List of Revised Courses

Department : Industrial and Production Engineering

Programme Name : B.Tech and Ph.D.

Academic Year : 2023-24

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	IP07TPC14	Computer Aided Design & Manufacturing
02.	IP08TPC16	Robotics and Robot Applications
03.	IPDATT1	Research Methodology in Engineering
04.	IPDATK1	Computer Aided Design

Academic Year : 2023-24

School : *School of Studies of Engineering and Technology*

Department : *Industrial and Production Engineering*

Date and Time : *Jul. 01, 2023*

Venue : *Online mode*

The scheduled meeting of member of Board of Studies (BoS) of Department of Industrial and Production Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held held on 01.07.2023 in online mode.

The following members were present in the meeting:

1. Prof. S.C. Shrivastava (HOD, Professor., Dept. of I.P.E., -cum Chairman, BOS)
2. Prof. M.K. Singh (Member BoS, Professor, Dept. of I.P.E)
3. Mr. C.P. Dewangan, (Member BoS, Associate Prof., Dept. of I.P.E)
4. Mr. Nitin Kumar Sahu, (Member BoS, Assistant Prof., Dept. of I.P.E)
5. Mr. Kawal Lal Kurrey (Invited Member BoS, Assistant Prof., Dept. of I.P.E)

Following External members has also participated in formulating the coding, scheme and syllabus of B. Tech. III and IV Semester by email.

1. Dr. A. R. Dixit (External Expert, Professor, Mechanical Engineering Department, Indian Institute of Technology ISM, Dhanbad)
2. Mr. Bhanja Prasad Patro (External Expert, Director & Head, CIPET: CSTS - Bhubaneswar)

The BOS meeting is conducted in online platform via Google meet link (https://meet.google.com/qrz-qmbd-gpq) for the following agenda.

Following points were discussed during the meeting

1. To approve the syllabus and scheme of B.Tech VII & VIII Semester and Ph.D of Industrial & Production Engineering for the session 2023-24
2. In the meeting, coding, scheme, syllabus of B. Tech. VII & VIII Semester and Ph.D of Industrial & Production Engineering department was discussed in detail and incorporated. The verbal suggestions received from the external experts are also incorporated and recommended for approval.
3. The departmental vision and mission is also discussed and approved by the BOS members.
4. All the members of BOS has approved the syllabus and scheme of B.Tech VII & VIII Semester and Ph.D of Industrial & Production Engineering department, where Mr. Bhanja Prasad Patro (External Expert- email: bppatra66@gmail.com) and Dr. A. R. Dixit

(External Expert, email: amitraidixit@iitism.ac.in) has given approval via replying to the sent invitation mail.

5. The discussion regarding the honorarium payment for the external experts sitting is also decided and will be paid as per rule from the imprest fund.

   The coding, scheme, syllabus of B. Tech. VII & VIII Semester, Ph.D and Vision as well as Mission of Industrial & Production Engineering department have been accepted by the B.O.S. (I.P.E.) and attached herewith for approval from the competent authority. The B.O.S. meeting was concluded with vote of thanks.

The committee discussed and approved the scheme and syllabi. The following courses were revised in the B. Tech. Final year (VII and VIII Semesters) and Ph.D:

- Computer Aided Design & Manufacturing (IP07TPC14)
- Robotics and Robot Applications (IP08TPC16)
- Research Methodology in Engineering (IPDATT1)
- Computer Aided Design (IPDATK1)

The following new courses were introduced in the of B. Tech. Final year (VII and VIII Semesters) and Ph.D:

- Environmental Sciences (IP207TMC02)
- Manufacturing Processes (IP207TOE02)
- Product Design and Manufacturing (IP208TPE71)
- Microprocessors in Automation (IP208TPE72)
- Computer Aided Process Planning (CAPP) (IP208TPE73)
- Advanced Manufacturing Processes (IP208TOE03)
- Production and Operations Management (IPDATK6)
- Industrial Engineering and Business Management (IPDATK7)
- Principles of Management, Cost and Projects (IPDATK8)
- Manufacturing Processes (IPDATK9)
- Fundamentals of Green Manufacturing (IPDATP6)
- Strategic Management in Supply Chain (IPDATP7)
- Product Design and Manufacturing (IPDATP8)
- Advanced Manufacturing Processes (IPDATP9)

विभागाध्यक्ष/Head
औद्योगिक एवं उत्पादन अभियांत्रिकी
Industrial & Production Engineering
प्रौद्योगिकी संस्थान/Engineering & Technology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Signature & Seal of HoD

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2023-24

School : *School of Studies of Engineering and Technology*

Department : *Industrial and Production Engineering*

Date and Time : *Oct. 06, 2023, 1:00PM*

Venue : *CAD Lab*

The scheduled meeting of member of Board of Studies (BoS) of Department of Industrial and Production Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held on 06.10.2023 in CAD Lab.

The following members were present in the meeting:

6. Prof. S.C. Shrivastava (HOD, Professor., Dept. of I.P.E., -cum Chairman, BOS)
7. Prof. M.K. Singh (Member BoS, Professor, Dept. of I.P.E)
8. Mr. C.P. Dewangan, (Member BoS, Associate Prof., Dept. of I.P.E)
9. Mr. Nitin Kumar Sahu, (Member BoS, Assistant Prof., Dept. of I.P.E)
10. Mr. Kawal Lal Kurrey (Invited Member BoS, Assistant Prof., Dept. of I.P.E)

Following External members has also participated in formulating the coding, scheme and syllabus of B. Tech. III and IV Semester by email.

6. Dr. A. R. Dixit (External Expert, Professor, Mechanical Engineering Department, Indian Institute of Technology ISM, Dhanbad)
7. Mr. Bhanja Prasad Patro (External Expert, Director & Head, CIPET: CSTS - Bhubaneswar)

Following points were discussed during the meeting

1. The coding, scheme and syllabus of B. Tech. III and IV Semester (Industrial & Production Engineering) is shared with the external experts. Moreover, several conversations held from the external experts by the Head of the Department and Departmental BOS Coordinator and their suggestion and comments are considered in the same.
2. In the meeting, coding, scheme, syllabus of B. Tech. III and IV Semester (Industrial & Production Engineering) was discussed in detail and incorporated. The verbal suggestions received from the external experts in the meeting are also incorporated and recommended for approval. After incorporation of all the suggestions, the final updated syllabus has been send for their reference.
3. It is also decided that the subject code may be changed (if any, in future) as per university norms/ regulations/ ordinance/ policies from time to time.

4. Also, the open elective (name and subject code/ syllabus) may be changed in future as per the directions of the offering department in the scheme/ syllabus.
5. The discussion regarding the honorarium payment for the external experts sitting is also decided and will be paid as per rule from the imprest fund.

   The coding, scheme, syllabus of B. Tech. III and IV Semester of Department of Industrial & Production Engineering has been accepted by the B.O.S. (I.P.E.) and attached herewith for approval from the competent authority.

The following new courses were introduced in the of B. Tech. Second year (III and IV Semesters):

- Mathematics-III (AMUCTE1)
- Manufacturing Processes– I (IPUCTT1)
- Fluid Mechanics (IPUCTT2)
- Materials Science (IPUCTT3)
- Industrial Engineering (IPUCTK1)
- Work Study and Ergonomics (IPUCTK2)
- I. C. Engine (IPUCTO1)
- Programming in C & MATLAB (IPUCLE1)
- Fluid Mechanics Lab (IPUCLT1)
- I. C. Engine (IPUCTO1)
- Statistical Methods (AMUDTT0)
- Theory of Machines (IPUDTT1)
- Strength of Materials (IPUDTT2)
- Engineering Thermodynamics (IPUDTK1)
- Plant Layout& Material Handling (IPUDTK2)
- Material Testing Lab (IPUDLT1)
- Theory of Machines Lab (IPUDLT2
- Mini Project (IPUDPV1)
- Automobile Engineering (IPUDTO1)

The B.O.S. meeting was concluded with vote of thanks by Head of the Department.

विभागाध्यक्ष/Head
औद्योगिक एवं उत्पादन अभियांत्रिकी
Industrial & Production Engineering
प्रौद्योगिकी संस्थान/Engineering & Technology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Signature & Seal of HoD

Scheme and Syllabus

B.O.S held on Date 01.07.2023

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2023-24
B. TECH FOURTH YEAR, VII SEMESTER

S. No	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP207TPC14	Computer Aided Design & Manufacturing	3	1	-	30	70	100	4
2.	IP207TPC15	Production Planning and Control	3	-	-	30	70	100	3
3.	IP207TPE5.	Professional Elective-05	3	-	-	30	70	100	3
4.	IP207TPE6.	Professional Elective-06	3	-	-	30	70	100	3
5.	XX207TOEXX	Open Elective-02	3	-	-	30	70	100	3
6.	IP207TMC02	Environmental Sciences	3	-	-	-	-	-	-
Total			**18**	**1**	**-**	**150**	**350**	**500**	**16**
PRACTICALS									
1.	IP207PPC08	CAD/CAM Lab	-	-	2	30	20	50	1
2.	IP207PSC02	Seminar on Summer Training	-	-	4	50	-	50	2
3	IP207PPR01	Minor Project	-	-	8	100	-	100	4
Total			**-**	**-**	**14**	**180**	**20**	**200**	**7**

Total Credits: **23**
Total Contact Hour: **33**
Total Marks: **700**
INTERNAL ASSESSMENT: two class tests of 15 marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP207TPE5. Professional Electives-05	
IP207TPE51 Fundamentals of Green Manufacturing	
IP207TPE52 Product Design & Development	
IP207TPE53 Engineering Economics	
IP207TPE6. Professional Electives-06	
IP207TPE61 Supply Chain Management	
IP207TPE62 Turbo Machinery	
IP207TPE63 Maintenance Management	
XX207TOEXX Open Elective-02	**Offering department**
CH207TOE02 Waste to Energy	Chemical
ME207TOE02 Principles of Management	Mechanical
EC207TOE02 CMOS Digital VLSI Design	ECE
CE207TOE02 Green Building and Sustainable Materials	Civil
IT207TOE02 Machine Learning	IT
CS207TOE02 GIS & Remote Sensing	CSE
IP207TOE02 Manufacturing Processes – I will be offered as an open elective for departments- Chemical, Civil, CSE, ECE, IT & MECH	

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPC14	Computer Aided Design & Manufacturing	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To introduce the student to be familiar with CAD/CAM terminology and its capabilities.
- To recognize geometric and graphical elements of engineering design problems.
- To study Basic features of CAM so as to be capable of accepting professional responsibilities and to understand the associativity between design and manufacturing.
- Integrate the CAD system and the CAM system by using the CAD system for modelling design information and converting the CAD model into a CAM model for modelling the manufacturing information.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand the various CAD/CAM and CNC processes.
- Recognize various types of Curves, surface and Solid and their application as used in geometric modelling.
- Analyse the NC programs to generate and verify the tool path for milling and drilling manufacturing processes.
- Appreciate the concept of parametric modelling which is the mainstay of most of the 3D modelling system.

COURSE CONTENT:

MODULE-I

Basics of CAD: Basics fundamental of computer graphics, principle of computer graphics, product life cycle, concept of computer aided design (CAD) and architecture, hardware and software, color management, raster graphics, graphic primitives, lines, and circle drawing algorithms, software documentations, CAD standards GKS, open GL, data exchange standards: IGES, STEP, CALS etc., communication standards, standards for exchange images.

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MODULE - II

Geometric modeling of curves, surface and solid: Basics representation of curves, parametric and non- parametric curves, mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves, basic of surface, techniques of surface modeling, plane surface, rule surface, surface of revolution and sweep, coons and bi-cubic patches, concept of Bezier and B-spline surfaces, basic concept of solid modeling technique, CSG and B-rep method for solid generation.

MODULE – III

Geometric transformation: Computer Aided Design (CAD) methodology, coordinate systems, theory and applications, 2D and 3D geometric transformation, homogeneous transformation, concatenation, assembly modeling, interferences of positions and orientation, tolerance analysis, mass property calculations, visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, concurrent engineering.

MODULE – IV

Basics of CAM: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, application of NC, concepts of computer numeric control (CNC) system, problems with conventional, NC, CNC.

Part Programming: Introduction to NC part programming, manual part programming, computer assisted part programming, automatically programming tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

MODULE - V

Advance manufacturing system: Concept of distributed numeric control (DNC) system, and its advantages and disadvantages of over NC and CNC, Concept of computer integrated method (CIM), Flexible manufacturing system (FMS), benefits and applications of CIM and FMS, group technology (GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), automated guided vehicle (AGV).

TEXT & REFERENCE BOOKS:

1. Principles of Computer Graphics, W. M. Neumann and R.F. Sproul, McGraw Hill.
2. Computer Graphics, D. Hearn and M.P. Baker, Prentice Hall Inc.
3. CAD/CAD Theory & Practice, I. Zeid & R. Sivasubramanium, TMH.
4. CAD/CAM, Groover & Zimmer, Prentice Hall, India.
5. Computer Graphics & CAD, Ramamurthy, T.M.H.
6. Industrial Robotics & CIM, Surendra Kumar I.B.H.

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7. CAD/CAM, P.N. Rao, Prentice Hall, India.
8. Mastering CAD CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
9. CAD/CAM Principles, C. McMohan & J. Browne, Pearson Education.

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	2	-	-	-	-	-	-	2	3	3	1
CO2	3	3	2	1	2	-	-	-	-	-	-	2	3	3	1
CO3	3	3	1	3	2	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

01/07/23

01/07/23

11/7/2023

01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPC15	Production Planning and Control	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

COURSE CONTENT:

MODULE – I

Introduction: Introduction to various types of production system viz. mass production, job shop, batch production system, continuous production system, concept of production and operation management, objective & functions of PPC.

Forecasting: Time series method, moving average, weighted average, trend, seasonality, regression technique, delphi method.

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MODULE – II

Aggregate planning: Definition, strategies, pure and mixed strategies, methods.
Master production schedule: Objective and functions, design of MPS, bill of materials.
Material requirement planning: Objectives, functions, MRP, MRP-II, limitations.
Capacity requirement planning: Definition, objectives, process of CRP, process sheet, rough cut capacity planning, loading, and preparation of CRP chart.

