SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &
Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Mechatronics Engineering

Minutes of Third BOS Meeting

Venue

R&D Lab,
Mechanical Block
Sri Manakula Vinayagar Engineering College

Date & Time

12th August 2021
2:00 P.M.

Department of Mechatronics Engineering

Minutes of Third Board of Studies Meeting

The Third Board of Studies meeting of Mechatronics Engineering Department was held on 12th August 2021 at 2:00 P.M in the R&D Lab, Sri Manakula Vinayagar Engineering College, with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	MEMBERS AS PER UGC NORMS
1	**Dr. G. Balamuruga Mohan Raj** Professor and Head Department of Mechatronics Engineering, SMVEC	Chairman
2	**Dr.Shankar Krishnapillai,** Professor, Indian Institute of Technology, Chennai – 600 036.	Subject Expert (University Nominee)
3	**Dr.D.Dinakaran,** Professor, Hindustan Institute of Tech. & Science, Chennai – 103	Subject Expert (Academic Council Nominee)
4	**Dr.R.Parameshwaran,** Professor, Kongu Engineering College, Erode – 638 606	Subject Expert (Academic Council Nominee)
5	**Mr.P.Ramesh** Managing Director, Switching Technologies Gunther Ltd., Tambaran, Chennai – 600045	Representative from Industry
6	**Dr. A.G.Ganesh Kumar, M.E., Ph.D** Professor/Mechanical	Internal Member
7	**Prof. P. Ramesh Kumar, M.E,** Assistant Professor/Mechatronics	Internal Member
8	**Dr. R. Kurinjimalar, M.E., Ph.D.,** Associate Professor/ECE	Internal Member

9	**Prof. Pushaparaj, M.E.** Assistant Professor/ECE	Internal Member
10	**Prof. N. Vijayan** Assistant Professor / Mathematics	Internal Member
11	**Dr. A. Rajappa** Associate Professor / Chemistry	Internal Member
12	**Dr. M. A. Ishrath Jahan** Associate Professor / English	Internal Member
13	**Dr. T. Sivaranjani** Associate Professor / Physics	Internal Member

Agenda of the Meeting

BOS/2021/MCT/UG/3.1: Confirmation of minutes of Second BoS meeting and the Curriculum Structure of B.Tech Mechatronics Engineering of R-2019 and R-2020 Regulations – Modifications if any.

BOS/2021/MCT/UG/3.2: Discuss about the curriculum Structure of B.Tech – Mechatronics Engineering

BOS/2021/MCT/UG/3.3: To discuss and approve the B.Tech. Degree Curriculum VII and VIII semesters under Autonomous Regulations 2019 for the B.Tech – Mechatronics Engineering and the students admitted in the Academic Year 2019-2020

- Course structures
- Professional Core Courses
- Professional Elective Courses
- Open Electives offered to other departments
- Evaluation Systems
- Employment Enhancement Courses
- AICTE – Mandatory Course

BOS/2021/MCT/UG/3.4: To discuss and approve the B.Tech. Degree Curriculum VII and VIII semesters under Autonomous Regulations 2020 for the B.Tech – Mechatronics Engineering and the students admitted in the Academic Year 2020-2021

- Course structures
- Professional Core Courses
- Professional Elective Courses
- Open Electives offered to other departments
- Evaluation Systems
- Employment Enhancement Courses

- AICTE – Mandatory Course

BOS/2021/MCT/UG/3.5: To discuss and approve the revised Vision, Mission, Programme Educational Objectives and Programme Specific Outcomes of the department.

BOS/2021/MCT/UG/3.6: To discuss about the uniqueness of the Curriculum (R-2020)

- Employability Enhancement Course
- Skill Development Courses- Foreign language /IELTS /NPTEL/MOOC Courses
- Indian Constitution, Essence of Indian traditional knowledge etc are introduced as Mandatory courses
- Statistical laboratory

BOS/2021/MCT/UG/3.7: To discuss about the Innovative Teaching / Practices Methodology adopted to handle the emerging / Advanced Technological concept courses.

