DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.S.S/ Sci & Tech./M.Voc/NEP/23/2025.

It is hereby inform to all concerned that, on recommendation of the Dean, Faculty of Science & Technology **Academic Council at its meeting held on 19th May, 2025 has accepted the following 1} M. Voc in Industrial Automation 2} M. Voc in Automobile Technology Two Years Industry Embedded P. G. Program** under the Faculty of Science & Technology run at the Deen Dayal Upadhyay Kaushal Kendra, Dr. Babasaheb Ambedkar Marathwada University as appended herewith.

This is effective from the Academic Year 2024-25 onwards under the Faculty of Science & Technology.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431004.
Ref. No. S.S/P. G. Course/2024-25/1486-88
Date: 12/ 06/ 2025

Deputy Registrar,
Syllabus Section

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Copy forwarded for Information and necessary action:-

1] **The Director, Deen Dayal Upadhyay Kaushal Kendra, Dr. Babasaheb Ambedkar Marathwada University.**
2] **The Director, Board of Examinations & Evaluation,**
3] **The Director,** University Network & Information Centre, UNIC, with **a request to upload the curriculum along with this Circular on University Website.**
Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR-431004 (M.S.), INDIA

FACULTY OF SCIENCE AND TECHNOLOGY

Master of Vocation in Industrial Automation

(M. VOC. in Industrial Automation)

(2 Years Industry Embedded P.G. Program)

As Per

National Education Policy-2020

Course Structure and
Outcome based Curriculum

For University Department

Deen Dayal Upadhyay KAUSHAL Kendra
(Department with Academic Autonomy)

Effective from the Academic Year 2024-25

SYLLABUS FOR SEMESTER - II

M.VOC. Industrial Automation

Course and Credit Distribution Structure
For
Two Years Post Graduate Programme
M. VOC. First Year Semester: Second
Subject: Industrial Automation

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Marks		Total Credits
			TH	PR	TH	PR	MIN	MAX	
Discipline Specific Core Course (DSC) Mandatory	MIAT/MJ/550	Robotics for Industrial Automation	2	--	2	--	20	50	14
	MIAT/MJ/551	Embedded Systems	2	--	2	--	20	50	
	MIAT/MJ/552	Manufacturing Systems	2	--	2	--	20	50	
	MIAT/MJ/553	Project Management-II	2	--	2	--	20	50	
	MIAP/MJ/554	Practical Based on MIAT/MJ/550	--	4	--	2	20	50	
	MIAP/MJ/555	Practical Based on MIAT/MJ/551	--	4	--	2	20	50	
	MIAP/MJ/556	Practical Based on MIAT/MJ/552	--	4	--	2	20	50	
DSE (Choose any one from pool of Course)	MIAT/DSE/557A	Industry 4.0	2	--	2	--	20	50	4
	MIAP/DSE/557A	Practical/Case Study Based on MIAT/DSE/557AT	--	4	--	2	20	50	
	OR								
	MIAT/DSE/557B	Computer Integrated Manufacturing	2	--	2	--	20	50	
	MIAP/DSE/557B	Practical/Case Study Based on MIAT/DSE/557BT	--	4	--	2	20	50	
OJT/FIELD PROJECT	MIA/OJT/FP/558 (Field Project)		--	8	4	4	40	100	4
			10	24	10	12	220	550	22

MIAT/MJ/550: Robotics for Industrial Automation

Total Credits : 02 **Total Contact Hours : 30 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Fundamental concepts of industrial robots
2. Operational framework of robots in industrial automation

Course Outcomes (COs) :

On completion of the course, students should be able to –

1. Explain foundational concepts on industrial robots and its peripherals
2. Analyze robot motion in world space
3. Evaluate application domains of industrial robots

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H		H			M					H	H	H	H
CO2	H	H	H		H			M					H	H	H	H
CO3	H	H	H		H			M					H	H	H	H

Module No.	Course Content	Contact Hours
I	**Fundamental Concepts** Robotics in industrial automation framework, Definition and laws of robotics, Robot systems and anatomy, Robot classifications, Robot Control Systems, Programming methods, Specifications of industrial robots	10 Hrs
II	**Mathematical Foundation** Manipulator Kinematics – Forward and Inverse (2, 3 and 4 DOF manipulators), Homogenous Transformation, Kinematic Equations using homogenous transformation, Inverse Kinematics, Manipulator Path Control	10 Hrs
III	**Application Considerations** Approach for implementing robots, Quantitative techniques for economic performance, Safety considerations, Application case studies	10 Hrs