MODULE – III

Scheduling: Types, single machine scheduling, job shop scheduling, flow scheduling;
Sequencing: Various priority rules, line of balancing, rank and positional weight method, Kilbridge westner method.
Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods.

MODULE – IV

Types of layouts: layouts design procedure such as CORELAP, CRAFT etc., material handling system & their classification, principles, JIT & KANBAN, depreciation & methods of depreciation.

MODULE -V

Maintenance management: Types of maintenance strategies, breakdown and preventive maintenance, predictive and total productive maintenance, condition monitoring, individual and group replacement policies, make or buy decision, concept of original equipment effectiveness.

TEXT & REFERENCE BOOKS:

1. Production and operation management, O. Paneerselvem, TMH.
2. Production and operation management, Adem Ebert.
3. Production and operation management, Charry S.N. TMH.
4. Production and operations management Theory and practice Mahadevan. B.
5. Production and operation management, Joseph G. Monks, TMH.
6. Handbook of Material Handling, Ellis Horwood limited.
7. Operations Management: Design Planning and control for the manufacturing and services.
8. Lawrence P. Atkin, James B. Dilworth Tata Mc Graw Hill.
9. Production and Operations management, R.B Khanna, PHI.
10. Production operations management, S.N. Buffa, PHI.

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	1	-	-	-	-	2	-	3	2	2	2
CO2	3	3	2	3	2	-	-	1	-	2	3	2	3	3	3
CO3	3	3	2	3	2	-	-	2	-	2	3	3	3	2	3
CO4	3	2	3	2	2	2	-	-	2	2	-	2	3	3	3
CO5	3	3	2	1	3	2	-	-	-	2	-	3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

1/7/2023 01/7/2023 01/07/23 01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE51	Fundamentals of Green Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

COURSE CONTENT:

MODULE-I

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

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MODULE - II

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing out puts, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

MODULE – III

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA, life cycle costing, eco labelling target setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

MODULE – IV

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

MODULE – V

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

TEXT & REFERENCE BOOKS:

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncrss and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.
7. Manufacturing strategy, Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar Publishing Limited, 2007.
12. Industrial Development for the 21st Century: Sustainable Development Perspectives, D. Rodick, UN New York, 2007.
13. An Introduction to Sustainable Development, P.P. Rogers, , K.F. Jalal & J.A. Boyd, J.A, Earth scan, London, 2007.

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14. Sustainable Development Indicators in Ecological Economics, P. Lawn, Edward Elgar Publishing Limited.
15. The Economics of Sustainable Development, S. Asefa, W.E. Upjohn Institute for Employment Research, 2005.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	-	2	3	2	1	2	3	1	1	2	2	1	3	2	2
CO2	-	2	3	2	1	3	3	1	1	2	3	2	3	2	2
CO3	-	2	3	2	1	2	3	1	1	3	3	2	3	3	3
CO4	-	2	3	2	2	3	3	1	1	3	2	2	3	2	2
CO5	-	2	3	2	1	3	3	1	1	2	2	1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

11/7/2023

01/07/23

01/07/23

01/7/2023

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE52	Product Design & Development	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To introduce design concepts and techniques to develop design ability in a product design.
- To provide knowledge about estimating and evaluating the feasible manufacturing design.
- To make aware of legal issues pertaining to product design.
- To provide knowledge of management of product development projects.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

- Describe an engineering design and development process.
- Identify, formulate, and solve engineering problems.
- Design a system, component, or process to meet desired needs.
- Understand the professional and ethical responsibility.
- Recognize the legal issue pertaining to patents of product design.

COURSE CONTENT:

MODULE – I

Product design: Definition, design by evolution, innovation, essential factors of product design, production-consumption cycle, flow and value addition in the production-consumption cycle, the morphology of design, primary design phases and flow charting, role of allowance, concurrent engineering.

MODULE – II

Product design practice and industry: Introduction, product strategies, time to market, analysis of the product, three S's, standardization, Renard series, simplification.

Designer: Role, myth and reality, industrial design organization, basic design considerations.

MODULE – III

New products idea generation: Modification, product variants: adding, dropping, formal testing: new products, concept, product testing, market tests, evaluation, adoption, expansion and forecasting.

Economic factors influencing design: Product value, economic analysis, profit and competitiveness.

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Product design for environment: Introduction importance of DfE, environmental factors, scope of environmental impact, design guidelines for DfE.

MODULE – IV

Developing product strategy: Benefits of strategy, elements of a product strategy, setting objectives, selection of strategic alternatives, increasing sales/market share, increasing profitability, design for manufacturing and design for assembly, ergonomics in design, modular versus integral design.

Human engineering considerations in product design: Introduction, anthropometry, design of controls, the design of displays, man/machine information exchange.

MODULE -V

Intellectual property systems: Definition, concept of intellectual property, kinds of intellectual property, economic importance of intellectual property, importance of IPR, TRIPS and its implications.

Trademark: Introduction, historical development of the concept, need for protection, kinds of trademarks, and well-known trademarks, patents: historical development, concepts, novelty, utility, inventiveness/non-obviousness, copyrights, industrial design.

TEXT & REFERENCE BOOKS:

1. Product Design and Manufacturing, A. K. Chitale & R. C. Gupta, PHI.
2. Fundamentals of Design and manufacturing, V. Gupta, G.K. Lal & Reddy, Narosa Publishing.
3. Design and technology (1996), James Garratt, Cambridge University Press.
4. Product Management, Donald R. Lehman, S. Rusell Wines, 3rd Edition, TMH.
5. Product Life Cycle Engineering and Management, CEP Lecture notes, Prof B. Ravi, IIT Bombay.
6. Product Design & Development, Karl. T. Ulrich & Steven D. Eppinger, 3rd addition, TMH.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	-	2	3	1	1	1	2	2	2
CO2	3	2	2	1	1	-	-	2	2	2	2	2	3	2	2
CO3	3	2	2	2	1	2	3	2	2	2	2	2	2	3	2
CO4	1	2	2	-	1	2	?	2	2	2	1	1	1	1	1
CO5	1	-	1	2	-	1	1	2	2	2	1	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE53	Engineering Economics	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. Prepare students to analyse cost/revenue data and carry out economic analyses in the decision-making process to justify or reject alternatives/projects on an economic basis.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Describe the role of economics in the decision-making process and perform calculations in regard to interest formulas.
- Trained towards eestimating the present, annual and future worth comparisons for cash flows.
- Calculate the rate of return, depreciation charges and income taxes.
- Enumerate different cost entities in estimation and costing the elements of budgeting.
- Explain the importance of finance functions, financial ratios and solve related problems.

COURSE CONTENT:

MODULE - I

Basic concepts and definitions: Methodology of economics, demand and supply-elasticity, theory of the firm and market structure, price and output determinations in different types of market.

MODULE - II

Public sector economics: Welfare economics, central and commercial marks and their functions, industrial policies, theory of localization, weber & surgent florence theory, investment analysis - NPV, ROI, IRR, payback period, SWOT analysis.

MODULE - III

Monetary and fiscal policy: Tools, impact on the economy, inflation, business cycle, cash flow-2, 3, 4 model.

MODULE - IV

Business forecasting: Elementary techniques, cost and revenue analysis, capital budget, break even analysis.

MODULE - V

Indian economy: Urbanization, unemployment–poverty, regional disparities, unorganized sectors roll of plans, reforms-post independent period.

TEXT & REFERENCE BOOKS:

1. Principles of Economics, N. Mankiw Gregory (2002), Thompson Asia.

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2. Managerial Economics, V. Mote, S. Paul, G. Gupta (2004), Tata McGraw Hill.
3. Indian Economy, Its Development Experience Misra, S. K. and Puri V. K., Himalaya Publishing House, Mumbai.
4. Textbook of Business Economics, Pareek Saroj (2003), Sunrise Publishers.
5. Indian economy since Independence, U. Kapila, Academic Foundation, New Delhi.
6. Indian Economy, R. Dutt & K.P.M. Sundharam, S. Chand & Company Ltd., New Delhi.
7. Indian Economic Policy and Reform, R. Mathur, RBSA Publisher, Jaipur.
8. Indian Economic Policy, B. Jalan, Penguin Books Ltd.
9. Economic Survey (Annual), Government of India, Economic Division, Ministry of Finance, New Delhi.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	-	-	-	-	-	2	2	-	-	-	2	3	3	2	3
CO2	-	-	-	-	-	3	2	2	-	-	2	1	3	2	2
CO3	-	-	-	-	-	2	3	-	-	-	2	2	2	3	-
CO4	-	-	-	-	-	2	2	1	1	-	3	1	3	2	-
CO5	-	-	-	-	-	1	2	1	2	1	3	1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE61	Supply Chain Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand supply chain activities, process planning, decision phases, importance and management of supply chains.
- To examine various drivers of supply chain for acquiring effectual performance, ease distribution and acquisition of production resources & Inventories.
- To understand about uncertainty, risk management, distribution network, role of location, capacity and forecasting in SC.
- To adapt drivers of supply chain, related framework and to appraise supply chain performance, pricing and sourcing decisions.

COURSE OUTCOMES

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

- Demonstrate basic understanding about competition, logistics network, capable factors for supply chain designs and supply chain strategies.
- Acquire knowledge about distribution network, e-business, forecasting, network design and time-series analysis.
- Decide technical understanding about demand, inventory, safety, pricing and information technology
- Manage and measure sourcing decisions in supply chain, product availability under capacity constraints, optimal levels of product, services and resources.

COURSE CONTENT:

MODULE - I

Building a strategic framework to analyze supply chains: Supply chain, its objective and the importance of supply chain decisions, decision phases in a supply chain, process view of a supply chain, examples of supply chains, supply chain performance, achieving strategic fit and scope, competitive and supply chain strategies, achieving strategic fit, expanding strategic scope, supply chain drivers and metrics, drivers of supply chain performance, framework for structuring drivers, facilities, inventory, transportation, information, sourcing, pricing.

MODULE - II

Designing the supply chain network: Designing distribution networks and applications to e-

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business the role of distribution in the supply chain, factors influencing distribution network design, design options for a distribution network, e-business and the distribution network, distribution networks in practice.

Network design in the supply chain: The role of network design in the supply chain, factors influencing network design decisions framework for network design decisions, models for facility location and capacity allocation, role of IT in network design, making network design decisions in practice.

Network design in an uncertain environment: The impact of uncertainty on network design, discounted cash flow analysis, representations of uncertainty, evaluating network design decisions using decision trees, AM tires: evaluation of supply, chain design decisions under uncertainty, risk management and network design 175, making supply chain decisions under uncertainty in practice.

MODULE - III

Planning demand and supply in a supply chain: Demand forecasting in a supply chain, the role of forecasting in a supply chain, characteristics of forecasts, components of a forecast and forecasting methods, basic approach to demand forecasting, time-series forecasting methods, measures of forecast error, forecasting demand at Tahoe salt, role of IT in forecasting, risk management in forecasting, forecasting in practice.

Aggregate planning in a supply chain: Role of aggregate planning in a supply chain, the aggregate planning problem, aggregate planning strategies, aggregate planning using linear programming, aggregate planning in excel, role of IT in aggregate planning, implementing aggregate planning in practice.

Planning supply and demand in a supply chain: Managing predictable variability, responding to predictable variability in a supply chain, managing supply, managing demand, implementing solutions to predictable variability in practice.

MODULE - IV

Planning and managing inventories in a supply chain: Managing economies of scale in a supply chain, cycle inventory, the role of cycle inventory in a supply chain, economies of scale to exploit fixed costs, economies of scale to exploit quantity discounts, short-term discounting, trade promotions, managing multiechelon cycle inventory, estimating cycle inventory-related costs in practice.

Managing uncertainty in a supply chain: Safety inventory, the role of safety inventory in a supply chain, determining appropriate level of safety inventory, impact of supply uncertainty on safety inventory, impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, managing safety, inventory in a multiechelon supply chain, role of IT in inventory management, estimating and managing safety inventory in practice.

Determining the optimal level of product availability: The importance of the level of product availability, factors affecting optimal level of product availability. managerial levers to improve supply chain profitability, setting product availability for multiple products under capacity constraints, setting optimal levels of product, availability in practice.

MODULE - V

Designing and planning transportation networks: Transportation in a supply chain, the role

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of transportation in a supply chain, modes of transportation and their performance characteristics, transportation infrastructure and policies, design options for a transportation network trade-off in transportation design, tailored transportation, role of IT in transportation risk management in transportation, making transportation decisions in practice.

Managing cross-functional drivers in a supply chain: Sourcing decisions in a supply chain, the role of sourcing in a supply chain, in-house or outsource, third-party and fourth-party logistics providers, supplier scoring and assessment, supplier selection-auctions and negotiations contracts and supply chain performance, design collaboration, the procurement process, sourcing planning and analysis, role of IT in sourcing, risk management in sourcing, making sourcing decisions in practice.

TEXT & REFERENCE BOOKS:

1. Supply Chain Management, Janat Shah, 2010, Pearson Publications.
2. Supply Chain Management, Sunil Chopra & Mein del, Fourth Edition, 2010, PHI.
3. Supply Chain Management, A.S. Altekar, Second Edition, 2006, PHI.
4. Logistics Management, James Stock & Douglas Lambert, Edition, 2006, McGraw Hill International.
5. Supply Chain Management for Global Competitiveness, B.S. Sahay, 2000, McMillan Publication.
6. Emerging Trends in Supply Chain Management, B.S. Sahay 2000, McMillan Publication.
7. Logistics Management, Bowersox, 2004, TMH.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	2	1	2	-	-	-	2	1	1	2
CO2	1	3	3	2	2	1	2	2	-	-	-	2	2	2	2
CO3	2	2	3	3	2	2	2	2	-	-	-	3	2	2	2
CO4	3	3	2	2	2	2	3	2	-	-	-	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE62	Turbo Machinery	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To study classifications of turbo-machines.
- To study construction and working of different turbo- machines.
- To acquire the knowledge and skill of analyzing different turbo- machines.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

COURSE CONTENT:

UNIT- I

Nozzles & Diffuser: Nozzles & Diffuser types, their efficiency, critical pressure & velocity, relationship between area, velocity & pressure in nozzles flow. Steam Turbine Types: Steam turbine-principal of operation of steam turbine, types, impulse turbine, compounding of steam turbine pressure compounded velocity compounded and pressure- velocity compounded impulse turbine. Velocity diagram for impulse turbine: force on the blade and work done, blade or diagram efficiency, gross stage efficiency, influence of ration of blade to steam speed on blade efficiency in a single stage impulse turbine, impulse blade section, choice of blade angle.

