COURSE STRUCTURE (DIPLOMA IN MECHANICAL ENGINEERING)

Sixth Semester

S.N.	Subject Code	SEGMENT	Subject	L	T	P	Credit
1	DME 601	PC	Design of Machine Elements	3	0	0	3
2	DME 603	PC	Refrigeration and Air-conditioning	3	0	0	3
3	DHS 601	HS	Entrepreneurship and Start-ups	3	1	0	4
4	DAU 601	MC	Indian Constitution	3	0	0	0
5		PE4		3	0	0	3
6		OE3	Elective	3	0	0	3
7	DME 604	PC	Refrigeration and Air-conditioning Lab.	0	0	2	1
8	DPR 651	MP	Project-II	0	0	6	3
9	DSE 651		Seminar	0	0	1	1
			Periods per week	18	2	9	-
			Total credits	-	-	-	21
			Total periods per week	-	-	-	29
			Program Elective (Any one)				
PE4	DPE 651		Mechatronics	3	0	0	
	DPE 652		Industrial and Production Management	3	0	0	
	DPE 653		Operation Research	3	0	0	
OE 3	DOE 651		**Non Conventional Energy Resources**	3	0	0	
	DOE 652		**Computer Aided Manufacturing**	3	0	0	

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SYLLABUS (CBCS)-2024

COURSE (DESIGN OF MACHINE ELEMENTS)

PROGRAMME: DIPLOMA							
COURSE CODE: **DME 601**			COURSE TITLE: **Design of Machine elements**				
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	Focus on understanding the concept of machines and to provide fundamental knowledge of designing various machine elements based on strength, durability, and functionality.
2.	Develop skills in applying engineering principles, material selection, and failure theories in machine design.
3.	Introduce fatigue, stress concentration, and reliability-based design concepts for real-world applications.
4.	Analyze and design mechanical components such as shafts, springs, bearings, gears, and fasteners under different loading conditions.
5.	Consideration of various design aspects on the behaviour of the material properties.

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

CO1	Apply the principles of strength of materials and failure theories in designing machine elements.
CO2	Design lever, riveted, and welded joints under static and dynamic loads.
CO3	Analyze and design shafts, keys, and Gears for different industrial applications.
CO4	Design and evaluate the performance of springs and Bearing.
CO5	To Work on real-world design projects to develop problem-solving and teamwork skills.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	**Introduction to design of Machine Elements** 1.1 Principles of Machine Design, standardization & types of loading 1.2 concept of different type of stresses, Selection of Materials 1.3 Factor of safety and factor governing selection of factor of safety 1.4 Concept of stress concentration, 1.5 Fatigue,S-N curve, Endurance limit. Design for fluctuating and impact loads (Goodman, Soderberg, and Gerber criteria) Course Outcome: CO1 Teaching Hours : 8 hrs
2	**TITLE: Theory of elastic failure.** 2.1 Concept of Theory of Failure 2.2 Principal normal stress theory, 2.3 maximum shear stress theory, 2.4 Maximum distortion energy theory. Course Outcome: CO2 Teaching Hours : 6 hrs
3	**TITLE: Designof simple machine elements &Joints**

	3.1 Design of Cotter and Knuckle joints, 3.2 Design of lever 3.3 Design of Riveted and Welded Joints. Course Outcome: CO3 Teaching Hours : 6hrs
4	**TITLE: Design of Shafts, keys, and Spurgear** 4.1 Types of Shaft, shaft material, Standard sizes, 4.2 design of solid shaft using strength criteria design of line shaft supported between bearings with one or two pulleys in between them. 4.3 Classification and selection of gears 4.4 Design of spur based on strength and wear considerations 4.5 Power transmission capacity of spur gears. Course Outcome: CO4 Teaching Hours :8 hrs
5	TITLE: Design of Springs and Bearing 5.1 Types of springs and their applications 5.2 Design of helical compression and tension springs 5.3 Design of leaf springs 5.4 Classification of bearings: Sliding contact and rolling contact bearings 5.5 Selection of rolling contact bearings based on dynamic and static load considerations, bearing life calculation Course Outcome: CO5 Teaching Hours : 8 hrs