Text Books:

- S. R. Deb, S. Deb 'Robotics Technology and Flexible Automation', Second Edition, McGraw Hill (India) Private Limited, 2016
- M. P. Groover, M. Weiss, R. N. Nagel. N. G. Odrey, A. Dutta, 'Industrial Robotics-Technology, Programming and Applications' , Second Edition, Tata McGraw Hill Publishing Co. Ltd; 2012

Reference Books:

- R. K. Mittal, I. J. Nagrath, 'Robotics and Control' , 23rd Reprint, McGraw Hill Education (India) Private Limited, 2013
- S. K. Saha, 'Introduction to Robotics', Third Edition, McGraw Hill Education (India) Private Limited, 2024

- R. K. Rajput,' Robotics and Industrial Automation', Second Edition, S. Chand and Company Pvt. Ltd., 2016
- A. K. Gupta, S. K. Arora, J. R. Westcott, ' Industrial Automation and Robotics', First Edition, Mercury Learning and Information, 2017

Online Reference:

- https://archive.nptel.ac.in/courses/112/105/112105249/
- https://nptel.ac.in/courses/107106090

MIAP/MJ/554: Practical Based on MIAT/MJ/550

Total Credits : 02 **Total Contact Hours : 60 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Primary Exposure to design and control of robot motions
2. Operational ideas concerning positions, velocity and acceleration synthesis of basic robotic motions

Course Outcomes (COs) :

On completion of this course, students should be able to-

1. Relate geometric relation between input and output motion parameters of industrial robots
2. Recognize formation of transformation matrix
3. Verify robot position for a particular set of joint solution and joint angles
4. Develop basic program for operational motion of an industrial robot in base coordinate system

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

At least five experiments have to be performed

1. Study of Quick Return Mechanism.
2. Study of Forward Kinematics of a Six axis Industrial Robot and Formation of Transformation Matrix
3. Study of Forward Kinematics of a Six axis Industrial Robot and Formation of Transformation Matrix
4. Performance of Offline Robot Teaching using VAL Programming for basic jogging
5. Study of a heavy payload industrial robot to identify geometric relationship between input and output motion parameters
6. Program a six axis industrial for pick and place operation of object on same plane
7. Program a six axis industrial for pick and place operation of object on orthogonal plane

(Experiments can be performed on Virtual Lab Platform, an MoE, Govt. Of India initiative)

https://mr-iitkgp.vlabs.ac.in/List%20of%20experiments.html

MIAT/MJ/551: EMBEDDED SYSTEMS

Total Credits :02 Total Contact Hours : 30Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Fundamental concepts of ARM Controller
2. Operational framework of Embedded Systems

Course Outcomes (COs):

On completion of the course, students should be able to –

1. Explain foundational concepts on ARM design philosophy
2. Study ARM instruction set.
3. Analyze Embedded system hardware and software.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Fundamental Concepts of ARM processor**	10 Hrs
	ARM processor and its features , ARM architecture , Risc design philosophy, ARM design, ARM bus technology, AMBA Bus technology , Embedded system software	
II	**ARM Instruction set**	10 Hrs
	Fundamentals of ARM Instructions ,Data types, Conditional Execution, Barrel shifter with example, Classification of instructions ,Data processing Instructions, Multiply Instructions, Zero Instruction, Swap instruction, Branch Instruction, Load and Store Instruction, Multiple register , Software Interrupt Instruction.	
III	**Application and Thumb and ARM programming**	10 Hrs
	ARM Applications , Introduction to Thumb, Difference between ARM and Thumb, Register usage in Thumb, Structure of ARM assembly module.	

TextBooks:

- Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things by Peter Marwedel | 25 January 2021 | 4th Edition
- E. A. Lee and S. A. Seshia,. Introduction to Embedded Systems - A Cyber-Physical Systems Approach,. Second Edition, MIT Press, 2017

Reference Books:

- ARM Controller by A.P.Godse Technical publications
- Fundamentals of System-on-Chip Design on *Arm* Cortex-M *Microcontrollers* · Modern System-on-Chip Design on *Arm* · Beginner's Guide to Designing Embedded Systems ...

- A.N. Sloss, D. Symes and C. Wright, "ARM System Developer's Guide: Design and Optimizing System Software", Morgan Kaufman Publishers, 2004.