UNIT – II

Impulse-reaction turbine: Velocity diagram, degree of reaction, Impulse-Reaction turbines with similar blade section and half degree of reaction (parson's turbine) Height of reaction, blade section. Energy losses in steam turbine-internal and external losses in steam turbine.

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UNITS – III

State points Locus & Reheat factors: Factor-stage, efficiency of impulse turbine, stage point locus of an impulse turbine, state point locus for multistage turbine reheat factor. Internal efficiency, overall efficiency, relative efficiency, Design procedures of impulse & impulse reaction turbine. Governing of steam turbine: Throttle governing, nozzle governing, bypass governing, combination of throttle and nozzle, governing and combination of bypass and throttle governing, Effect of governing on the performance of steam turbine.

UNIT – IV

Gas turbine: Classification of Gas turbine, simple open cycle gas turbine, ideal and actual (Brayton cycle) for gas turbine, Optimum pressure ratios for maximum specific output in actual gas turbine, Regeneration, reheat and inter cooling and effect of these modification on efficiency and output, closed cycle gas turbine.

UNIT –V

Turbo compressors: Introduction, classification of Centrifugal Compressor- Component working, velocity diagram, calculations of power and efficiencies. Slip factor, surging and choking, power and efficiencies. Axial Flow Compressor: Construction and working, velocity diagram, calculation of power and efficiencies, Degree of reaction, work done factor, stalling, comparison of centrifugal and axial flow compressor.

TEXT BOOKS:

1. Steam and Gas Turbine – R. Yadav by C.P.H. Publication, Allahabad.
2. Turbine, Compressors and Fans – S.M. Yahya – TMH.
3. Gas Turbine – V. Ganeshan – TMH
4. Fundamentals of Turbo Machinery- Venkanna, PHI.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	2	2	3	3							3	3	2	3
CO2	3	3	3	3	2							3	3	2	2
CO3	3	3	3	3	3	2						3	2	3	-
CO4	3	1	2	1	1	3						2	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE63	Maintenance Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To develop the skill of maintenance functions in industry.
- To provide the concept of various types of maintenance system used in industries.
- To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
- To create the ability of data, analyze failure cause and reliability engineering.
- To develop the new techniques of maintenance for minimizing the cost of maintenance and improving of life of equipment's.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand and be able to explain the aim and basics of maintenance activity.
- Use various methods of maintenance and procedures applied to equipment's.
- Be aware of methods of detection for faults and errors in operations.
- Apply the tools and techniques of repairing, faults analysis.

COURSE CONTENT:

MODULE - I

Introduction: Fundamentals of maintenance engineering, maintenance engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. safety regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.

MODULE - II

Maintenance management: Types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance and their comparison, advantages & disadvantages, limitations of computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

MODULE - III

Tribology in maintenance: Friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes.

Lubricants: Types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing.

MODULE - IV

Machine health monitoring: Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, instrumentation & equipment used in machine health monitoring. instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

TPM: Introduction, history, components, pillars of TPM, calculation of OEE, Terri technology.

MODULE - V

Reliability, availability & maintainability (RAM) analysis: Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo simulation technique, FMECA.

TEXT & REFERENCE BOOKS:

1. Maintenance Engineering Hand Book, Higgins.
2. Maintenance & Spare parts Management, Gopal Krishnan.
3. Industrial Maintenance Management, S.K. Shrivastava.
4. Industrial Engineering, Hand book of Condition Monitoring, C.N.R. Rao.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	2	3	-	2	-	-	-	1	2	3	3	3	2
CO2	3	3	3	3	-	2	-	-	-	-	-	3	3	3	2
CO3	3	3	3	3	-	2	3	-	-	1	-	3	3	3	2
CO4	3	3	3	-	-	2	2	1	1	3	-	3	3	3	2
CO5	3	3	3	3	-	1	2	1	2	3	2	3	2	2	1

- **1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)**

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B. Tech. VII Sem.	IP207TOE02	Manufacturing Processes I	3	--	--	15	15	70	100	3

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

- Understand the principle, concept, thermal and metallurgical aspects during solidification of metal.
- Demonstrate about principles/ methods of casting with detail design of gating/ riser system needed for casting, defects in cast objects and requirements for achieving sound casting.
- Evaluate foundry practices like pattern making, mould making, core making and inspection of defects.
- Build knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach.
- Understand the application of jigs and fixtures.
- Analyze various metal forming processes and plastic deformation during forming processes.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Decide yield of a material according to different yield theory for a given state of stress.
- Analyze the different bulk metal forming process mechanics using different analysis approach and calculate the force, power requirements etc.
- Evaluate the effect of process parameters on the process mechanics during bulk metal forming.
- Select appropriate design of gating systems and manufacturing processes in order to design products.
- Identify the various metal forming techniques and the theory of plasticity and its application for analyzing various metal forming Processes.
- Select appropriate jigs and fixtures in various engineering applications.

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COURSE CONTENT:

Module –I

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances & design considerations, types of moulding sand & their properties, testing, cores and sand core boxes, core making, moulding machine.

Gating system: Elements & design of gating system, design of riser, solidification of casting.

Module –II

Melting furnaces and practices: Melting cast iron, steel and non-ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

Module –III

Special casting processes: Centrifugal and investment casting, shell, types and principle of die casting, squeeze casting, gravity and pressure die casting, die casting consideration, continuous casting, centrifugal casting, slush casting, casting defects.

Module –IV

Metal forming: Need and classification, elastic and plastic deformation, yield criteria, fundamentals of hot and cold working processes.

Drawing: Drawing process geometry and analysis of wire and sheet drawing for load and power calculations, maximum reduction possible.

Rolling: Classification of rolling, process geometry and analysis of plate rolling for rolling load, rolling pressure and power calculations, defects in rolled products.

Forging: Classification of Forging, determination of forces in disc forging considering sticking and slipping, forging defects.

Extrusion: Classification, process geometry and analysis of rod and sheet extrusion for load and power calculations, maximum reduction possible, defects in extruded product.

Module –V

Work holding device: Introduction to jigs, fixtures and their types, design criteria, economic justification, fundamental principles of design of jigs and fixtures, location and clamping in jigs and fixtures, drilling jigs, milling fixtures, indexing jigs and fixtures.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials - Kalpakjian and Schmid, Pearson India.
2. Manufacturing Science- A. Ghosh and A. K. Mallik, East-West Press Pvt. Ltd. New Delhi.

3. Manufacturing Technology (Foundry, Forming and Welding) – P. N. Rao, Tata McGraw Hill Publishing Company.
4. Materials and Processes in Manufacturing - E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi.
5. Production Engineering Sciences - P. C. Pandey and C. K. Singh, Standard Publishers Ltd.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2	-	-	-	-	2	1	2	2	2
CO2	3	2	1	2	1	2	2	1	-	-	2	2	3	3	3
CO3	3	2	2	2	2	1	2	2	-	-	2	3	2	3	3
CO4	3	2	2	2	2	2	2	1	-	-	2	2	2	3	3
CO5	3	1	2	2	1	2	2	1	-	-	2	2	2	2	3
CO6	2	2	2	2	1	2	2	-	-	-	1	2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TMC02	Environmental Sciences	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To learn the importance of Ecosystems, Natural Resources and Energy resources
- To learn the importance of Biodiversity and Environmental pollution
- To understand the Environmental ethics

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- To understand the importance of Ecosystems, Natural Resources and Energy resources, learn the importance of Biodiversity and Environmental pollution and understand the Environmental ethics

COURSE CONTENT:

Introduction to environmental studies Multidisciplinary nature of environmental studies: scope and importance: Concept of sustainability and sustainable development. Ecosystems: structure and function of ecosystem: Energy flow in an ecosystem: food chains. Food webs and ecological succession a) Forces: ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, Streams lakes, rivers, Oceans, estuaries). Natural Resources Renewable and Non-renewable Resources: Land resources and land use change: Land degradation, soil erosion and desertification. Deforestations: Causes and impacts due to mining, dam building on environment, forests biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts. Conflicts over water (international & inter-state) Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies Biodiversity and Conservation: Levels of biological diversity: genetic species and ecosystem diversity. Bio geographic zones of India.

Biodiversity patterns and global biodiversity hot spots India as a mega-biodiversity nation. Endangered and endemic species of India. Threats to biodiversity: Habitat loss poaching of wildlife man wildlife conflicts, biological invasions: Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental pollution: Environmental pollution types, causes, effects and controls: Air, Water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case

studies. Environmental potencies & practices, Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment laws Environment protection Act: air (prevention & Control of pollution) Act: water (prevention and control of pollution) Act: wildlife protection Act: Forest Conservation Act; International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD), Nature reserves. tribal populations and rights, human wildlife conflicts in Indian context. Hunan Communities and the Environment. Human population growth: Impacts on environment. Human health and welfare. Resettlement and rehabilitation of project affected persons: case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e. g.CNG vehicles in Delhi). Field work: visit to an area to document environmental assets. River/ forest/flora/fauna, etc. Visit to a local polluted site-urban/rural/Industrial/Agricultural. Study of common plants birds and basic principles of identification Study of simple ecosystems-pond river- etc.

TEXT BOOKS:

1. Gleick P.H.1993 Water in Crisis Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute Oxford Univ.press.
2. Grumbine.R. Edward and pandit M.K.2013 Threats from India's Himalaya dams Science 339;36—37
3. Sengupta R 2003 Ecology and economics: An approach to sustainable development OUP.
4. sodhi, N.S.Gibson L.& Raven P.H.(eds) 2013 Conservation Biology: Voices from the Tropics john wiley & Sons.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	-	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

11/7/23 01/07/2023 01/07/23 01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP207PPC08	CAD/CAM Lab			2	30	20	50	1

COURSE LEARNING OBJECTIVES:

- To provide students with the writing and reading principles of "Engineering Drawing", which is a graphical universal language used in technical world for describing the shape and size of an object via supplying orthographic views and/or solid models associated with all the necessary dimensions, associated tolerances and annotations created in a CADD environment.
- To understand 3D drafting and analysis software used for modelling and analysis.

COURSE OUTCOMES:

- Ability to perform both 2D and 3D drafting of component using CAD software.
- Create solid models of objects, objects in basic shapes, composite bodies, custom built machine parts, building modules etc.
- Draw the orthographic views of an object in CAD environment (particularly in Autodesk AutoCAD environment).
- Create the orthographic views of an object from the solid model (particularly in Autodesk Inventor environment).
- Dimension the views, show some annotations, provide the size tolerance of functional features, and general tolerances.
- Explain and interpret the dimensions and the associated tolerances, some annotations.
- Read the given orthographic views; i.e., visualize the 3- Dimensional model of the object shown to its orthographic views and create its CAD model.
- Create auxiliary views, revolved views, sectional views.
- Ability to construct assemblies from the concepts learnt using drafting software.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	2	3	-	-	-	-	-	-	1	2	2	1
CO2	3	-	3	2	3	-	-	-	-	-	-	1	2	2	1
CO3	3	1	-	1	-	-	-	-	-	-	-	1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP07PSC02	Seminar on Summer Training	-	-	4	50	-	50	2

COURSE LEARNING OBJECTIVES:

- To provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
- To enhance students' knowledge in one particular technology.
- To increase self-confidence of students and helps in finding their own proficiency.
- To cultivate student's leadership ability and responsibility to perform or execute the given task.
- To provide learners hands on practice within a real job situation.
- Enhance and supplement the knowledge and skills of the students.
- Develop the students in terms of ability, competence and interpersonal relationship.

COURSE OUTCOMES:

- Capability to acquire and apply fundamental principles of engineering.
- Become master in one's specialized technology.
- Become updated with all the latest changes in technological world.
- Develop a skill of a multi-skilled engineer with sound technical knowledge, management, leadership and entrepreneurship skills.
- Ability to identify, formulate and model problems and find engineering solution based on a systems approach.
- Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.
- Awareness of the social, cultural, global and environmental responsibility as an engineer.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING, GGVV, BILASPUR CG

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2								2	2	1
CO2	2	2	2	1	1								1	1	1
CO3	2	3	3	2	1								1	1	2
CO4	-	-	-	-	1								1	2	2
CO5	-	-	-	-	-								1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

BOS held on Date 01.7.2023

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2023-2024
B. TECH FOURTH YEAR, VIII SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP208TPC16	Robotics and Robot Applications	3	1	-	30	70	100	4
2.	IP208THS4.	Electives from Humanity Science-04	3	-	-	30	70	100	3
3.	IP208TPE7.	Professional Elective-07	3	-	-	30	70	100	3
4.	XX208TOEXX	Open Elective-03	3	-	-	30	70	100	3
5.	IP208TMC03	Essence of Indian Knowledge Tradition	3	-	-	-	-	-	-
		Total	**15**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	IP208PPR02	Major Project	-	-	12	120	80	200	6
2.	IP208PCV01	Comprehensive Viva	-	-	-	-	50	50	2
		Total	**-**	**-**	**12**	**120**	**130**	**250**	**8**

Total Credits: **21**
Total Contact Hour: **28**
Total Marks: **650**
INTERNAL ASSESSMENT: -two class tests of 15 marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP208THS4. Electives from Humanity Science-04	
IP208THS41 Intellectual Property Rights	
IP208THS42 Safety Management and Labour Law	
IP208TPE7. Professional Electives-07	
IP208TPE71 Product Design and Manufacturing	
IP208TPE72 Microprocessors in Automation	
IP208TPE73 Computer Aided Process Planning (CAPP)	
XX208TOEXX Open Elective-03	**Offering department**
CH208TOE03 Project Engineering Economics and Management	Chemical
ME208TOE03 Supply Chain Management	Mechanical
EC208TOE03 Introduction to IOT	ECE
CE208TOE03 Infrastructure Planning and Management	Civil
IT208TOE03 Soft Computing	IT
CS208TOE03 Artificial Intelligence	CSE
IP208TOE03 Advanced Manufacturing Processes will be offered as an open elective for departments- Chemical, Civil, CSE, ECE, IT & MECH	

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TPC16	Robotics and Robot Applications	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To define basic concept about robots, robotics and programming.
- To learn about coordinate frames, mapping and transforms plots.
- To understand kinematic modelling of the manipulators and their working.

