Updated on 16.04.2020/28092020

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

COMPUTER AIDED DESIGN AND MANUFACTURING

Course Code	18ME72	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
- To make students to understand the Computer Applications in Design and Manufacturing (CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
- To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
- To expose students to computer aided process planning, material requirement planning, capacity planning etc.
- To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
- To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module-1

Introduction to CIM and Automation: Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM. Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in- process, numerical problems.

Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numericals.

Module-2

CAD and Computer Graphics Software: The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

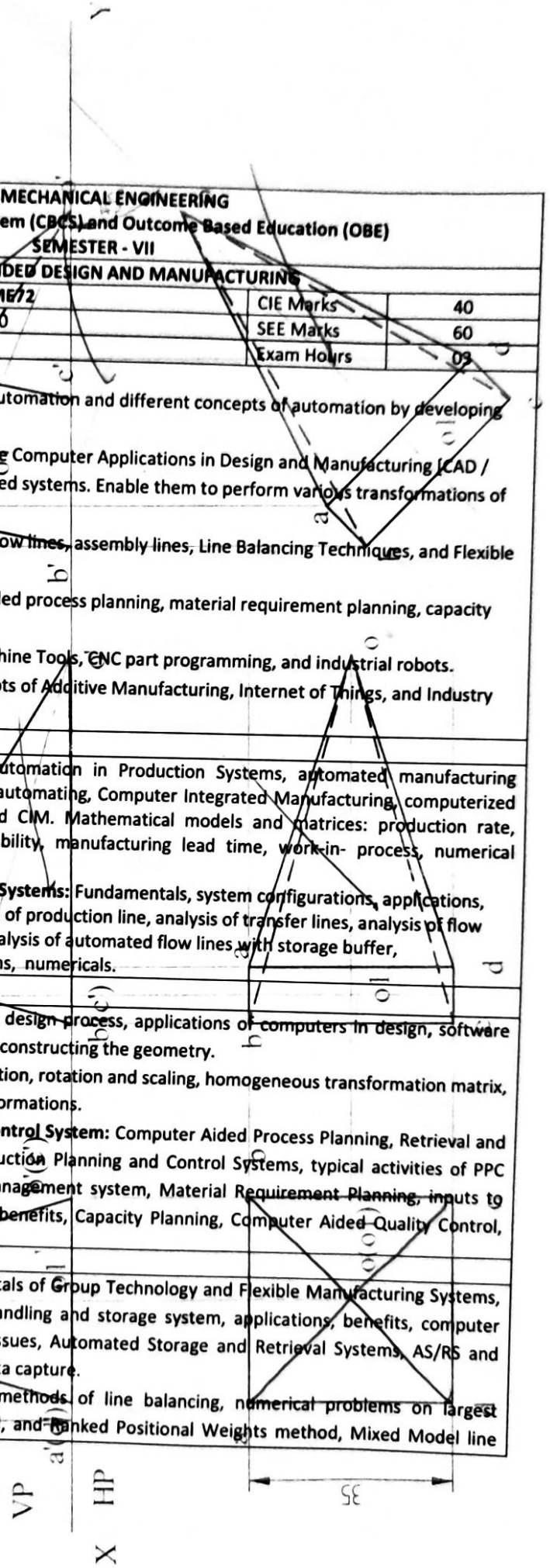
Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control

Module-3

Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

Line Balancing: Line balancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line



PROJECTIONS OF SOLIDS

II-SECTION

PRAJNA

balancing, computerized line balancing methods.

Module-4

Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics. Robot programming methods: on-line and off-line methods. Robot industrial applications: material handling, processing and assembly and inspection.

Module-5

Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM.

Future of Automated Factory: Industry 4.0: functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen

CO2: Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.

CO3: Analyse the automated flow linestoreduce time and enhance productivity.

CO4: Explain the use of different computer applications in manufacturing, and able to prepare part programs forsimple jobs on CNC machine tools and robot programming.

CO5: Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automation, Production Systems and Computer-Integrated Manufacturing	Mikell P Groover	Pearson Learning.	4th Edition,2015
2	CAD / CAM Principles and Applications	P N Rao	Tata McGraw-Hill	3rd Edition, 2015
3	CAD/CAM/CIM	Dr. P. Radhakrishnan	New Age International Publishers, New Delhi.	3rd edition
Reference Books				
1	"CAD/CAM"	Ibrahim Zeid	Tata McGraw Hill.	
2	Principles of Computer Integrated Manufacturing	S.Kant Vajpayee	, Prentice Hall of India, New Delhi.	1999

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3	Work Systems And The Methods, Measurement And Management of Work	Groover M. P.,Pearson	Prentice Hall	Upper Saddle River, NJ, 2007.
4	Computer Automation in Manufacturing	Boucher, T. O., Chapman & Hall	London, UK,	1996.
5	Introduction to Robotics: Mechanics And Control	Craig, J. J.	Addison-Wesley Publishing Company	2nd Ed 1989.
6	Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition	Nicolas Windpassinger	Amazon.	
7	Internet of Things: A Hands-on Approach"	ArshdeepBahga and Vijay Madisetti	Universities Press	
8	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing,	Ian Gibson, David W. Rosen, Brent Stucker		2nd Ed. (2015)
9	Understanding Additive Manufacturing	Andreas Gebhardt, Hanser Publishers		2011
10	Understanding Additive Manufacturing"	Andreas Gebhardt,	Hanser Publishers,	2011