not scheduled and not followed**	**Scheduled but not followed strictly**	**Scheduled and followed strictly**	**PO8, PO11**
[B] Usage of the latest application and software [MARKS= 10% OF MAXIMUM MARKS]	**No latest applications and software's used**	**Slightly Outdated**	**Moderate Usage of new technology**	**latest applications and software are used**	**PO5**
[C] Proper documentation work [MARKS=	**Poor Documentation**	**Average documentation**	**Good Documentation**	**Excellent Documentation**	**PO10**

20% OF MAXIMUM MARKS]					
[D] Presenting skills, Fluency, and Vocabulary **[MARKS= 30% OF MAXIMUM MARKS]**	**Poor Skills**	**Less confidence, vocabulary needs to be improved**	**Good confidence, but lack of communication skills**	**Good confidence, but lack of communication skills**	**PO10**
[E] Slide Organization and Contents time conscious **[MARKS= 30% OF MAXIMUM MARKS]**	**Poor Organization and least time management**	**Content is not organized properly**	**Content is organized properly but no effective time management**	**Content is organized properly and effective time management**	**PO10**

There will be continuous evaluation during the semester for 50 practical marks. **The practical marks are 50, out of which 30 marks will be awarded for Power Point Presentation and 20 marks for lab work.** **20 marks for lab work to be awarded for day-to-day performance.**	
Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Ravindra Mohan**
Checked and approved by	**Name 1.Dr. Ashish Manoria**