COURSE OUTCOMES:

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

- Apply knowledge of robotics for understanding, formulating and solving engineering problems.
- Demonstrate creativeness in designing and development of robotics.
- Analyse the kinematic of industrial robot.
- Design control laws for a simple robot.
- Identify, analyse and design of robots useful to the society.

COURSE CONTENT:

MODULE -I

Introduction to robotics: Evolution of robots and robotics, progressive advancement in robots, definitions and classifications, laws of robotics, robot anatomy and related attributes, repeatability, accuracy and precision, human arm characteristics, robot specification and notations, concept of robots programming, the future prospects.

MODULE – II

Coordinate frames, mapping and transforms: Coordinate frames, spatial descriptions and transformations, fundamental of translation, rotations and transformations, inverting a homogeneous transform, fundamental rotation matrices, yaw pitch and roll, yaw pitch and roll transformation, equivalent angle.

MODULE – III

Symbolic modeling of robots, direct kinematic model: Mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit-Hartenberg (D- H) representation, kinematic relationship between adjacent links, manipulator, transformation matrix, arm equations.

MODULE – IV

Robotic sensors and vision: The meaning of sensing, sensors in robotics, kinds of sensors used in robotics, robotic vision, industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision systems, image acquisition, description of other components of vision system, image representation, image processing, artificial intelligence (AI) in robotics.

MODULE – V

Robot controller & applications: Linear control of robot manipulation, feedback and close loop control, second-order linear systems, trajectory following control, modelling and control of single joint, architecture of industrial robotic controllers, artificial intelligence, industrial and non-industrial applications, robotic application for sustainable development & social issues.

TEXT & REFERENCE BOOKS:

1. Robotics & Control, R.K. Mittal & I.J. Nagrath, TMH Publications
2. Robotics for engineers, Yoram Korean, McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications, M.P. Groover, M. Weiss.
4. Robotics Control Sensing, Vision and Intelligence - K.S. Fu, R.C. Gonzalex, C.S.G. Lee, McGrew Hill Book Co.
5. Kinematics and Synthesis of linkages, Hartenberg & Denavit, McGrew Hill Book Co.
6. Kinematics and Linkage Design, A.S. Hall, Prentice Hall.
7. Kinematics and Dynamics of Machinary, J. Hirchhorn, McGrew Hill Book Company.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2								3	1	2
CO2	3	3	3	2	3								2	3	2
CO3	3	3	3	2	3								2	3	2
CO4	3	2	2	2	2		2						3	2	2
CO5	3	2	3	2	2	3					1		2	2	3

Weightage: 1-Slightly, 2-Moderately, 3-Strongly

01/07/23

01/7/2023

01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech VIII Sem.	IP208THS41	Intellectual Property Rights	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand, define and differentiate various types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- Understand the framework of strategic management of Intellectual Property (IP).
- Appreciate and appraise different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs.
- Explain how to derive value from IP and leverage its value in new product and service development.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Identify the different types of Intellectual properties (IPs), the right of ownership and scope of protection.
- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Analyze ethical and professional issues which arise in the intellectual property right context.
- Apply intellectual property right principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property rights.
- Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

COURSE CONTENT:

MODULE - I

Introduction to intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

MODULE - II

Trademarks: Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

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MODULE - III

Law of copyrights and law of patents: Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

MODULE - IV

Trade secrets and unfair competition: Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right of publicity and false advertising.

MODULE - V

New developments of intellectual property: New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual Property Right, Deborah. E. Bouchoux, 4th Edition, 2013, Cengage Learning.
2. Intellectual Property Right: Unleashing the Knowledge Economy, Prabuddha Ganguli, 3 rd Edition, 2005, Tata McGraw Hill Publishing Company Ltd.,

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	-	1	3	3	1	2	1	3	2	3	2	2	2	2	2
CO2	-	2	3	3	1	1	1	3	3	2	3	2	3	2	3
CO3	-	3	3	2	1	2	2	3	2	3	3	2	2	3	1
CO4	-	2	3	3	2	2	1	3	2	3	2	2	3	2	2
CO5	-	2	3	3	1	1	2	3	3	2	2	1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

01/7/23 7/7/2023 01/07/23 01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208THS42	Safety Management & Labour Law	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand roles, responsibilities importance of health safety, and welfare in workplaces.
- To impart knowledge about material handling, air pollution control system, fire prevention and protection.
- To learn about safety audit, disaster control, safety principles.
- To understand the labour laws and various acts applicable to industries.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- To acquire the knowledge of substantive as well as procedural contents of safety management and labour laws.
- To develop an insight into the wages law, factory act etc.
- To gather an understanding of natures of accidents and its effects.
- To gather an understanding of natures of various types of hazards in industry.

COURSE CONTENT:

MODULE -I

Safety management: Concept's evolution of modern safety concept, safety policy, safety in organization, line and staff functions for safety, safety committee, budgeting for safety, techniques incident recall technique (IRT), disaster control, job safety analysis (JSA), safety survey, safety inspection, safety sampling, safety audit.

Safety in material handling: Ergonomic consideration in material handling, design, installation, operation and maintenance of conveying equipment, hoisting, traveling and slewing mechanisms.

MODULE -II

Design of air pollution control system: Industrial sources of air pollution, emission factors, regulations control strategies, policies, gaseous pollutant control: gas absorption in tray and packed towers, absorption with/without chemical reaction, removal of SO_2, absorption in fixed blades-breakthrough, removal of HCs/VOCs, NOx removal, wet scrubbers.

Integrated air pollution control systems: Pollution control in process industries, pollution control in process industries like cement, paper, petroleum, petroleum products, textile, tanneries, thermal power plants dying and pigment industries, eco-friendly energy.

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MODULE –III

Safety in metal working machinery and wood working machines: General safety rules, principles, maintenance, inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes, saws, types, hazards.

MODULE -IV

Fire prevention and protection: Sources of ignition, fire triangle, principles of fire extinguishing, active and passive fire protection systems, various classes of fires, A, B, C, D, E, types of fire extinguishers, fire stoppers, hydrant pipes, hoses, monitors, fire watcher's layout of stand pipes, fire station, fire alarms and sirens, maintenance of fire trucks, foam generators, escape from fire rescue operations, fire drills, notice first aid for burns.

MODULE -V

Explosion protecting systems: Principles of explosion, detonation and blast waves, explosion, parameters, explosion protection, containment, flame arrestors, isolation, suppression, venting, explosion relief of large enclosure, explosion venting, inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO_2) and halons-hazards in LPG, ammonia (NH_3), sulphur dioxide (SO_2), chlorine (Cl_2) etc.

TEXT & REFERENCE BOOKS:

1. Accident Prevention Manual for Industrial Operations, N.S.C. Chicago, 1982.
2. Industrial Accident Prevention, H.W Heinrich, 1980, McGraw-Hill Company, New York.
3. Hand Book of Fire Technology, R.S. Gupta, Orient Longman, 1977, Bombay.
4. Accident Prevention manual for industrial operations, N.S.C. Chicago, 1982.
5. Fire and explosion protection, Dinko Tuhtar.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	2	3	1	-	2	2	-	2	-	2	2	3	2	3
CO2	3	2	2	2	-	3	2	-	-	-	2	1	3	2	2
CO3	3	3	2	3	-	2	3	-	-	-	2	2	2	3	2
CO4	3	3	3	3	-	2	2	-	1	-	2	2	3	2	2
CO5	3	3	3	2	-	2	2	-	2	-	2	2	2	2	-

- **1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)**

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TPE71	Product Design and Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

- Competence with a set of tools and methods for product design and manufacturing
- Develop confidence in your own abilities to create a new product.
- Create awareness of the role of multiple functions in creating a new product (e.g., marketing, finance, industrial design, engineering, production).
- Apply creative process techniques in synthesizing information, problem-solving and critical thinking

COURSE OUTCOMES:

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

- Understand the product design and manufacturing process
- Design and validate technological solutions to defined problems and write clearly and effectively for the practical utilization of their work
- Discuss various phases of value engineering, analyse the function, approach of function and evaluation of function and to determine the worth and value
- Select suitable manufacturing processes to manufacture the products optimally and to identify/control the appropriate process parameters.
- Use basic fabrication methods to build prototype models for hard-goods and soft-goods

COURSE CONTENT:

Module 1

Introduction to Product Design and Manufacturing: Design by evolution, Design by innovation, Production□Consumption cycle, Ideas and methods of product realization process, Manufacturing, Logistics & Producibility, Problem Confronting the Designers, Steps of the Engineering Design Process, Defining the Problem and Setting Objectives

Module 2

Product design morphology: Developing Provisional Designs, Evaluation and Decision□Making, The morphology of design (the seven phases)

Product Characteristics: Developing successful products, Attributes of successful product developments, Key factors for successful products, Product Characteristics, Aesthetic Design, Design Principles, Product Message, Visual Design, Elements of Visual Design

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Module 3

Value engineering in product design: Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Why poor Value? The Value Engineering Methodology, Information phase, Function Phase, Creativity Phase, Evaluation Phase, Development Phase, Implementation Phase, Case studies

Module 4

Material and Manufacturing process selection: Importance of material selection, Factors affecting the material selection process, Material selection procedures, Design Recommendations, how to select manufacturing process? Primary, secondary and tertiary manufacturing process, Design guidelines, Design for Manufacturing, Design for Assembly, Design for Environment

Product costing: Cost and Price Structure Information Need Sources, Estimating Direct and Indirect Costs, Design and Manufacturing Costs, Ways to Model Manufacturing Costs

Module 5

Rapid Prototyping an introduction: Rapid Prototyping or Additive Manufacturing, Rapid Prototyping: Topography and Photosculpture, Rapid Prototyping □ An Integral Part of Concurrent Engineering, Geometrical Modelling Techniques, Rapid Prototyping Information Workflow, Rapid Prototyping Processes

Reverse Engineering: Reverse Engineering-Definition, Importance, Applications, Process ,3D Scanning Process

Managing Competitiveness: Benchmarking, Outsourcing, Mass customisation

TEXT & REFERENCE BOOKS:

1. Product design and development, Eppinger, S. and Ulrich, K., 2015. McGraw-Hill Higher Education
2. Integrated product and process design and development: the product realization process, Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009. CRC Press.
3. Product design for manufacture and assembly. Computer-Aided Design, Boothroyd, G., 1994.
4. Product design and manufacturing by Prof J Ramkumar and Prof Amandeep Singh Oberoi IIT Kanpur, NPTEL sources

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	2	-	-	-	2	1	1	2
CO2	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO3	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO4	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO5	3	2	2	2	1	2	1	2	-	-	-	1	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

01/7/23 1/7/2023 01/07/23 01/07/23

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TPE72	Microprocessors in Automation	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the fundamentals of PIC microcontroller.
- Understand the working of microcontroller systems and able to determine its hardware and software.
- Interface with real time systems.
- Understand the design application based on microprocessors systems.

COURSE OUTCOMES:

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

- Learn embedded system and its applications in industry.
- Recognise working of microcontroller architecture and programming model.
- Identify the concept of timer, interrupt, I/O port interfacing with microcontroller.
- Study the concept of interfacing with real time system.

COURSE CONTENT:

MODULE - I

Number Systems: Codes, digital electronics, logic gates, combinational circuits design, flip-flops, sequential logic circuits design, counters, shift registers.
Introduction to 8085 functional block diagram, registers, ALU, bus systems, timing and control signals.

MODULE - II

Machine cycles: Instruction cycle and timing states, instruction timing diagrams, memory interfacing.

MODULE - III

Assembly language programming: Addressing modes, instruction set, simple programs in 8085, concept of interrupt, need for interrupts, interrupt structure, multiple interrupt requests and their handling, programmable interrupt controller, interfacing peripherals, programmable peripheral interface (8255).

MODULE - IV

Interfacing analog to digital converter & digital to analog converter, multiplexed seven segments LED display systems, stepper motor control, data communication: serial data communication (8251), programmable timers (8253), 8086/8088 microprocessor and its advanced features.

MODULE - V

Introduction to digital control: Sampling theorem, signal conversion and processing, Z-transform, digital filters, implementation of digital algorithm.

TEXT & REFERENCE BOOKS:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited.
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	2	1	2	-	-	-	2	1	1	3
CO2	2	3	3	2	2	1	2	2	-	-	-	2	2	3	1
CO3	2	2	3	3	2	2	2	2	-	-	-	3	3	2	2
CO4	3	3	2	1	2	1	3	2	-	-	-	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TPE73	Computer Aided Process Planning (CAPP)	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

- Learn the fundamentals of computer aided process planning, group technology and applications.
- Study the simulation of machining processes, importance of design and manufacturing tolerances.
- Understand the role of optimal selection of machining parameters.

COURSE OUTCOMES:

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

- Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation.
- Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence.
- Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances.
- Explain the generation of tool path and solve optimization models of machining processes.
- Create awareness about the implementation techniques for CAPP.

COURSE CONTENT:

MODULE -I

Introduction to CAPP: Information requirement for process planning system, role of process planning, advantages of conventional process planning over CAPP, structure of automated process planning system, feature recognition, methods.

MODULE – II

Generative CAPP system: Importance, principle of generative CAPP system, automation of logical decisions, knowledge-based systems, inference engine, implementation, benefits.

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.