TEXT BOOK:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Heat Transfer – A Practical Approach	J.P. Holman, McGraw Hill Book Company, New York	0072406550
2.	Heat Transfer	Yunus A. Cengel, Tata McGraw Hill Publishing Company Ltd., New Delhi.	978-0072406559

REFERENCE BOOKS:

S. N.	**Title**	**Author, Publisher, Edition and Year of publication**	**ISBN**
1.	Design of Machine element	V. B. Bhandari	978-0-07-068179-8
2.	Design of Machine	R. S. Khurni& Gupta	81-219-2537-1
3.	Mechanical Engineering Design	J. F. Singley	9789390219643
4.	Machine Design Data Hand book	Bhandari, TMH	9789353166359
5.	Handbook of Properties of Engineering Materials and Design Data for Machine Elements	Abdulla Shariff, Dhanpat Rai & Sons, New Delhi.	

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcome

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	3	3	3	2
CO2	2	2	2	1	2	2	2	3	3	2
CO3	2	2	2	1	2	1	2	2	3	3
CO4	2	2	2	1	2	1	2	2	2	2
CO5	2	3	2	2	2	2	3	3	2	3

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SYLLABUS (CBCS)-2024

COURSE (REFRIGERATION AND AIR CONDITIONING)

PROGRAMME: DIPLOMA							
COURSE CODE: **DME 603**			COURSE TITLE: **REFERIGERATION AND AIR CONDITIONING**				
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

Course Objectives: This course enables the students to

1	Understand vapour compression and vapour absorption system operation.
2	Analyses the refrigeration cycles and methods for improving performance.
3	Familiarize the components of refrigeration systems.
4	Design air conditioning systems using cooling loads calculation
5	Know the application of refrigeration and air-conditioning system.

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

CO1	Outline the concepts of refrigeration, air-conditioning and application of air refrigeration system in aero -plane.
CO2	Outline basic knowledge, electrical system and interpret vapour compression system and its application in multi pressure, multi evaporator and cascade system with different refrigerant.
CO3	Analyze different air conditioning systems and economic application.
CO4	To know the different types of compressors and calculate the work function.
CO5	Specify, interpret psychometric relations and cooling load for refrigeration and air

COURSE CONTENT DETAILS:

Module	Topic / Sub-Topic
1	1.1 Introduction to Refrigeration and Air-conditioning - 1.2 Definition of various terms like cooling effect ,COP, Tonnage and air refrigeration cycle 1.3 Method of refrigeration, its application in Air refrigeration system, Bell-Coleman cycle, 1.4 Introduction to Air craft refrigeration 1.5 Evaporative cooling system, Boot strap cooling system, 1.6 Regenerative cooling system, methods for improving COP-Multi stage and multiple compressor Course Outcome: CO1 Teaching Hours: 8 hrs
2	2.1 Analysis of simple vapour compression refrigeration cycle, 2.2 multi-evaporator system and Cascade system, 2.3 Selection of refrigeration system, and its applications. 2.4 Discussion of components of VC system, Servicing, Course Outcome: CO2 Teaching Hours: 8 hrs
3	3.1 Vapour Absorption Refrigeration system and its applications, 3.2 Thermo-electric Refrigeration system, 3.3 Steam jet Refrigeration system, magnetic refrigeration, 3.4 vortex and pulse tube refrigeration system Course Outcome: CO3 Teaching Hours: 8 hrs
4	4. Psychrometry- Definition for properties, 4.2 Introduction to cooling load calculations, 4.3 Comfort conditions, 4.4 Effective temperature concept, 4.5 Specific humidity, Relative humidity, Enthalpy, 4.6 Psychometric of Air conditioning Process, Mixing of air stream. Course Outcome: CO4 Teaching Hours: 8 hrs
5	5.1 1 Properties of Refrigerants and eco-friendly refrigerants. 5.2 Low Temperature Refrigeration and its applications. 5.3 Cooling load calculation and Air-conditioning, systems and accessories, 5.4 Design of Air-conditioning systems, 5.5 Cooling Towers & Cooling Ponds Course Outcome: CO5 Teaching Hours: 8 hrs