Online Reference: http://www.ietf.org/rfc/ien/ien137.txt.

- https://archive.nptel.ac.in/courses//
- https://nptel.ac.in/courses/107106090

MIAP/MJ/555: Practical Based on MIAT/MJ/551

Total Credits :02 **Total Contact Hours: 60Hrs**

Maximum Marks: 50

Learning Objectives of the Course:

To provide students with-

1. Primary Exposure to understand ARM
2. Introduce the outline architecture of ARM controller including basics

Course Outcomes (COs):

On completion of this course, students should be able to-

1. Students should be able to understand the main features of the ARM based Embedded System development environment.
2. After studying this course, students will be able to: Understand the instruction set of 32-bit microcontroller ARM Cortex M3, and the.
3. software tool required for programming in Assembly and C language.
4. Develop assembly language programs using ARM Cortex M3 for different applications.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

At least five experiments have to be performed

1. Study of structure of an assembly language program.
2. Study assembly directives to allocate memory in the data section.
3. Introduce the idea that ARM is a Load-Store Architecture and data has to be moved to registers before any operations can be performed on them.
4. Program to find square of number (1 to 10) using lookup table.
5. Program for, if there is a constant whose size is greater than 16 bits
6. Program for Converting a complex expression into an assembly program evaluating that expression
7. Program for Translating if-then-else statements into assembly
8. Program for Writing loops in assembly
9. Study of IDE and ARM development board usage & program execution.

(Experiments can be performed on Virtual Lab Platform, an MoE, Govt. Of India initiative)

https://cse11-iiith.vlabs.ac.in/exp/arm1/objective.html

MIAT/MJ/552: Manufacturing System

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Basic aspects of production system
2. Knowledge of management issues that must be addressed in implementation of manufacturing systems
3. Various mathematical models of production performance and manufacturing

Course Outcomes (COs) :

On completion of the course, students should be able to –

1. Explain basic dimensions of modern production systems
2. Describe mathematical models of production performance and manufacturing costs
3. Discuss classification scheme of Manufacturing Systems

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Production systems**	**10 Hrs**
	Production systems, automation in production systems, automation principle and strategies, manufacturing industries and products, manufacturing operations, production facilities	
II	**Mathematical models of Production performance**	**10 Hrs**
	Mathematical models of Production performance: production rate, production capacity, utilization and availability, manufacturing lead time, work in process, manufacturing costs	
III	**Manufacturing systems**	**10 Hrs**
	Components of manufacturing systems: production machines, material handling systems, computer handling system, human resources; Classification Scheme for Manufacturing Systems: types of operations performed, number of workstations, system layout, automation and manning levels, part or product variety; Overview of classification scheme: single station cells, multi-station systems with fixed routing, multi-station systems with variable routing	

Text Books:

- Mikell P Groover, 'Automated Production Systems, and computer integrated manufacturing', Third Edition, Pearson Education, Inc. 2016, ISBN-978-93-325-4981-4

- Kapil Gupta, 'Advanced Manufacturing Technologies- Modern Machining, Advanced Joining, Sustainable Manufacturing', Springer. 2017, ISBN 9783319560984; 9783319560991
- Tien-chien Chang, Richard A Wysk, Hsu-Pin Wang, 'Computer aided manufacturing", Third Edition, Pearson Education, Inc. 2019 ISBN: 978-81-317-2164-3
- A.Alavudeen, N. Venkateshwaran 'Computer aided manufacturing', PHI Learning Private Limited, 2008. ISBN: 978-81-203-3345-1

Reference Books:

- K.K. Shivanand, M.M.Benal,V.Koti, 'Flexible Manufacturing System', New age Publishers, ISBN-10 : 8122418708, ISBN-13 : 978-8122418705
- Mikell P Groover, 'Fundamentals of Modern Manufacturing: Materials, processes and systems', Fifth Edition, Wiley. 2012, ISBN-978-11-183-9367-3
- Er. R. K. Rajput 'Robotics and Industrial Automation', S. Chand and Company, 2016, ISBN: 978-81-219-2997-4
- P.N.Rao, N.K.Tewari, T.K.Kundra 'Computer aided manufacturing', Tata McGraw Hill Education Pvt. Ltd, 2017, ISBN-13: 978-0-07-463103-4 and ISBN-10:0-07-463103-9
- S. Kant Vajpayee, ' Principles of Computer-Integrated Manufacturing', PHI Learning Private Limited, 2015, ISBN-978-81-203-1476-4