MODULE –III

Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

MODULE – IV

Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

MODULE – V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

TEXT & REFERENCE BOOKS:

5. Automation, Production systems & Computer Integrated Manufacturing System, Mikell P. Groover, PHI Publication.
6. Computer Aided Engineering, David Bedworth, TMH Publishers
7. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Publisher.
8. Computer Aided Process Planning, H.P. Wang and J.K. Li, Elsevier Science and Technology Publishers, 1st edition, 1991.
9. Computer Aided Process Planning, Joseph Tulkoff, SME Publications.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2								2	1	2
CO2	3	2	2	2	1					1			2	2	2
CO3	3	1	3	1	2								2	1	2
CO4	3	2	3	1	2								2	1	2
CO5	3	2	1	1	2				1		3		2	1	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VIII Sem.	IP208TOE03	Advanced Manufacturing Processes	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the principle of various advanced machining processes kinematics drive of machine tool.
- To impart knowledge about cutting different material removal, joining processes.
- To understand about various advanced metal forming processes.
- Explain how to identify suitable hybrid welding processes for joining dissimilar materials.
- To understand about various advanced casting processes.

COURSE CONTENT:

MODULE – I

Advanced machining processes: Introduction, micro machiningprocess, principle, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes, working principle of plasma arc machining.

MODULE – II

Advanced machining theory & practices: Mechanisms of chip formation, shear angle relations, and theoretical determination of cutting forces in orthogonal cutting, analysis of turning, drilling and milling operations, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear, economics of machining, processing of polymers, ceramics, and composites.

MODULE – III

Advanced metal forming processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming electro-hydraulic forming, stretch forming, contour roll forming.

MODULE – IV

Advanced welding processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW),cold welding, diffusion welding, forge welding, friction welding, explosive welding, hard vacuum welding, soft vacuum welding, underwater welding processes, concept of robotized welding and welding automation.

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MODULE -V

Advanced casting processes: Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, evaporative pattern casting, ceramic shell casting.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Basic understanding of advanced casting processes and able to analyze real-life application in various organizations.
- Categorize different material removal, joining processes as per therequirements of material being used to manufacture end product.
- Choose material processing technique with the aim of cost reduction, reducing material wastage & machining time.
- Estimate process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.
- Evaluation and Analysis of the different advanced welding process to select most suitable welding procedure and consumables for a product.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for Engineering Materials, Serope Kalpakjian, Steven R. Schemid, Fourth edition, Pearson Education.
2. Manufacturing Engineering and Technology, Serope Kalpakjian, Third Edition, Addison-Wesley Publication Co.,
3. Materials and Processes in Manufacturing, E.P. DeGarmo, J. T Black, R.A. Kohser, 8th Edition, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
4. Manufacturing Science, A. Ghosh & A.K. Mallik, East-West Press Pvt. Ltd. New Delhi.
5. Non-traditional Manufacturing Processes, G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)
6. Advanced Machining Processes, V.K. Jain, Allied Publishers Pvt. Ltd.
7. Modern Machining Processes, P.C Pandey & H.S. Shan, McGraw Hill Education.
8. Manufacturing Technology, P. N Rao, Tata McGraw Hill Publishing Company.
9. Non-Conventional Machining, P. K Mishra, Narosa Publishers.
10. Unconventional Manufacturing Processes, K. K Singh, Dhanpat Rai & Company, New Delhi.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	2	2	2	-	1	1	2	1	2	2
CO2	2	2	2	1	1	-	-	1	1	1	1	2	1	2	2
CO3	1	2	2	2	1	1	2	1	2	1	1	2	2	2	2
CO4	2	3	3	3	1	-	-	2	-	1	1	2	2	2	2
CO5	2	2	2	3	2	1	1	2	-	2	1	2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TMC03	Essence of Traditional Knowledge	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. sustainability is at the core of Indian traditional knowledge systems connecting society and nature.
- Holistic life style of yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian knowledge system, Indian perspective of modern scientific world-view and basic principles of yoga and holistic health care system.

COURSE OUTCOMES:

- Ability to understand, connect up and explain basics of Indian traditional knowledge modern scientific perspective.

COURSE CONTENT:

- Basic structure of Indian knowledge system: अष्टादशविद्या -४वेद, ४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, ज्योतिष, छंद) ४उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र).
- Modern science and Indian knowledge system.
- Yoga and holistic health care.
- Case studies.

TEXT & REFERENCE BOOKS:

1. Cultural Heritage of India-course material, V. Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014.
2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan.
3. Tao of Physics, Fritz of Capra.
4. Tarkasangraha of Annam Bhatta, V.N. Jha (Eng. Trans.), International Chinmay Foundation, Velliarnad, Arnakulam.
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Yoga-darshanam with Vyasa Bhashya, G.N. Jha (Eng. Trans.), Ed. R.N. Jha, Vidyanidhi Prakashan, Delhi 2016.

7. **Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	2	-	-	-	2	1	1	2

8. **1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)**

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B.O.S held on Date 01.7.2023

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
SCHOOL OF STUDIES, ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

EVALUATION SCHEME OF PRE-PH.D COURSE WORK

EFFECTIVE FROM SESSION 2023-24

SN.	Name of the Subject	Subject Code	Periods / Week L – T – P	ESE Duration	ESE MARKS		Credits
					Max.	Min.	
1	Research Methodology in Engineering	IPDATT1	3 – 1 – 0	3 Hrs.	100	40	4
2	Elective - Program Elective	**	3 – 1 – 0	3 Hrs.	100	40	4
3	Elective – Professional Elective	***	3 – 1 – 0	3 Hrs	100	40	4
4	Seminar	IPDASC1	-	-	Qualified/Not qualified		-
Total			**9 – 3 – 0**	**-**	**300**	**165***	**12**

Duration of the semester will be 6 months.
*Candidate has to score minimum 55% of the aggregate marks to qualify in ESE.
Two core subjects as Electives (4 credits each) to be decided by the DRC.

List of Electives - Program Elective		** Subject Code	List of Electives – Professional Elective		*** Subject Code
S.N	Name of the Subject		S.N.	Name of the subject	
1	Computer Aided Design	IPDATK1	1	Advanced optimization techniques	IPDATP1
2	Robotics	IPDATK2	2	Logistics & supply chain management	IPDATP2
3	Finite Element Method	IPDATK3	3	Manufacturing Systems Management and Quality Engineering	IPDATP3
4	Artificial Intelligence	IPDATK4	4	Mechanics of Composite Materials	IPDATP4
5	Quality Engineering and Manufacturing	IPDATK5	5	Lean Manufacturing	IPDATP5
6	Production and Operations Management	IPDATK6	6	Fundamentals of Green Manufacturing	IPDATP6
7	Industrial Engineering and Business Management	IPDATK7	7	Strategic Management in Supply Chain	IPDATP7
8	Principles of Management, Cost and Projects	IPDATK8	8	Product Design and Manufacturing	IPDATP8
9	Manufacturing Processes	IPDATK9	9	Advanced Manufacturing Processes	IPDATP9

L : Lecture, T: Theory,P: Practical,Max.: Maximum Marks in ESE; Min.: Minimum Pass Marks in each subject as 40%

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Program Revision

IPDATT1 - RESEARCH METHODOLOGY IN ENGINEERING

COURSE OBJECTIVES

The objective of this course is to

1. To learn basic definition of research, statistical analysis and research types.
2. To learn mathematical tools for analysis, ethics in research and critical evaluation.
3. To define graphical description of data, research report and understanding about Probability Distributions

COURSE CONTENT

Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, developing a research question-Choice of a problem.

Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series Analysis. Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods.

Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis.

Use of statistical software SPSS in research. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.

Reference Books

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, VishwaPrakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0,2006

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3. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.

COURSE OUTCOME

CO1: Explain the concepts of tabular and graphical description of data, tables and graphs of frequency data of one variable

CO2: Demonstrate an ability to impart Relation between frequency distributions and other graphs and preparing data for analysis.

CO3: Develop Fundamentals of Statistical Analysis and Inference and Multivariate methods.

CO4: Demonstrate different types of research, various Steps in Research process, mathematical tools for analysis in developed research question.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3-	2	2	1	2	2	-	-	-	-	-	1	3	3	3
CO2	2	1	3	3	2	-	2	-	-	-	-	2	2	3	-
CO3	3	2	2	2	1	-	3	-	-	-	-	-	2	1	1
CO4	1	3	1	2	2	-	2	-	-	-	-	3	1	1	2

1. **Slight (Low) 2: Moderate (Medium) 3: Substantial (High)**

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IPDATK1- COMPUTER AIDED DESIGN

COURSE LEARNING OBJECTIVES:

The objective of this course is to

1. Understand the basic fundamentals of computer graphics used in CAD hardware and software.
2. Impart knowledge of various algorithms used to generate analytical, synthetic and parametric curves.
3. Introduce the new design concept and optimization technique to generate surface and solid in CAD.

COURSE CONTENT:

Basics of CAD, CAD system evaluation criteria, Principle of computer graphics, Hardware and software, Color management, Raster graphics, Lines, Circle, Ellipse, Parabola and Hyperbola drawing algorithms, Windowing, Clipping and View port, Software documentations.

Basics of curves, Parametric and non-parametric curves, Analytical and synthetic curves, Continuity of curves, Mathematical representation of curves, Wire frame models, Wire frame entities, Parametric representation of synthetic curves. Hermite cubic splines, Bezier curves, B-splines, Rational curves. Curve manipulation: Displaying, Segmentation, Trimming, and Intersection.

Coordinate systems, Fundamental of transformations, Concatenation and homogeneous transformations, Two and three dimensional geometric transformations, Projections.

Mathematical representation of surfaces, Surface model, Surface entities, Surface representation, Parametric representation of surfaces, Plane surface, Rule surface, Surface of revolution, Tabulated cylinder. Hermitebi-cubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface, Sculptured surface.

Mathematical representation of solid, Solid modeling, Solid representation, Boundary representation (B-rep), Constructive solid geometry (CSG), Analytic solid modelling, Introduction of Finite Element Method (FEM).

Text Books & References:

1. Zeid I. & Subramanian R. S., *CAD/CAM Theory and practice*, Tata McGraw Hill.
2. Zeid I., *Mastering CAD/CAM*, McGraw Hill International.
3. Groover M.P. &Zimmers E., *CAD/CAM: Computer-Aided Design and Manufacturing*, Pearson Education.

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4. Rao P.N., *CAD/CAM Principles and Applications*, Tata McGraw Hill.
5. Alavala, *CAD/CAM Concepts and Applications*, Prentice Hall of India.
6. Krishnamurthy N., *Introduction to Computer Graphics*, Tata McGraw Hill.
7. Newman W.M. &Sproull R.F., *Principles of Interactive Computer Graphics*, Tata McGraw Hill.

COURSE OUTCOMES

After successful completion of this course students are able to;
CO1: Analyze the engineering design process and its role in graphic communication process.
CO2: Generate and interpret engineering technical drawings of parts and assemblies according to engineering design standards.
CO3: Use CAD software to generate a computer model and technical drawing for a simple, well-defined part or assembly.
CO4: Fluent application of engineering techniques, tools and resources Effective oral and written communication in professional and lay domains.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs 1	PSOs 2	PSOs 3
CO1	3	2	2	3	1	-	-	-	-	-	-	2	3	3	3
CO2	3	1	3	3	1	-	-	-	-	-	-	3	2	3	2
CO3	3	2	2	-2	1	-	-	-	-	-	-	2	3	2	3
CO4	3	2	2	3	1	-	-	-	-	-	-	2	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK2 – ROBOTICS

COURSE LEARNING OBJECTIVES:

The objective of this course is to

1. Study about mechanism, mechanics and mechanical behaviour of the industrial robot.
2. Train researchers in the field of robotics and automation.
3. Learn how to design and build intelligent systems through a multidisciplinary approach.
4. Explore the concept of artificial intelligence and machine learning algorithms used in the robotics.

COURSE CONTENT:

An over view of Robotics, Progressive development, Classifications, Anatomy of robot and terminology, repeatability, Accuracy and precision, Yaw, Pitch and Roll, The mechanics and control of mechanical manipulator, sensors, actuators and controller.

Spatial descriptions and transformations, Description of links and joints, Coordinates frames, Fundamental of translation, rotations and transformations, Homogeneous transformations, Denavit-Hartenberg (D-H) representation, Arm equations, Forward and inverse kinematic problems, Solutions of inverse kinematic problems, multiple solutions.

General consideration in path description and generation, Joint space schemes, Trajectory planning and obstacles avoidance, Path planning, Skew motion, Joint integrated motion, Straight line motion, Robot programming languages and software packages.

Linear control of robot manipulation, Feedback and close loop control, Second-order linear systems, Trajectory following control, Modelling and control of single joint, Architecture of industrial robotic controllers, Artificial intelligence, Robot applications.

Reference Books

1. John J. Craig, "Introduction to robotics", Addison Wesley Longman.
2. Schilling Robert J., "Fundamentals of Robotics", Prentice Hall of India.
3. Nagrath I.J. & Mittal R.K., "Robotics & Control" Tata McGraw Hill.
4. Fu K.S., "Robotics", McGraw Hill.
5. Murphy, "Introduction of AI robotics", MIT press.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Understanding the concept of man and machine operation of industrial robots used in industries and real-world environment.

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CO2: Analysis of kinematic and dynamic behaviour of robot.
CO3: Understanding the concept of robot control theory and its application in robot controller.
CO4: Apply the concept of artificial intelligence and machine learning in industrial robots.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	-	-	-	-	-	-	2	3	3	2
CO2	3	1	3	2	1	-	-	-	-	-	-	3	2	3	2
CO3	3	3	2	2	1	-	-	-	-	-	-	2	3	2	1
CO4	3	3	2	3	1	-	-	-	-	-	-	2	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK3 - FINITE ELEMENT METHOD

COURSE OBJECTIVES:

- To learn basic principles and skills of finite element modelling and analysis.
- To learn the theory and characteristics of finite elements that represent engineering structures
- Apply knowledge of mathematics to understand the basic concepts of the finite element method
- Implement the basics of FEM to relate stresses and strains.
- Recognize the need for life-long learning to keep abreast of new numerical analysis methods, and to enhance one's abilities as an analyst.
- Model engineering problems using the finite element method

COURSE CONTENT:

Historical background, Basic concept of the Finite Element Method, Basic equations in elasticity, Elemental shapes, nodes, nodal unknowns and coordinate systems, A general procedure for Finite Element Analysis, Application to the continuum, Discretization of the domain, Governing equations for continuum, Pre-processor, Processer and Post processer.