RTEFERENCE BOOK:

S.No.	Title	Author, Publisher, Edition and Year of publication	ISBN no.
1	Refrigeration and Air Conditioning	Kurmi R.S., Gupta J.K.	81-219-2781-1
2	A Cource in Refrigeration and Air- Conditioning	Domkundwar ;Dhanpat Rai ;2018	B07NJ1VH8P

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcome

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	3	2	3
CO2	2	2	2	2	2	2	2	2	1	2
CO3	2	3	3	2	2	2	1	3	1	3
CO4	3	1	1	2	2	2	2	3	1	3
CO5	3	3	2	2	2	2	2	2	2	3

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SYLLABUS (CBCS)-2024

COURSE (REFRIGERATION AND AIR CONDITIONING LAB)

PROGRAMME: DIPLOMA							
COURSE CODE: **DME 604**				COURSE TITILE: **Refrigeration and Air Conditioning LAB**			
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
0	0	2	2	1	60	40	100

Course Objectives: This course enables the students to

1	Evaluate and analyze the different refrigeration and air conditioning machine.
2	Familiarize the students to perform experiments related to refrigeration machine and equipment.
3	Study and evaluate performance analysis of refrigeration and air conditioning machine and look prospects of alternative source of input.
4	Know how to calculate the capacity and COP Of air conditioning system with the help of P- H Chart.
5	Evaluate the COP of vapour absorption Refrigeration (VAR) system, COP of vapour compression refrigeration (VCR) systems.

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

CO1	Understand the procedure to conduct experiments of refrigeration and air conditioning machines.
CO2	Understand various parameters influence the performance of the refrigeration and air conditioning machines.
CO3	Analyze the observations made through experiments and evaluate the machine

	performance.
CO4	Apply the experimental knowledge how to perform the experiments and study parameters for further improvements.
CO5	Able to find out the different energy sources for refrigeration and air conditioning machines

LIST OF EXPERIMENTS:

1	To study different types of tools used in Refrigeration and air Conditioning.
2	. Study of House hold/Domestic Refrigerator.
3	Study of Leak Detection and charging Procedure for refrigerant.
4	Study of Refrigeration controls used in refrigeration and air conditioning.
5	To study Heat Pump and calculate its COP.
6	To study ice Manufacturing plant and calculate its COP.
7	To demonstrate vapour compression cycle and to calculate theoretical and actual COP.
8	To study Air conditioning system and calculate COP Of air conditioning system with the help of P- H Chart.
9	To study and calculate and capacity and COP of vapour absorption Refrigeration (VAR) system.
10	To study and calculate capacity and COP of vapour compression refrigeration (VCR) systems.

TEXT BOOKS:

1. A Text book of Refrigeration & conditioning – R.S. Khurmi & J.K. Gupta

2. Air-

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	3	0	3	3
CO2	3	3	2	1	2	2	3	1	2	3
CO3	2	2	3	3	1	3	2	2	2	3
CO4	2	2	2	3	3	2	2	2	2	3
CO5	1	2	2	3	3	2	1	2	3	3

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SYLLABUS (CBCS)-2024

COURSE (MECHATRONICS)

PROGRAMME: DIPLOMA (Mechanical)							
COURSE **CODE: DPE 651**			COURSE TITLE: **Mechatronics**				
COMPULSARY / OPTIONAL: Program Elective							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	Develop knowledge and understanding of mechatronics systems and its relevance in engineering field,
2.	Develop the understanding of the fundamental working principles of commonly used components, their advantages and limitations of mechatronics systems.
3.	Develop mechatronics related skills in professional practice in relation to relevant industry standards and safety regulations
4.	Develop knowledge and understanding of current and future electromechanical engineering technology principles to solve a problem
5.	Understand the importance of sustainable development and ethical conduct and practice in mechatronics field.