Online Reference:

- https://nptel.ac.in/courses/112107077/
- https://nptel.ac.in/courses/112104028/3
- https://nptel.ac.in/courses/112107078/

MIAP/MJ/556: Practical Based on MIAT/MJ/552

Total Credits : 02 **Total Contact Hours : 60 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Primary Exposure to manufacturing processes
2. Operational ideas of manufacturing systems

Course Outcomes (COs) :

On completion of this course, students should be able to-

1. Recognize advance manufacturing processes
2. Verify mathematical models with respect to local industries

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

At least five experiments have to be performed

(Student has to perform any five experiments from sr.no. 1 to 7 OR students have to perform Experiment no 08 only by visiting the industry in person and calculate all mathematical models as per Theory course as advised by the faculty)

1. Study of stereolithography (SLA) process
2. Study of Fused Deposition Modelling (FDM) Process
3. Study of Selective Laser Sintering (Non-Metal) Process
4. Study of Selective Laser Sintering (Metal) Process
5. Study of Laminated object manufacturing Process
6. Study of Project Investment using Internal Rate of Return (IRR) method
7. Study of Project Investment using Net Present Value (NPV) and PI method
8. Study the Mathematical models with respect to Local industry

(Experiments can be performed on Virtual Lab Platform, an MoE, Govt. Of India initiative)
(Expt. 1 to 5 from https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html)
(Expt. 6 to 7 from http://vlabs.iitkgp.ac.in/gs/index.html)

MIAT/MJ/553 : Project Management - II

Total Credits : 02 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Basics knowledge of crashing project, risk management
2. Understanding of outsourcing negotiation

Course Outcomes (COs) :

On completion of the course, students should be able to-

1. Holistic view of project management covering among others project risk and quality management, procurement and contract management
2. Developing leadership skills and managing PM team, project performance evaluation, project audit and closure.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						H	H	H	H	H	H	H				
CO2						H	H	H	H	H	H	H				
CO3						H	H	H	H	H	H	H				

Module No.	Course Content	Contact Hours
I	**Reducing Project Duration and Managing Risks**	10 Hrs
	Reducing Project duration - Crashing project activities to speed up a project Project Risk Management - Identification, quantification, and mitigation of risks	
II	**Outsourcing, Negotiation, and Procurement in Projects**	10 Hrs
	Project Outsourcing, Negotiation, and Managing inter-organizational Relations Project Procurement and Contract Management	
III	**Project Evaluation, Performance, and Closure**	10 Hrs
	Project Evaluation, Project progress and Performance Management Project Closure, and Project Oversight	

Text Books:

- Fundamentals of Quality Control and Improvement by Mitra, Amitava; Wiley India Pvt Ltd, ISBN- 9781118491645
- Project Management (A Strategic Managerial Approach) by Meredith ISBN: 0471073237

Reference Books:

- The certified six sigma Green Belt Handbook,by Roderick A. Munro and Govindarajan Ramu and Daniel J. Zrymiak,; ASQ Quality Press and Infotech Standards India Pvt. Ltd. , ISBN-978087389891:
- The Certified Six Sigma Black Belt Handbook by T. M. Kubiak and Donald W. Benbow; Pearson Publication, ISBN- 9788131728697

Online Reference:

- https://nptel.ac.in/courses/110105167

MIAT/DSC/557: Industry 4.0

Total Credits :02 Total Contact Hours : 30Hrs

Maximum Marks: 50

Learning Objectives of the Course:

To provide students with-

1. basic idea in Industry 4.0.
2. good depth of knowledge of designing Industrial 4.0 Systems for various application.
3. design and analysis of Industry 4.0 systems for Energy and smart vehicular application

Course Outcomes(COs):

On completion of the course, student will be able to

1. Understand the basic concepts of Industry 4.0 and the other related fields.
2. Understand cyber physical system and the emerging applications.
3. Analyze the different energy storage systems

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**INTRODUCTION TO INDUSTRY 4.0**	10Hrs
	Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances	
II	**Industry 4.0 and Technologies & Design Principles**	10Hrs
	Network Operator Requirements, IoT Platform Design Specification – Requirements, Process, Domain Model, Service, IoT Level, Function, Operational view, Device and Component Integration, Application development. File Handling, Python Packages for IoT, IoT Physical Servers – Cloud Storage Models, Communication APIs	
III	**Communication, Smart Applications**	10Hrs
	Protocols – MQTT, OPC UA, EtherNet/IP, Profinet, EtherCAT, etc; MQTT – History, MQTT broker, Message types, Quality of Service (QoS), Application; OPC UA – History, Specification, Client, Server, Programming with – Free and open-source software, Propriety software; Augmented Reality; Understanding Smart	