Basic concept of interpolation functions, Shape function in one, two and three dimension, Finding of shape function by Polynomial, Lagrange polynomial, Serendipity family and Hermite polynomial, Construction of shape function by degrading technique.

Strain displacement and elemental stiffness matrix, Assembling stiffness equation, boundary conditions and solution, Spring and bar elements, Direct approach, Strain energy, Castigliano's first theorem, Minimum potential energy, Galerkin's method, and Variational method, Isoparametric formulations.

Finite Element Analysis, Bars, Beams Trusses and Rigid frame, Plates and shells, Heat transfer, Fluid and solid mechanics, Introduction to non-linear Finite Element Methods, Adaptive finite analysis, Automatic mesh generation, Choice of new mesh, Transfer variables.

Reference Books

1. Rao S.S., "The Finite Element Method in Engineering", Elsevier Science & Technology.
2. Hutton D.V., "Fundamental of Finite Element Analysis", McGraw Hills.
3. Cook R.D., Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite Element Analysis", 3 rd Ed., John Wiley & Sons.
4. Bathe K.J., "Finite Element Procedures", Prentice Hall of India, New Delhi.

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5. Huebner K.H. and Thorton, E.A., "The Finite Element Methods for Engineers" John Wiley & Sons.
6. Zienewiccz O.C. and Taylor, R.L., "The Finite Element Methods", Vol. 1, Vol. 2 and Vol.3, McGraw Hill.
7. Belytshko, T., Liu, W.K. and Moran, B., Non-linear Finite Elements for Continua and Structures", McGraw Hills.

COURSE OUTCOME

1. Explain the concepts and principles used in the formulation and application of the finite element method (focussed on stress analysis of common mechanical devices);
2. Demonstrate an ability to formulate, implement, and document solutions to solve simple engineering problems using the finite element method
3. Choose appropriate software packages to assist in the solution of a range of common engineering problems;
4. Evaluate the performance of an existing design using computer aided engineering software, in particular, to evaluate the validity of the model and solution in relation to the original problem specification;
5. Develop the finite element formulations for heat transfer problems.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3-	2	2	1	2	-	-	-	-	-	-	1	3	3	3
CO2	3	1	3	3	1	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	3	1	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1	2
CO5	3	1	3	3	1	-	-	-	-	-	-	2	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK4 -ARTIFICIAL INTELLIGENCE

COURSE OBJECTIVES:

The primary objective of this course is to:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
- Experiment with a machine learning model for simulation and analysis. 6. Explore the current scope, potential, limitations, and implications of intelligent systems.

COURSE CONTENT:

Definition of AI, Brief history of AI, General problem Solving Approaches in AI- Learning Systems, Knowledge representation and reasoning, Planning, Knowledge Acquisition, Intelligence search, Logic Programming, Soft computing, Applications of AI techniques, Characteristic requirement for the realization of intelligent system, Programming languages for AI, Architecture for AI machine.

Cognitive perspective of pattern recognition- Template Matching, Prototype matching, feature based approach, Computational approach; Cognitive models of memory- Atkinson-Shiffrin´s model, Tulving´s model, Parallel distributed processing approach; Understanding of problem; Cybernetic view to cognition.

Production rules, Working memory, Control Unit/Interpreter, Conflict Resolution strategies, Types of production systems-Commutative Production system, Decomposable Production system, Forward verses Backward reasoning, Merits of a Production system- Isolation of knowledge and control strategy, Direct Mapping onto State-space, Modular Structure of Production rules, Knowledge base Optimization in production system.

Production Solving by Intelligent Search: General problem solving approaches- Breadth first search, depth first search, Iterative deepening search, Hill Climbing, Simulated annealing; Heuristic Search- for OR Graph, Iterative deepening algorithm, AND-OR Graph, Adversary Search- MINIMAX algorithm, Alpha-Beta heuristics.

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Logic of Propositions and Predicates- Formal definition, Propositional Logic-Semantic method for theorem proving, Syntactic method for theorem proving, Resolution in Propositional Logic, Predicate Logic, Unification of Predicates, Robinson´s Interference Rule, Types of Resolution, Soundness and Completeness of Logic.

References:

1. Artificial Intelligence and Soft Computing, Amit Konar
2. Journal of Artificial Intelligence, Science Direct, Elsevier Publication
3. IEEE Transaction on Computational Intelligence and AI

COURSE OUTCOMES:

Upon successful completion of this course, the student shall be able to:

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	3	-	1	2	1	1
CO2	3	1	3	2	-		-		2	2		2	2	-	-
CO3	2	1	-	2	-	-	-	-	-	-	-	1	1	-	1
CO4	2	2	-	-	-	-	-	-	2	3		2	1	1	1
CO5	3	2	1	1	1	-	-	-	-	1	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK5 - QUALITY ENGINEERING AND MANUFACTURING

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Recognize the basic knowledge of quality value and engineering and importance of quality engineering in design production processes.
2. Understand the tolerance design and core values of design strategy.
3. Develop the concepts and statistical methods that are employed for functional limits, tolerance design in manufacturing environment.
4. Determine the effect of DOE process steps description and analysis of variance amongst data sets.
5. Apply and analyze the concept of quality system, 6-sigma and quality circles.

COURSE CONTENT:

Quality value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design production processes.

Loss function and quality level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type-, S-type and L-type)

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and tolerance design: Introduction to parameter design, signal to noise ratios, parameter design strategy, Introduction to tolerance design, tolerance design using the loss function, identification of tolerance design factors.

Design of Experiments: Introduction, Task aids and Responsibilities for DOE process steps, DOE process steps description. Analysis of variance (ANOVA): Ono-WAY anova, One-way ANOVA, two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, conducting and analyzing an experiment. Interpolation of experimental results: Interpretation methods, percent contribution, estimating the mean.

ISO-9000 Quality system, BDRE, 6-sigma, bench marking, quality circles-brain storming fish bone diagram-problem analysis.

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References Books

1. Taguchi techniques for quality engineering/Philip J.Ross / McGraw Hill Intl. 2nd Edition.
2. Quality Engineering in Production systems/G.Taguchi, A.Elasayed et al/Mc.Graw Hill Intl. Edition.
3. Taguchi methods explained: Practical steps to Robust Design/PapanP.Bagchi/Prentice Hall Ind. Pvt. Ltd. New Delhi.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Develop conceptual understanding of Design of Experiments and identification of tolerance design factors.
2. Analyze and develop an experiment and. Interpolation of experimental results and Interpretation methods.
3. Apply the knowledge of Parameter and tolerance design and its principles for handling manufacturing operations.
4. Implicate the concept of ANOVA and philosophy of quality circles for productivity.
5. Define the quality engineering and manufacturing and implicated quality engineering in production design for inducing efficiency.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	2	-	2	2	-	2	3	2	1
CO2	1	1	3	1	1		-			1		2	2	3	2
CO3	-	-	3	2	1		-	-	-	-	-	3	2	3	2
CO4	2	1	2	-	-	-	2	-	2	2		3	1	1	2
CO5	3	2	2	2	2	-	-	-	-	3	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK6- PRODUCTION AND OPERATIONS MANAGEMENT

COURSE LEARNING OBJECTIVES:

The objective of this course is to

1. To define operation management, Types of production systems and current issues in operation management.
2. To categorize various processes of product development and its concepts in product development for grasping effectual performance
3. To understand about standardization, simplification and planning.
4. To outline competitive advantages, factors considerations in plant location and aggregate planning strategies
5. To elaborate JIT Production process, push system and techniques of MRP.

COURSE CONTENT:

Operation Management – Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management. Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization - simplification – Speed to market – Introduction to concurrent engineering.

Value engineering – objective – types of values –function & cost – product life cycle – steps in value engineering – methodology in value engineers – FAST Diagram –Matrix Method. Location – Facility location and layout – Factors considerations in Plant location – Comparative Study of rural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout – line balancing.

Aggregate Planning – definition – Different Strategies – Various models of Aggregate Planning- Transportation and graphical models Advance inventory control systems push systems –Material Requirement – Terminology – types of demands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP – Manufacturing Resources Planning (MRP – II). Pull systems – Vs Push system – Just in time (JIT) philosophy Kanban System - Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

Scheduling – Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

Project Management – Programming Evaluation Review Techniques (PERT) – three times estimation – critical path – probability of completion of project – critical path method - crashing of simple nature.

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References Books

1. Operations Management by E.S. Buffa.
2. Operations Management, Theory and Problems by Joseph G. Monks.
3. Production Systems Management by James. L. Riggs.
4. Production and Operations Management by Chary.
5. Operation Management by Chase&Acquilino
6. Production & Operation Management by PannerSelvam
7. Production & Operation Analysisby Narsimha

COURSE OUTCOMES:

After the completion of this course, students will be:

1. Demonstrate a basic understanding about types of scheduling and critical paths.
2. Acquire knowledge about various models of aggregate planning and methods of selection plant layout.
3. Demonstrate technical understanding about value engineers, inventory and MRP.
4. Implement decision making policies, Gantt Charts and line balancing principles for handling manufacturing network.
5. Resolve uncertain production decision in decision making by applying critical thinking, tools and techniques.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	2	-	2	2	-	2	3	2	1
CO2	3	1	-	1	2		2	3		2		3	2	3	3
CO3	2	-	1	2	1	-	-	-	-	-	-	3	2	1	1
CO4	2	1	2	-	2	1	2	-	2	2		2	1	2	2
CO5	1	2	3	2	2	-	-	-	-	3	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK7- INDUSTRIAL ENGINEERING AND BUSINESS MANAGEMENT

COURSE LEARNING OBJECTIVES:

The objective of this course is to

1. To develop an understanding about work design, method design and associated terminologies.
2. To understand about capacity planning, business structure and productivity.
3. To comprehend about the nature and process and functions of communication.
4. To develop an understanding about operational control, agile management and competition

COURSE CONTENT:

Work Design and Facility layout Method study, Work measurement, applied work measurement, Physical ergonomics, Environmental factors, Productivity, Role of industrial Engineering in attaining productivity.

Plant location, Facilities layout, Group technology and line balancing, Materials handling, Break even analysis, Incentives.

Capacity analysis, Operational control, Agile management, Just-in-Time, Creative design, Innovation, Invention, Globalization, Team work, Project scheduling and management

Overview of business analytics, scope of business analytics, business analytics process, relationship of business analytics process and organisation, competitive advantages of business analytics.

Statistical tools: statistical notation, descriptive statistical methods, review of probability distribution and data modelling, sampling and estimation methods overview.

Nature and process of communication, Functions of communication, Theories and models of communication. Development communication, Role of media in Development communication, communication research, research problem, objectives, variables, sampling, qualitative research methods, field observation, focus groups, interviews, case studies, quantitative methods, content analysis, survey research, questionnaire, statistics.

Text Books & References

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.
3. Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjan, Pearson Education.

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4. The Economics of Sustainable Development, S. Asefa, W.E. Upjohn Institute for Employment Research, 2005.
5. Production and operation management, O.Paneerselvem, TMH.
6. Charles T. Horngren and George Foster, Advanced Management Accounting.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Identify the various process of communication, associated theories and models
2. Students will be able to classify development communication, Role of media in development communication, communication research.
3. Students will be able to use the knowledge of Innovation, Invention, Globalization, Team work, Project scheduling.
4. Students will be able to examine the factors related with Productivity and industrial Engineering in attaining productivity.
5. Students will be able to participate in business analytics process and can plan relationship amongst business analytics process and organization.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	1	2	-	-	-	2	2	-	2	3	3	3
CO2	2	1	3	3	1		-			3		2	2	2	-
CO3	2	-	-	3	-	-	-	-	3	-	-	2	2	1	-
CO4	2	3	3	-	-	-	-	-	3	3		3	1	1	2
CO5	2	1	3	3	1		-			3		2	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK8- PRINCIPLES OF MANAGEMENT, COST AND PROJECTS

COURSE OBJECTIVES:

The objectives of this course are:

- To understand the basic concept of the functions and responsibilities of managers.
- To learn the nature and purpose of planning, business organizations, sole proprietorship and partnership
- To understand the nature and purpose of organization, departmentalization, delegation of authority, centralization and decentralization.
- To learn the leadership qualities and the methods of directing for effective communication.
- To learn the different methods of controlling the management activities.
-

COURSE CONTENT:

Definition of management, science or art, manager v/s entrepreneur, types of managers managerial roles and skills, evolution of management- scientific, human relations, system and contingency approaches, types of business organizations, sole proprietorship, partnership, company, public and private enterprises, organization culture and environment, current trends and issues in management.

Planning objectives, policies, strategic management, planning tools and techniques, decision making steps & processes, Introduction and overview of the strategic cost management process.

Formal and informal organization, organization structure, departmentalization, delegation of authority, centralization and decentralization, job design, performance management, Cost concepts in decision-making, differential cost, incremental cost and opportunity cost. Objectives of a costing system.

Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

Project: meaning, different types, why to manage, various stages of project execution, Detailed engineering activities, use of computers and IT in management control, productivity problems and management, control and performance, Quantitative techniques for cost management, linear programming, PERT/CPM, transportation problems, assignment problems, simulation.

TEXT & REFERENCE BOOKS:

1. Management, S.P. Robins & M. Couiter, 10th Edition, 2009, Prentice Hall India.
2. Management, Jaf Stoner, R.E Freeman and D.R Gilbert, 6th Edition, 2004, Pearson Education.
3. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi

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4. Charles T. Horngren and George Foster, Advanced Management Accounting
5. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
6. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.
7. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.
8. Principles of Management, P.C Tripathy & P.N. Reddy, 1999, Tata McGraw Hill.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Learn the basic concepts of managerial functions and current trends and issues in management.
- Explain the nature of planning with the help of tools and techniques.
- Learn the nature and purpose of organization structure and the whole management system.
- Explain the leadership qualities and learn about quantitative techniques for cost management, linear programming.
- Analyze and apply both qualitative and quantitative information to isolate issues and formulate best control methods.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	3	-	-	2	2	-	2	3	3	3
CO2	2	1	2	3	1		-			3		2	2	2	-
CO3	1	-	-	3	-	1	1	-	3	-	-	2	-	1	2
CO4	1	3	3	-	-	-	-	-	3	3		3	3	1	2
CO5	3	2	2	2	2	-	-	-	-	2	-	2	-	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATK9- MANUFACTURING PROCESSES

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

- Understand the principle, concept, thermal and metallurgical aspects during solidification of metal.
- Demonstrate about principles/ methods of casting with detail design of gating/ riser system needed for casting, defects in cast objects and requirements for achieving sound casting.
- Evaluate foundry practices like pattern making, mould making, core making and inspection of defects.
- Build knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach.
- Analyze various metal forming processes and plastic deformation during forming processes.