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

CO1	Understand the basic components and structural frameworks of mechatronics system and their applications
CO2	Develop the foundation knowledge for advance subjects such as sensor, control system, machines etc
CO3	Develop critical thinking for project-oriented knowledge.
CO4	Understand the health & safety aspects, ethics and sustainability in mechatronics field.
CO5	Students will learn the importance for the futuristic approach and practice in mechatronics field.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	**Title : Introduction** 1.1 Structural framework of mechatronics system 1.2 Basic components of mechatronic systems 1.3 Control units: open loop and closed loop 1.4 Basic building blocks of mechanical, electrical, fluid and thermal systems 1.5 Behavior of mechatronic systems Course Outcome: CO1 Teaching Hours:8 hrs
2	**Title :Sensors in Mechatronics System** 2.1 Fundamental working principles of commonly used sensors 2.2 Properties of sensors (span, range, accuracy, error, hysteresis, linearity, dead band etc)

	2.3 Specifications of commonly used sensors 2.4 Installation of sensors (working and safety manual Course Outcome: CO2 Teaching Hours:8 hrs
3	**Title :Signal conditioning unit and Data transmission** 3.1 Basic components of signal conditioning (Amplifiers, Filters, Modulation units, Protection) 3.2 Wired and wireless data transmission methods and transmission protocols Course Outcome: CO3 Teaching Hours:8hrs
4	**Title:Actuator and Actuation systems** 4.1 Pneumatic & Hydraulic actuation systems (different actuation mechanism of pneumatic and hydraulic systems including directional control valves and cylinders, their working principle and characteristics, 4.2 Mechanical actuation systems (spring and damper systems, actuation systems for motion structural components such as linkages, cams, gears. 4.3 Electrical actuation systems (Working principle and application of relays, resistors, capacitors, AC motor, DC motor solid-state switches, transistors, solenoids etc Course Outcome:CO4 Teaching Hours:8 hrs
5	**Title: Engineering system design** 5.1 Studies of mechatronic systems from local industry 5.2 Sustainability 5.3 Health & Safety (risk assessment) 5.4 Ethics. Course Outcome: CO5 Teaching Hours:8 hrs

REFERENCE BOOKS:

S.No	Title	Author	ISBN
1.	Mechatronics Electronic control systems in mechanical and Electrical Engineering	W. Bolton	935- 01447001245
2.	Mechatronics: fundamentals and application	Clarence W. de Silva	978-8126590797
3.	Automotive Mechatronics	Reif, Konrad	874-458652178

E-REFERENCES:

1. https://nptel.ac.in/courses/112103019/
2. **https://www.tandfonline.com/**
3. Web links and Video Lectures (e-Resources): E-book URL:https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html.

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	3	3	3	2
CO2	2	2	2	1	2	2	2	3	3	2
CO3	2	2	2	1	2	1	2	2	3	3
CO4	2	2	2	1	2	1	2	2	2	2
CO5	2	3	2	2	2	2	3	3	2	3

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COURSE (INDUSTRIAL ENGINEERING & PRODUCTION MANAGEMENT)

PROGRAMME: DIPLOMA							
COURSE CODE: **DPE 652**			COURSE TITLE: **Industrial & Production Management**				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	To present the principles associated with basics of production management and to apply these principles in the day-to-day life.
2.	To understand the break-even point for manufacturing aproduct, criteria for replacement or retention of products.
3.	The course aims at material requirements, resource planning and inventory management.
4.	Know about maintenance methods and other concepts such JIT and lean manufacturing
5.	To understand the philosophy of using techniques of work measurement and method study to improve the existing manufacturingmethod.