	Appliances -Smart Operation-Smart Monitoring-Smart Energy; Savings-Smart Maintenance, Case study-Smart Cars, Self-Driving Cars, Introducing Google's Self-Driving Car, Intellectual Property Rights	

TextBooks:

- Jean-Claude André, —Industry 4.0||, Wiley- ISTE, July 2019, ISBN: 781786304827,2019
- Diego Galar Pascual, Pasquale Daponte, Uday Kumar, —Handbook of Industry 4.0 and SMART Systems|| Taylor and Francis,2020
- Miller M, —The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world||, Pearson Education, 2015, ISBN: 9780134021300.

Reference Books:

- Pengwei Du and Ning Lu, —Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs ||, Academic Press, 2018, Reprint edition, ISBN-13:978-0128100714
- Hossam A. Gabbar, —Smart Energy Grid Engineering||, Academic Press, 2017, ISBN 978-0-12-805343-0.

Online Reference:

- http://www.mqtt.org
- https://opcfoundation.org/about/opc-technologies/opc-ua/
- https://www.profibus.com/pi-organization/about-pi/organization-communitu/
- https://www.ethercat.org/default.htm

MIAP/DSE/557A: Practical/Case Study Based on MIAT/DSE/557AT

Total Credits :02 **Total Contact Hours:60Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Impart knowledge of smart manufacturing for industry 4.0 for making student innovative.
2. Understand could-computing IoT platform for Smart Manufacturing.
3. Understand machine learning to make smart factories.
4. Understand application of hardware, communication protocol, IOT platform, machine
5. learn to implement IoT for smart manufacturing for the need of Industry 4.0.

Course Outcomes(COs):

On completion of the course, student will be able to

1. Introduce concept of Industry 4.0 for Smart Manufacturing.
2. Understand use various hardware used in Smart Manufacturing.
3. Understand need of various communication protocols. hardware and software, IoT Layers
4. and their relative importance.

CO –PO – PSO Articulation Matrix																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Student has to perform either practical or case study

Practical Based on MIAT/DSE/557AT
At least five experiments have to be performed

1. Python Programming (Any three practical's/ Programs)
2. Arduino Programming, Integration of Sensors and Actuators with Arduino,
3. Raspberry Pi, Implementation of IoT with Raspberry Pi
4. Creation of Things Speak Account
5. Actuator Controlling Through Cloud
6. Dht11sensor Data To Cloud
7. Iot Based Air Pollution Control System
8. Tds Sensor Interfacing With Arduino
9. Actuator Controllingby Mobile Using Arduino

(Experiments can be performed on Virtual Lab Platform, an MoE, Govt. Of India initiative)

EXP 1- https://python-iitk.vlabs.ac.in/
EXP 2- https://ggnindia.dronacharya.info/CSE-IOT-CS/Downloads/Labmanuals/Sensors-and-Actuators-28072023.pdf
EXP 3 - https://ai.thestempedia.com/example/thinkspeak-send-data-to-cloud-dht-sensor/
EXP 5 to 9 - https://vemu.org/uploads/lecture_notes/28_12_2022_411037496.pdf

Case Study Based on MIAT/DSE/557A

Student has to make a case study on MIAT/DSE/557A in consultation with the concerned faculty.

MIAT/DSE/557B: Computer Integrated Manufacturing

Total Credits : 02 **Total Contact Hours : 30 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Basic traits of Computer Integrated Manufacturing
2. Introductory concepts of computer graphics and computer geometric modelling
3. Fundamental concepts of NC and CNC machines
4. Diversified spectrum of Computer Aided Manufacturing

Course Outcomes (COs) :

On completion of the course, students should be able to –

1. Recognize the diversified role of computers in modern manufacturing fabric
2. Describe basic traits of computer-based design related to manufacturing industries
3. Explain NC and CNC machines
4. Discuss different horizon of computer aided modern manufacturing

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H		H			M					H	H	H	H
CO2	H	H	H		H			M					H	H	H	H
CO3	H	H	H		H			M					H	H	H	H