COURSE CONTENT:

Module –I

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances & design considerations, types of moulding sand & their properties, testing, cores and sand core boxes, core making, moulding machine.

Gating system: Elements & design of gating system, design of riser, solidification of casting.

Module –II

Melting furnaces and practices: Melting cast iron, steel and non-ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

Module –III

Special casting processes: Centrifugal and investment casting, shell, types and principle of die casting, squeeze casting, gravity and pressure die casting, die casting consideration, continuous casting, centrifugal casting, slush casting, casting defects.

Module –IV

Metal forming: Need and classification, elastic and plastic deformation, yield criteria, fundamentals of hot and cold working processes.

Drawing: Drawing process geometry and analysis of wire and sheet drawing for load and power calculations, maximum reduction possible.

Rolling: Classification of rolling, process geometry and analysis of plate rolling for rolling load, rolling pressure and power calculations, defects in rolled products.

Forging: Classification of Forging, determination of forces in disc forging considering sticking and slipping, forging defects.

Extrusion: Classification, process geometry and analysis of rod and sheet extrusion for load and power calculations, maximum reduction possible, defects in extruded product.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials - Kalpakjian and Schmid, Pearson India.
2. Manufacturing Science- A. Ghosh and A. K. Mallik, East-West Press Pvt. Ltd. New Delhi.
3. Manufacturing Technology (Foundry, Forming and Welding) – P. N. Rao, Tata McGraw Hill Publishing Company.
4. Materials and Processes in Manufacturing - E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi.
5. Production Engineering Sciences - P. C. Pandey and C. K. Singh, Standard Publishers Ltd.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Decide yield of a material according to different yield theory for a given state of stress.
- Analyze the different bulk metal forming process mechanics using different analysis approach and calculate the force, power requirements etc.
- Evaluate the effect of process parameters on the process mechanics during bulk metal forming.
- Select appropriate design of gating systems and manufacturing processes in order to design products.
- Identify the various metal forming techniques and the theory of plasticity and its application for analyzing various metal forming Processes.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2		-	-	-	2	1	2	2	2
CO2	3	2	1	2	1	2	2	1	-	-	2	2	3	3	3
CO3	3	2	2	2	2	1	2	2	-	-	2	3	2	3	3
CO4	3	2	2	2	2	2	2	1	-	-	2	2	2	3	3
CO5	3	1	2	2	1	2	2	1	-	-	2	2	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP1 - ADVANCED OPTIMIZATION TECHNIQUES

COURSE LEARNING OBJECTIVES:

- Impart knowledge on theory of optimization and conditions for optimality for unconstraint and constraint optimization problems
- Learn quantitative methods and techniques for effective decision making process
- Inculcate modeling skills necessary to describe and formulate optimization problems in design and manufacturing
- Familiarize with the working principle of optimization algorithms used to solve linear and non-linear problems
- Train the students to solve optimization problems using software tools

COURSE CONTENT

Linear programming: Two-phase simplex method, Big-M method, duality, interpretation, applications. Assignment problem: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, traveling salesman problem.

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.
Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,
Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

Multi-Objective GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multiobjective problems .

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining

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process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

References Books

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers
4. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
5. Genetic Programming- Koza
6. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI publisher.

COURSE OUTCOMES

- **CO1**: Formulate the engineering problems as an optimization problem.
- **CO2**: Apply necessary and sufficient conditions for a given optimization problem for optimality
- **CO3**: Select appropriate solution methods and strategies for solving an optimization problem and interpret and analyze the solution obtained by optimization algorithms
- **CO4**: Justify and apply the use of modern heuristic algorithms for solving optimization problems
- **CO5**: Solve Engineering Design and Manufacturing related optimization problem using software tools.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PC6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	-	-	-	1	1	-	1	1	-	-
CO2	1	3	2	1	-	-	-	-		1	-	-	1	-	-
CO3	1	3	2	1	1	-	-	-	2	1	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	2	1	-	-	-	-	-
CO5	1	3	3	2	3	-	-	-	2	2	-	1	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP2- LOGISTICS & SUPPLY CHAIN MANAGEMENT

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To understand supply chain activities, process planning, decision phases, importance and management of supply chains.
2. To examine various drivers of supply chain for acquiring effectual performance, ease distribution and acquisition of production resources & Inventories.
3. To understand about uncertainty, risk management, distribution network, role of location, capacity and forecasting in SC.
4. To adapt drivers of supply chain, related framework and to appraise supply chain performance, pricing and sourcing decisions.
5. To learn the role of logistics and transportation networks.

COURSE CONTENT

Logistics and Competitive Strategy: Competitive advantage through logistic – Mission –integrated supply chains – Models in Logistics Management – Logistics to supply Chain Management – Focus areas in supply Chain Management – performance Measures for SCM. Customer Service Dimension: The marketing and logistics interface – Customer service and customer retention - Service driven logistics systems – Basic service capability – Increasing customer expectations – Value added services – Customer satisfaction and success – Time based logistics. Logistics System Design: Logistics positioning – Logistics reengineering – reengineering procedure – logistics environmental assessment – time based logistics – alternative logistics strategies – strategic integration – logistics time based control techniques. Measuring Logistics Costs and Performance: The concept of Total Cost analysis – Principles of logistics costing – Logistics and the bottom line – Impact of Logistics on Shareholder value – customer profitability analysis – direct product profitability – cost driver and activity based costing. Logistics and Supply chain relationships: Benchmarking the logistics process and SCM operation – Mapping the supply chain processes – Supplier and distributor benchmarking – setting benchmarking priorities – identifying logistics performance indicators – Channel structure – Economics of distribution – channel relationship – logistic service alliances. Sourcing, transporting and pricing products: Sourcing decisions – transportation in the supply chain – basic transportation economics and pricing – transportation documentation – pricing and revenue management in the supply chain – pricing and revenue management in supply chains. Coordination and Technology in Supply chain: Lack of coordination and Bullwhip Effect – obstacles to coordination – managerial levers to achieve coordination – Building strategic partners and trust within a supply chain. Role of IT in the supply chain – E-business. Managing global logistics and global supply chains: Logistics in a global economy –

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global operating levels – interlink global economy – Global supply chain business processes – Global strategy, purchasing, logistics – Global alliances – Issues and Challenges.

References Books

1. Donald J. Bowersox and David J. Closs, Logistical Management: The Integrated Supply Chain Process, TMH.
2. Martin Christopher, Logistics Supply Chain Management, Pitman, London.
3. Sunil Chopra and Peter Meindl: Supply Chain Management: Strategy, Planning and Operation, Pearson Education, New Delhi.
4. B.S.Sahay, supply Chain Management for Global competitivesness, Macmillan.
5. Philip B.Schary, TageSkjott – Larsen: Managing the Global Supply Chain.
6. Arjun J Van Weele: Purchasing and Supply Chain Management- Analysis, Planning and Practice, Thomson Learning.
7. Ballou, Business Logistics/Supply chain management, Pearson Education.

COURSE OUTCOMES

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

CO1- Demonstrate basic understanding about competition, logistics network, capable factors for supply chain designs and supply chain strategies.

CO2- Acquire knowledge about distribution network, e-business, forecasting, network design and time-series analysis.

CO3- Decide technical understanding about demand, inventory, safety, pricing and information technology.

CO4- Manage and measure sourcing decisions in supply chain, product availability under capacity constraints, optimal levels of product, services and resources.

CO5- Identify and rectify barriers in coordination in a supply chain system.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	2	3	2	2	-	2	-	2	-	2	2	3	2	3
CO2	3	3	3	2	2	3	2	-	2	-	2	-	3	2	2
CO3	3	3	2	2	2	2	-	-	2	-	2	2	2	3	-
CO4	3	3	2	2	-	2	2	-	2	-	2	2	3	2	-
CO5	3	3	-	3	-	1	-	1	2	-	2	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP3 -MANUFACTURING SYSTEMS MANAGEMENT AND QUALITY ENGINEERING

COURSE LEARNING OBJECTIVES:
The objective of this course is to:

1. Recognize the basic knowledge of Manufacturing Systems and importance of quality control and management.
2. Understand the philosophy, principles and core values of TQM.
3. Develop the concepts and statistical methods that are employed for assurance of quality in products, processes and systems in manufacturing environment.
4. Determine the effect of process capability analysis and introduction of sampling plans.
5. Apply and analyze the concept of measurement, maintenance and planning for quality.

COURSE CONTENT:

Manufacturing Processes, Advances in Manufacturing Processes, Casting, Welding, Forming, Unconventional machining processes, Additive manufacturing, Micro and Nano-Machining Processes, Metrology for quality control.

Manufacturing management and Operations research facility, Capacity & Layout Planning, Maintenance strategies. Role of Linear Programming, Sequencing.

Measurements, Errors, Accuracy, Precision, Calibration, Measuring instruments, types, Gauges, Comparators, In-process inspection, Introduction of sensors and transducers.

Control charts acceptances sampling, TQM, TPM, Design of Experiments, Statistical process control, Sampling, TQM principles and their Implementation, TQC, Maintenance, Replacement.

Statistical process control, Online/offline quality control, Process capability, Design of experiments, Reliability, Maintainability

Elimination of waste and problem exposure. Total quality control systems. Demings wheel, Deming 14 points-pros and cons in engineering context, Quality management philosophies. Quality function development, Quality control circles. Application of TQM to service type organizations.

Numerical control, Robotics, Material handling, FMS, Cellular manufacturing

Text Books & References:

1. Manufacturing Engineering and Technology – Serope Kalpak Jain, and Steven R. Smith, Pearson education.
2. Automation, Production systems and Computer Integrated Manufacturing System – Mikell P. Groover, PHI Publication.

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3. Grant E.L. and Leave Worth, Statistical Quality Control, TMH. 1996.
4. Amitava Mitra, Fundamentals of Quality Control and Improvement, Wiley, 2016.
5. Maintenance Engineering, H. P. Garg, S. Chand and Company.
6. Introduction to Manufacturing Processes by John A Schey, Mc Graw Hill.
7. Non-Traditional Manufacturing Processes by Gary F Benedict, CRC Press.
8. Advanced Methods of Machining by J. A Mc Geough, Springer
9. Jain K.C. and Chitale A.K., Quality Assurance and Total Quality Management, Khanna Publisher, India, 2003.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Develop conceptual understanding of maintenance, manufacturing, quality cost and value.
2. Analyze and develop control charts for statistical quality control.
3. Apply the knowledge of quality control and its tools for handling manufacturing operations.
4. Implicate the concept of TQM and philosophy of quality leaders for productivity.
5. Define the manufacturing process and implicated sensors and transducers for inducing process capability analysis.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	2	2	-	2	3	2	3
CO2	2	1	3	3	1		-			1		2	2	3	2
CO3	3	-	-	2	1	-	-	-	-	-	-	2	2	2	2
CO4	2	3	2	-	-	-	-	-	2	3		3	1	1	2
CO5	3	2	2	2	2	-	-	-	-	2	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP4 - MECHANICS OF COMPOSITE MATERIALS

COURSE LEARNING OBJECTIVES:

The objectives of this course is to

1. Understand the fundamental properties of composite materials;
2. Apply the fundamental principles and mechanics of composite materials;
3. Apply modern analytical techniques to mechanical systems with composite materials;
4. Apply computational techniques to mechanical systems with composite materials;
5. Understand the manufacturing processes and cost analysis in composite materials;
6. Demonstrate effective communication and teamwork skills through technical presentations and reports in term projects.

COURSE CONTENTS

Introduction: Definition of composites; classification of composites; Fibers and matrix materials and their properties; generalized Hook's law- orthotropic, transversely isotropic and isotropic materials; constitutive equations under plane stress condition for orthotropic materials, restrictions on elastic constants of orthotropic materials.

Macromechanics of Lamina: Stress-strain relations for a lamina of arbitrary orientation, invariant properties of an orthotropic lamina, strength of an orthotropic lamina, experimental determination of strength and stiffness, biaxial strength theories of an orthotropic lamina: maximum stress theory, maximum strain theory, Tsai-Hill theory, Tsai-Wu tensor theory.

Micromechanics of lamina: Mechanics of materials approach to stiffness (determination of E_1, E_2, U_{12}& G_{12}); mechanics of materials approach to strength; tensile and compressive strength in fiber directions, elasticity approach to stiffness, some results of exact solution.

Micromechanics of laminate: Classical lamination theories (CLT)- laminate stress, laminate stiffness- A-B-D matrix and their implication, symmetric and non-symmetric laminates interlaminate stress, limitations of classical lamination theory.

Short Fiber Composites: Theories of stress-transfer, average fiber stress, modulus prediction, strength prediction, the effect of matrix ductility, ribbon–reinforced composites.