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

CO1	Able to solve various basic problems in the field of engineering and management
CO2	Able to Perform brake even analysis under different conditions, to perform replacement or retention using different methods and estimate the cost of products/equipment.

CO3	Understand the factors influencing decisions related to inventory, purchase, plant location, layout and Material Handling Systems
CO4	Apply the concept of JIT, Lean manufacturing & MRP.
CO5	Apply the concept of work study and ergonomics to increase the productivity of industry.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	**TITLE: Production Management** 1.1: Production and Production Management, Production System 1.2 Objectives of Production Management, Scope of Production Management 1.3 Types of Production system : Make to Stock System, Make to Order, Job type, Batch Type and Mass production System 1.4 Definition, objectives and activities of Industrial Engineering 1.5 Functions and techniques of Industrial Engineer Course Outcome: CO1 Teaching Hours: 6 hrs
2	**TITLE: Facility Layout and Engineering Economy** 2.1 Process Chart: Operation Process Chart, Flow Process Chart, Two Handed Process Chart, Multiple Activity Chart 2.2 Plant Layout : Objectives of Plant layout, Plant Layout Problems, Objectives of plant Layout, Advantages of Plant Layout, Types of Plant Layout 2.3 Concept of Replacement and Depreciation 2.4 Brake Even Analysis 2.5Cost and its elements, Overhead, Fixed and Variable Cost Course Outcome: CO2 Teaching Hours: 6 hrs
3	**TITLE : Material Management and Inventory Control** 3.1 Material Management-objectives 3.2 Inventory-concept, types, objective, associated cost 3.3EOQ, buffer stock, reorder point, fixed reorder quantity system, periodic reorder system, ABC analysis 3.4Material Requirement Planning Course Outcome: CO3 Teaching Hours:8hrs
4	**TITLE: Plant Maintenance, JIT and Forecasting** 4.1 Plant Maintenance: -Break down, Scheduled and Preventive maintenance, Introduction to TPM concept 4.2 JIT -Production wastages and its control, Elements of JIT, Implementation of JIT 4.3 Definition of Forecasting, Need for Forecasting 4.4 Classification of Forecasting Method Course Outcome: CO4 Teaching Hours: 8hrs
5	**TITLE: Work Study** 5.1 Introduction, Importance of work study, advantages of work study and procedure 5.2 Method Study-Objectives, Scope and procedure of method study, selection of job for method study

	5.3 Principles of motion economy 5.4 Man -machine chart, Therblig 5.5 Work Sampling Course Outcome: CO5 Teaching Hours:8hrs

TEXT BOOK:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	INDUSTRIAL ENGINEERING and OPERATIONS MANAGEMENT	Dr. S K SHARMA,S.K. KATARIA & SONS,2ND,2013	9788185749136

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	INDUSTRIAL ENGINEERING & MANAGEMENT	O. P. Khanna	81-7409-099-1
2.	INDUSTRIAL ENGINEERING & PRODUCTION MANAGEMENT	MARTAND TELSANG; S CHAND & COMPANY LTD.FIRST;2005	81-219-1773-5

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	3	3	2	2	3
CO2	3	2	2	1	2	2	3	2	2	3
CO3	3	3	2	2	2	2	3	2	2	3
CO4	1	3	2	1	2	2	3	2	2	3
CO5	2	2	2	1	2	1	2	3	2	3

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COURSE (OPERATION RESEARCH)

PROGRAMME: DIPLOMA	
COURSE CODE: DPE653	COURSE TITLE: OPERATIONAL RESEARCH
COMPULSARY / OPTIONAL: OPTIONAL	

Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	Define and formulate linear programming problems and appreciate their limitations.
2.	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3.	Conduct and interpret post-optimal and sensitivity analysis and explain the primal- dual relationship.
4.	Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.
5.	To know about decision theory and game theory techniques