Module No.	Course Content	Contact Hours
I	**Introduction to Computer Integrated Manufacturing (CIM)**	10 Hrs
	Introduction to CIM, Data flow in CIM, CIM wheel, Processes involved in CIM, Necessity of CIM, Advantages, CIM integration, Applications of CIM, Challenges, Subsystems in CIM, Present industry scenario	
II	**Computers and Manufacturing System**	10 Hrs
	Computers in manufacturing industries – Concepts of Industry 4.0, Artificial Intelligence, Machine learning, Deep learning, Digital learning, Smart manufacturing, IOT, Cloud based manufacturing; Future Prospects; Computer Graphics – Concept of design, Coordinate systems	
III	**Computer Aided Manufacturing**	10 Hrs
	Introduction to group technology, Benefits, Part Family, Coding systems, Limitations of GT; Process planning details, Stages of computer aided process planning stages; CAD/CAM integration; Advance manufacturing planning; Flexible Manufacturing System – Introduction, FMC/FMS components, FMS applications consideration;	

Text Books:

- Mikell P Groover, 'Automated Production Systems, and computer integrated manufacturing', Third Edition, Pearson Education, Inc. 2016, ISBN-978-93-325-4981-4
- Kapil Gupta, 'Advanced Manufacturing Technologies- Modern Machining, Advanced Joining, Sustainable Manufacturing', Springer. 2017, ISBN 9783319560984; 9783319560991

Reference Books:

- Tien-chien Chang, Richard A Wysk, Hsu-Pin Wang, 'Computer aided manufacturing', Third Edition, Pearson Education, Inc.; ISBN: 978-81-317-2164-3
- A.Alavudeen, N. Venkateshwaran 'Computer aided manufacturing', PHI Learning Private Limited, 2008. ISBN: 978-81-203-3345-1
- K.K. Shivanand, M.M.Benal, V.Koti, 'Flexible Manufacturing System', New age Publishers; ISBN-13 : 978-8122418705
- S. Kant Vajpayee, ' Principles of Computer-Integrated Manufacturing', PHI Learning Private Limited, 2015, ISBN-978-81-203-1476-4

Online Reference:

- Lectures of Professor J. Ramkumar (Department of Mechanical Engineering, IIT, Kanpur) on 'Computer Integrated Manufacturing' available with NPTEL ; https://nptel.ac.in/courses/112/104/112104289/

MIAP/DSE/557B: Practical/ Case study Based on MIAT/DSE/557B

Total Credits : 02 **Total Contact Hours : 60 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with-

1. Primary Exposure to Computer Integrated Manufacturing
2. Operational ideas of CIM

Course Outcomes (COs) :

On completion of this course, students should be able to-

1. Recognize advance manufacturing processes
2. Verify mathematical models with respect to local industries

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Student has to perform either practical or case study

Practical Based on MIAT/DSE/557B

At least five experiments have to be performed

1. Simulation of Pre-processing in Additive manufacturing
1. Simulation of Post-processing in Additive manufacturing

2. Study of 3D Printer Machine
3. To study Digital fabrication and project development
4. Digital Fabrication of flexible circuit board
5. Programming and operation of a Robot manipulator
6. Programming and operation of CNC Miling Machine
7. Machine vision-based quality control
8. Remote Monitoring and Operation of a Computer Integrated Manufacturing System
9. Modeling and Simulation of Computer Integrated Manufacturing System

(Experiments can be performed on Virtual Lab Platform, an MoE, Govt. Of India initiative)
(Expt. 1 to 5 from https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html)
(Expt. 6 to 9 from http://vlabs.iitkgp.ac.in/cim/index.html#)

Case study Based on MIAT/DSE/557B

Student has to make a case study on MIAT/DSE/557B in consultation with the concerned faculty.

MIA/OJT/FP/558 (Field Project)

Total Credits : 4 **Total Contact Hours : 120 Hrs**
Maximum Marks : 100

Students have to identify an industry-relevant problem in the field of industrial automation, develop a detailed project proposal, and work on its practical implementation in an industrial environment. They must apply theoretical concepts to real-world scenarios, utilizing tools such as PLCs, SCADA, IoT, and robotics to design, analyze, and optimize automation systems. The project involves data collection, system integration, troubleshooting, and performance evaluation. Students are required to manage resources, adhere to timelines, and collaborate effectively while maintaining professional and ethical standards. The course culminates in a comprehensive technical report and a final presentation to academic and industry evaluators, showcasing their findings, innovations, and practical expertise in automation.