Text & Reference books:

1. "Modern Composite Materials" by L J Broutman and R M Krock,
2. "Composite Materials – Science and Engineering" by K K Chawla,
3. "Mechanisms and Mechanics of Composite Fracture" by R B Bhagat and S G Fishman,
4. "An Introduction to Composite Materials" by D Hull,

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5. "Structural composite materials" by F C Campbell.
6. "Composite Materials" by Berthelot,
7. "Electrostatic Discharge Sensitivity of Composite Energetic Materials" by Michelle L Pantoya and Chelsea Weir.
8. Jones, R M, Mechanics of Composite Materials, Scripta BookCo.
9. Agarwal, B D and Broutman, J. D, Analysis and Performanceof Fiber Composites, New York, John Willey, and Sons, 1990.
10. Mallik, P. K, Fiber reinforced composites: materials,manufacturing and design, New YorkMarcel and Dekker,1993 (2nd edition)
11. Arthur, K Kaw, Mechanics of Composite Materials, CRCPress, 1997.
12. Reddy J N, Mechanics of Laminated Composite Plates, CRCPress

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus.
2. Determine the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness.
3. Apply classical laminated plate theory to determine extensional, coupling, and bending stiffnesses of a composite laminate. Also be able to perform this calculation using MATLAB for a composite laminate with many layers.
4. Fabricate composite laminates and built-up composite structures such as I-beams, box beams, or model-scale aircraft wings using a composite manufacturing procedure.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	2	1	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3
CO3	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO4	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP5 - LEAN MANUFACTURING

COURSE OBJECTIVES

- Detailed knowledge and information about lean manufacturing tools and their impact on Plant Productivity and Product Cost
- The required skills to understand and/or audit lean implementation maturity in your plant across various departments in different processes to check for gaps and advice accordingly
- Tools and techniques in the efforts to introduce lean practices within the organisation
- A sense of achievement for contributing to organisational scalability and hence growth, in turn, demonstrating potential, talent and encouraging additional opportunities for higher roles and responsibilities
- The necessary flexibility to adapt to change, without letting it affect the individual, team or organisational performance
- The skill and ability to deliver higher quality and establish reliability and credibility for work

CONTENTS

Introduction Lean Manufacturing:

Introduction, Definitions of Lean manufacturing, explaining basic concepts, historical development, overview of Lean Principles / concepts / tools.

Primary Tools of Lean manufacturing:

5-S, Workplace organization, Total Productive Maintenance, Process mapping/ Value stream mapping, Work cell.

Secondary Tools of Lean manufacturing:

Objective and benefits of Secondary lean tool, Cause and Effect diagram, Pareto chart, Spider chart, Poka yoke, KANBAN, Automation, Single minute exchange of die (SMED), Design for manufacturing and assembly, Just in time (JIT), Visual workplace, OEE.

Tools and Techniques:

The seven traditional tools of quality, new management tools, concepts, methodology, applications to manufacturing, Bench marking. Reason to bench mark, Bench marking process, FMEA, Stages, and Types. Quality circles, Quality Function Deployment (QFD), Taguchi quality loss function, TPM, improvement needs, Cost of Quality, Performance measures.

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Lean Management:

Concepts and Frame Work of Lean Manufacturing, Characteristics, benefits to organizations, Management theory, six sigma, Why six sigma, case studies

Text Books & Reference Books:

1. Mitra A., "Fundamentals of Quality Control and Improvement", PHI, 2nd Ed., 1998.
2. J Evans and W Linsay, The Management and Control of Quality, 6'th Edition, Thomson, 2005
3. Besterfield, D H et al., "Total Quality Management", 3rd Edition, Pearson Education, 2008.
4. D. C. Montgomery, Design and Analysis of Experiments, John Wiley & Sons, 6th Edition,2004
5. Dale H.Besterfiled, "Total Quality Management", Pearson Education Asia.

COURSE OUTCOMES:

1. Identify types of waste in manufacturing system and systematic eliminate it.
2. Study and implement lean principles.
3. Able to implement primary and secondary lean tools in manufacturing system.
4. Analyze and implement objectives and drivers of lean production system to achieve cost reduction and efficient service of customer demands
5. Apply appropriate approaches to project using Lean tools and techniques.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	1	1	3
CO2	3	3	1	3	1	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	2	1	1
CO4	3	2	1	2	2	-	-	-	-	-	-	1	1	1	2
CO5	3	1	3	1	1	-	-	-	-	-	-	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP6 - FUNDAMENTALS OF GREEN MANUFACTURING

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To develop the basic concepts of the three pillars of sustainability and how they are manifested in sustainable and green manufacturing as well as to facilitate the students to presume position of scientific and/or managerial leadership in their career paths towards green manufacturing.
2. To help students to develop the basics of the green manufacturing concepts, strategy, different technology used to implement green manufacturing.
3. To develop the basic concepts of Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.
4. To broaden and deepen their capabilities and understanding towards concepts of different types of green technology.
5. To help students to develop the basic understanding on lean and green technology and differences and similarities between both.

COURSE CONTENT:

Introduction: Sustainable development indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing out puts, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA, life cycle costing, eco labellingtarget setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

TEXT & REFERENCE BOOKS:

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.

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4. Costing the earth, Cairncrss and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.
7. Manufacturing strategy, Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar Publishing Limited, 2007.
12. Industrial Development for the 21st Century: Sustainable Development Perspectives, D. Rodick, UN New York, 2007.
13. An Introduction to Sustainable Development, P.P. Rogers, , K.F. Jalal & J.A. Boyd, J.A, Earth scan, London, 2007.
14. Sustainable Development Indicators in Ecological Economics, P. Lawn, Edward Elgar Publishing Limited.
15. The Economics of Sustainable Development, S. Asefa, W.E. Upjohn Institute for Employment Research, 2005.

COURSE OUTCOMES:

Upon completion of the course students will be able to

1. **CO1**-Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
2. **CO2**-Graduate will become familiar with green manufacturing concepts and practices and analyze the problems within the domains of Green Manufacturing as the members of multidisciplinary teams. As well will be able to formulate appropriate green manufacturing strategy.
3. **CO3**-Graduate will be trained towards the basic concepts of Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.
4. **CO4**-Formulate and apply different green technologies as per the requirement and situations and able to plan good housekeeping practices for Industry/other places with concern of safety, hygiene and waste reduction.
5. **CO5**- Apply different approaches of lean and green manufacturing in the real world problem to overcome the problems arises due to manufacturing.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	-	2	3	2	1	2	3	1	1	2	2	1	3	2	2
CO2	-	2	3	2	1	3	3	1	1	2	3	2	3	2	2
CO3	-	2	3	2	1	2	3	2	1	3	3	2	3	3	3
CO4	-	2	3	2	2	3	3	1	1	3	2	2	3	2	2
CO5	-	2	3	2	1	3	3	1	1	2	2	1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP7- STRATEGIC MANAGEMENT IN SUPPLY CHAIN

COURSE LEARNING OBJECTIVES:

The objective of this course is to

1. To define supply chain, its importance and management.
2. To categorize various drivers of supply chain for grasping effectual performance
3. To understand about uncertainty, risk management and forecasting.
4. To outline competitive advantages, distribution networks and supply chain strategies
5. To elaborate drivers and barriers of distribution networks in practice.

COURSE CONTENT:

Strategic framework to analyze supply chains, Supply chain and its objective, the importance of supply chain decisions, decision phases in a supply chain, process view of a supply chain, examples of supply chains.

Supply chain performance: achieving strategic fit and scope, competitive and supply chain strategies, achieving strategic fit, expanding strategic scope, supply chain drivers and metrics, drivers of supply chain performance, framework for structuring drivers, facilities, inventory, transportation, information, sourcing, pricing.

Forecasting, Time series method, moving average, weighted average, trend, seasonality, regression technique, Delphi method, The role of network design in the supply chain, factors influencing network design decisions framework for network design decisions, models for facility location and capacity allocation, role of IT in network design, making network design decisions in practice.

Aggregate planning in a supply chain, Master production schedule: Material requirement planning: objectives, functions, MRP, MRP-II, limitations. Capacity requirement planning, process of CRP, process sheet, rough cut capacity planning, loading, and preparation of CRP chart, Planning supply and demand in a supply chain, Planning and managing inventories in a supply chain, Managing uncertainty in a supply chain:

Text Books & References:

1. Supply Chain Management: Janat Shah, Pearson Publications 2010.
2. Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI 2010.
3. Supply Chain Management: A.S.Altekar PHI Second Ed.2006.
4. Logistics Management: James Stock and Douglas Lambert. McGraw Hill International Ed.2006.
5. Supply Chain Management for Global Competitiveness :Ed.B.S.Sahay McMillan Publication 2000
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication 2000.
7. Logistics Management: Bowersox TMH 2004.

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COURSE OUTCOMES:

After the completion of this course, students will be:

1. Demonstrate a basic understanding about competition and supply chain strategies.
2. Acquire knowledge about distribution network, E-business and time-series.
3. Demonstrate technical understanding about demand, inventory, safety, pricing.
4. Implement decision making policies, infrastructure and optimum design for handling transportation network.
5. Resolve uncertain and risk decision in decision making and can capably tailored transportation and supply chain costs.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs 1	PSOs 2	PSOs 3
CO1	3	2	1	2	2	-	2	-	2	-	-	2	3	2	2
CO2	3	-	3	2	2	3	2	2	2	-	2	-	-	-	-
CO3	2	-	2	-	2	-	-	-	3	-	-	2	2	1	-
CO4	2	3	2	2	-	2	2	-	3	-	3	2	1	3	-
CO5	-	3	-	-	-	1	-	2	2	-	2	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP8 - PRODUCT DESIGN AND MANUFACTURING

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

1. Competence with a set of tools and methods for product design and manufacturing
2. Develop confidence in your own abilities to create a new product.
3. Create awareness of the role of multiple functions in creating a new product (e.g., marketing, finance, industrial design, engineering, production).
4. Apply creative process techniques in synthesizing information, problem-solving and critical thinking

COURSE CONTENT:

Introduction to Product Design and Manufacturing: Design by evolution, Design by innovation, Production-Consumption cycle, Ideas and methods of product realization process, Manufacturing, Logistics & Productivity, Problem Confronting the Designers, Steps of the Engineering Design Process, Defining the Problem and Setting Objectives

Product design morphology: Developing Provisional Designs, Evaluation and Decision-Making, The morphology of design (the seven phases), Product Characteristics: Developing successful products, Attributes of successful product developments, Key factors for successful products, Product Characteristics, Aesthetic Design, Design Principles, Product Message, Visual Design, Elements of Visual Design

Value engineering in product design: Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Why poor Value? The Value Engineering Methodology, Information phase, Function Phase, Creativity Phase, Evaluation Phase, Development Phase, Implementation Phase, Case studies

Importance of material selection, Factors affecting the material selection process, Material selection procedures, Design Recommendations, how to select manufacturing process? Primary, secondary and tertiary manufacturing process, Design guidelines, Design for Manufacturing, Design for Assembly, Design for Environment

Product costing: Cost and Price Structure Information Need Sources, Estimating Direct and Indirect Costs, Design and Manufacturing Costs, Ways to Model Manufacturing Costs
Rapid Prototyping or Additive Manufacturing, Rapid Prototyping, Reverse Engineering: Reverse Engineering-Definition, Importance, Applications, Process ,3D Scanning Process Managing Competitiveness: Benchmarking, Outsourcing, Mass customisation

TEXT & REFERENCE BOOKS:

1. Product design and development, Eppinger, S. and Ulrich, K., 2015.McGraw-Hill Higher Education
2. Integrated product and process design and development: the product realization process, Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009.CRC Press.

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3. Product design for manufacture and assembly, Computer-Aided Design, Boothroyd, G., 1994.
4. Product design and manufacturing by Prof J Ramkumar and Prof Amandeep Singh Oberoi IIT Kanpur, NPTEL sources

COURSE OUTCOMES:

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

1. Understand the product design and manufacturing process
2. Design and validate technological solutions to defined problems and write clearly and effectively forthe practical utilization of their work
3. Discuss various phases of value engineering, analyse the function, approach of function and evaluation of function and to determine the worth and value
4. Select suitable manufacturing processes to manufacture the products optimally and to identify/control the appropriate process parameters.
5. Use basic fabrication methods to build prototype models for hard-goods and soft-goods

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	2	-	-	-	2	1	1	2
CO2	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO3	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO4	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO5	3	2	2	2	1	2	1	2	-	-	-	1	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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IPDATP9 - ADVANCED MANUFACTURING PROCESSES

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the principle of various advanced machining processes kinematics drive of machine tool.
- To impart knowledge about cutting different material removal, joining processes.
- To understand about various advanced metal forming processes.
- Explain how to identify suitable hybrid weldir g processes for joining dissimilar materials.
- To understand about various advanced casting processes.

COURSE CONTENT:

Advanced machining processes: Introduction, micro machiningprocess, principle, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes, working principle of plasma arc machining.

Advanced machining theory & practices: Mechanisms of chip formation, shear angle relations, and theoretical determination of cutting forces in orthogonal cutting, analysis of turning, drilling and milling operations, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear, economics of machining, processing of polymers, ceramics, and composites.

Advanced metal forming processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming electro-hydraulic forming, stretch forming, contour roll forming.

Advanced welding processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW),cold welding, diffusion welding, forge welding, friction welding, explosive welding, hard vacuum welding, soft vacuum welding, underwater welding processes, concept of robotized welding and welding automation.

Advanced casting processes: Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, evaporative pattern casting, ceramic shell casting.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for Engineering Materials, Serope Kalpakjian, Steven R. Schemid, Fourth edition, Pearson Education.
2. Manufacturing Engineering and Technology, Serope Kalpakjian, Third Edition, Addison-Wesley Publication Co.,
3. Materials and Processes in Manufacturing, E.P. DeGarmo, J. T Black, R.A. Kohser, 8th Edition, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
4. Manufacturing Science, A. Ghosh & A.K. Mallik, East-West Press Pvt. Ltd. New Delhi.
5. Non-traditional Manufacturing Processes, G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)
6. Advanced Machining Processes, V.K. Jain, Allied Publishers Pvt. Ltd.

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7. Modern Machining Processes, P.C Pandey & H.S. Shan, McGraw Hill Education.
8. Manufacturing Technology, P. N Rao, Tata McGraw Hill Publishing Company.
9. Non-Conventional Machining, P. K Mishra, Narosa Publishers.
10. Unconventional Manufacturing Processes, K. K Singh, Dhanpat Rai & Company, New Delhi.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Basic understanding of advanced casting processes and able to analyze real-life application in various organizations.
- Categorize different material removal, joining processes as per therequirements of material being used to manufacture end product.
- Choose material processing technique with the aim of cost reduction, reducing material wastage & machining time.
- Estimate process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.

Evaluation and Analysis of the different advanced welding process to select most suitable welding procedure and consumables for a product

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	2	2	2	-	1	1	2	1	2	2
CO2	2	2	2	1	1	-	-	1	1	1	1	2	1	2	2
CO3	1	2	2	2	1	1	2	1	2	1	1	2	2	2	2
CO4	2	3	3	3	1	-	-	2	-	1	1	2	2	2	2
CO5	2	2	2	3	2	1	1	2	-	2	1	2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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