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

CO1	Identify and develop operational research models from the verbal description of the real system.
CO2	Understand the mathematical tools that are needed to solve optimization problems.
CO3	Develop a report that describes the model and the solving technique, analyses the results and propose recommendations in language understandable in Management Engineering.
CO4	Multi-criteria decision techniques, Decision making under uncertainty and risk, Game theory, and Dynamic programming.
CO5	Use mathematical software to solve the proposed simulation models.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	TITLE: Introduction and Allocation: - 1.1 Development of OR – Definitions-Operation Research models–scope and applications. 1.2 Introduction, Requirement of LPP, Basic Assumptions, Formulation of LPP, GeneralStatement of LPP, 1.3 Solution techniques of LPP: Graphical Methods, 1.4 Simplex method, procedure to obtain optimal solution by simplex method,Use of slack / surplus / artificial variables, 1.5 alternative optimal solution minimization and Maximization problem BIG M and TWO-PHASE methods, degeneracy. Duality in LPP, Dual problem and its construction, interpretation and properties, Dual simplex algorithm. Course Outcome: CO1 Teaching Hours: 10 hrs
2	**TITLE: Transportation & Assignment problems:** 2.1 Mathematical statement of T.P. Methods to obtaining the initial basic feasible solution. 2.2Transportation problem -North west corner rule -Least cost method -Vogel's approximation method -MODI method, 2.3Unbalance and degeneracy in transportation model 2.4Assignment Problem– Formulation – Optimalsolution 2.5Hungarian method Course Outcome: CO2 Teaching Hours: 8 hrs
3	**TITLE: SCHEDULING AND NETWORK ANALYSIS** 3.1 Problem of sequencing.Shop sequencing, 3.2 Processing 'n' jobs through two machines and three machines 3.3 Processing two jobs through 'm' machines.

	3.4 PERT and CPM, Total slack, free slack, 3.5 Probability of achieving completion date -Cost analysis. Course Outcome: CO3 Teaching Hours :6 hrs
4	**TITLE: Queuing Theory** 4.1 Basis of Queuing theory, 4.2 Input process, queue discipline, service mechanism, inter arrival times, service time, 4.3Kendall's notation queuing models, M/M/1 and with finite queue model with poisson arrival with exponential service, 4.4multi-channel queuing model. The [M/M/1: (/SIRO)] model III [M/M/1 :(N/FIFO)] 4.5Model IV (Birth death process M/M/C Queuing systems with M/M/C :(/FIFO) M/M/C (N/FIFO) M/M/C (C/FIFO) Queues in series. Course Outcome: CO4 Teaching Hours: 8 hrs
5	**TITLE:Game Theory** 5.1 Introduction, 5.2Characteristics of Game Theory 5.3Two Person, Zero sum games,Purestrategy. 5.4 Dominance theory, Mixed strategies (2x2, M x2), 5.5Algebraic and graphicalmethods. Course Outcome: CO5 Teaching Hours : 8 hrs

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Operations Research	Prem Kumar Gupta & D S Hira,S Chand,2023	81-219-0218-9
2.	Operations Research, Theory and Applications	4th Ed. Macmillan India, 2009.	9789350593363, 9789350593363
3.	Operations Research *Introduction to Management Science*	Swarup Kanti, Gupta PK (Dr), Mohan Man, Sultan Chand & Sons,20'th,2022	93-5161-183-7
4.	Operations Research – An Introduction –	Fifth edition by Hamdy A Taha- Prentice Hall of India,6'th	0132729156, 9780132729154

Mapping of Course Outcomes onto Program Outcomes& Program Specific Outcome

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	3	3	2	3
CO2	2	2	2	1	2	2	2	3	2	3
CO3	2	2	2	1	2	1	2	2	2	3
CO4	2	2	2	1	2	1	2	2	3	2
CO5	2	3	2	2	2	2	3	2	3	2

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COURSE (NON-CONVENTIONAL ENERGY RESOURCES)

PROGRAMME: DIPLOMA							
COURSE CODE: **DOE 651**			COURSE TITLE: **NON- CONVENTIONAL ENERGY RESOURCES**				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	Understand Energy Resources & Needs
2.	Study Wind & Solar Energy Systems
3.	Explore Thermal Energy Storage & Solar Applications
4.	Examine Bio-Energy & Geothermal Energy
5.	Learn Tidal, Ocean & Other Non-Conventional Energy Sources

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

CO1	Gain comprehensive knowledge of conventional and non-conventional energy sources and their role in global energy sustainability.
CO2	Analyze Wind & Solar Energy Systems
CO3	Apply concepts of thermal storage, solar ponds, and solar-powered devices for practical and industrial use.
CO4	Understand bio-conversion techniques, biogas plant design, and geothermal energy utilization.
CO5	Analyze tidal, ocean thermal, and other non-conventional energy sources for feasibility and implementation in real-world scenarios.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	**TITLE: Introduction to Energy** 1.1Energy Needs and Supply. 1.2 Conventional and Non-Conventional Energy Sources 1.3 Present Energy Scenario. 1.4 Wind Energy **1.5** Wind Energy System Design Course Outcome: CO1 Teaching Hours :6 hrs

2	**TITLE: Solar Energy.** 2.1 Solar Geometry and Radiation 2.2 Types of Solar Collectors 2.3 Collector Efficiency and Performance. 2.4 Solar Energy Storage 2.5 Solar Applications Course Outcome: CO2 Teaching Hours :6 hrs
3	**TITLE: Thermal Storage and Solar Applications** 3.1 Thermal Storages 3.2 Solar Ponds 3.3 Solar Heating Applications 3.4 Solar Power and Pumping Systems 3.5 Other Solar Applications Course Outcome: CO3 Teaching Hours : 6 hrs
4	**TITLE :Bio-Energy Conversion** 4.1 Photosynthesis and Biomass Energy 4.2 Biogas Production and Digesters 4.3 Biogas Utilization and Efficiency. 4.4 Pyrolysis and Gasification. 4.5 Advanced Bio-Energy Technologies Course Outcome: CO4 Teaching Hours :8 hrs
5	**TITLE: Other Non-Conventional Energy Sources** 5.1 Geothermal Energy 5.2 Geothermal Energy Conversion Systems 5.3 Tidal Energy 5.4 Ocean Thermal Energy Conversion (OTEC) 5.5 Other Emerging Non-Conventional Energy Sources. Course Outcome: CO5 Teaching Hours :8 hrs

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Non Conventional Energy Resources	KhanB.H,McGraw Hill Education India,3rd Edition,2017	978-9352601882
2.	Non Conventional Energy Sources	Anand Tembulkar& S.P. Meher,S.K. Kataria & Sons,3rd Edition,2021.	978-93-5014-477-0
3.	Non-Conventional Energy Sources	G.D. Rai, Khanna Publishers,	978-8174090737

TEXT BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Non Conventional Energy Sources	Ashish Chandra Khanna Publishing House Second, 2023	978-93-82609-82-7
2.	Non-Conventional Energy Resources	D.S. Chauhan & S.K. Srivastava, New Age International Pvt Ltd,5th Edition, **Year of Publication:** 2025.	978-93-88818-93-3
3.	Non Conventional Energy Resources	Sobh Nath SinghPearson Education India, First, 2015.	978-93-325-4357-7

E-REFERENCES:

1. Website :https://archive.nptel.ac.in/courses/121/106/121106014/.
2. Website :https://onlinecourses.nptel.ac.in/noc22_ge14/preview.

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	3	2	1
CO2	3	3	2	2	3	2	1	3	3	2
CO3	2	3	3	3	2	2	2	2	3	3
CO4	2	2	2	3	3	3	2	2	2	3
CO5	1	1	2	2	3	3	3	1	2	3

B.I.T., MESRA – 835215 (RANCHI)
UNIVERSITY POLYTECHNIC

SYLLABUS (CBCS)-2024

COURSE (COMPUTER AIDED MANUFACTURING)

PROGRAMME: DIPLOMA							
COURSE CODE: **D0E 652**			COURSE TITLE: **Computer Aided Manufacturing**				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEK	CREDIT	PE	FINAL	TOTAL
3	-	-	3	3	50	50	100

Course Objectives: This course enables the students to

1.	Understand the fundamentals of CAM.
2.	Conceptualize the concept of Automated Machine Tools.
3.	Understand the concept of Computer Aided Process planning and control system
4.	Understand the concept of computer Aided production management system
5.	Understand fundamentals of Computer Aided Quality Control.

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

CO1	understand the concept and features of a CAM
CO2	understand the concept of Automated Machine Tools.
CO3	understand the concept of computer Aided production Planning and Control.
CO4	understand the computer aided management system
CO5	understand fundamentals of Computer Aided Quality Control.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	**TITLE: Introduction to CAM** 1.1 Introduction of Computer Aided Manufacturing, 1.2 Different types of Manufacturing System. 1.3 Concept of Automation. 1.3 Function of the computer in CAM 1.4 Benefits of CAM. Course Outcome: CO1 Teaching Hours : 6 hrs
2	**TITLE: Automated Machine Tools.** 2.1 Introduction to Standard computer control Machine Tools 2.2 Introduction to Special purpose Machine tools. 2.3 Tooling of Automated Machine tools. 2.4 Computer assisted NC part programming 2.5 Computer assisted robot Programming Course Outcome: CO2 Teaching Hours : 10 hrs
3	**TITLE: Computer Aided Process Planning**

	3.1The Planning Function 3.2 Retrieval Type Process Planning Systems 3.3 Generative Process Planning Systems and benefits of CAPP 3.4 Computerized machinability data system 3.5 Computer generated time standard Course Outcome: CO3 Teaching Hours : 8hrs
4	**TITLE : Computer aided Production Management system** 4.1 computer Aided production management 4.2 Computer aided Inventory Planning 4.3 Cost Planning and Control Course Outcome: CO4 Teaching Hours : 6hrs
5	**TITLE: Computer Aided Quality Control** 5.1 Terminology in Quality Control, The computer in Quality Control 5.2 Concept of Inspection methods 5.3 Numerical inspection methods 5.4 Computer aided testing application of ROBOT 5.5 Integration CAQC and CAD/CAM. Course Outcome: CO4 Teaching Hours :10 hrs

TEXT BOOK:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Automation, Production System & Computer Integrated Manufacturing	Michell. P. Groover	81-7808-511-9
2.	Computer aided Aided Design & manufacturing	M. P. Groover & E. Zimmers Pearson	978-81-775-8416-5

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Cad & CAM Concept & Applications	P.N. RAO Mc Graw Hill Education (India) Pvt. Ltd.	978-0-07-068193-4
2.	CAD 7 CAM Theory & Practice	IBRAHIM ZIED & R, Shiva Subramaniam Mc Graw Hill Education (India) Pvt. Ltd.	978-0-07-05134-5
3.	CAD/CAM/CIM	P. Radhakrishnan, S. Subramanyam & V. Raju New Age International Publisher	81-224-1248-3

Mapping of Course Outcomes onto Program Outcomes & Program Specific Outcome

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	3	2	3	2
CO2	2	2	2	1	2	2	2	2	3	2
CO3	2	2	2	1	2	1	2	3	2	3
CO4	2	2	2	1	2	1	2	3	2	3
CO5	2	3	2	2	2	2	3	3	2	2