BOS/2021/MCT/UG/3.8: List of Internal and External Examiners.

BOS/2021/MCT/UG/3.9: Any other item with the permission of chair.

Minutes of the Meeting

Dr. G. Balamuruga Mohan Raj, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal members and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

BOS/2021/MCT/UG/3.1: Chairman, BoS, appraised the minutes of Second BoS, its implementation and then it is confirmed with the approval for the incorporation of minor revisions needed as mentioned below.

Sl. No.	Regulations	Semester	Subject Name with Code	Unit	Particulars
1	R2019	V	Operations Research U19MCE53	IV	Inventory analysis and Replacement analysis may be included instead of theory of games
2	R2020	V	Operations Research for Mechatronics U20BST553	IV	Inventory analysis and Replacement analysis may be included instead of theory of games
3	R2019 R2020	V	Control System for Mechatronics Systems U19MCT52 U20MCT510	V	Fifth unit may be modified related to mechatronics
4	R2019	V	Thermal Engineering and Heat	IV, V	Lab oriented topics may be removed from 3rd and 4th units of Thermal

			Transfer U19MCT54		Engineering and Heat Transfer because the concept is repeated in practical also and the unit is vast.
5	R2019 R2020	VI	Embedded system design U19MCT61 U20MCT613	-	VLSI and Embedded system design subject can be split and taught as two different subjects
6	R2019 R2020	VI	VLSI Design U19MCE63 U20MCE613	-	
7	R2019 R2020	VI	Design of Mechanical Elements U19MCT64 U20MCT616	III	Design of bevel and worm gears are to be removed in the Subject
8	R2019 R2020	VI	Industrial Robotics lab U19MCP63 U20MCP612	-	Latest simulation software can be used in Industrial Robotics lab

The above corrections are approved by BoS members and the details are given in Annexure- I.

BOS/2021/MCT/UG/3.2: The curriculum structure of Mechatronics Engineering has been discussed.

The BoS members suggested that Reliability Engineering (U19MCE80/U20MCE821), Robotics and Machine Vision (U19MCE83/20MCE824) subjects can be included as Professional Elective instead of Industrial Electronics and CFD and the details are given in Annexure- II.

BOS/2021/MCT/UG/3.3 & 3.4

Recommended to the Academic Council with following suggestions in the Curriculum and Syllabus of Regulation 2019 and the Curriculum and Syllabus of Regulation 2020.

Sl. No.	Regulations	Semester	Subject Name with Code	Unit	Particulars
1	R2019 R2020	VII	Design of Mechatronics System U19MCT72 U20MCT718	II, III	Second and Third Unit may be modified

2	R2019 R2020	VII	Non-Destructive Testing Methods U19MCE71 U20MCE716	All	Second and Third units may be taught with mechatronics application
3	R2019 R2020	VIII	Automation In Manufacturing Systems U19MCE81 U20MCE822	Text books list may be modified	1. Beno Benhabib Manufacturing: Design, Production, Automation, and Integration, CRC Press, 2009. 2. R. Thomas Wright, Mich+ael Berkeihiser, 'Manufacturing and Automation Technology', 2011. 3. Mikell P. Groover, 'Automation, Production Systems and Computer-Integrated Manufacturing', Pearson Publisher, Fourth Edition, 2016.
4	R2019 R2020	VIII	Project Management U19MCE84 U20MCE825	IV	Fourth Unit may be modified.
5	R2019 R2020	VIII	Unconventional Machining Processes/ U19MCE86 U20MCE827	All	Subject must be taught with mechatronics application
6	R2019 R2020	VIII	Industrial Engineering U19MCE89 U20MCE830	IV	Plant layout may be included

Seventh and Eighth Semester Courses are common for both R2019 and R2020 Regulations.

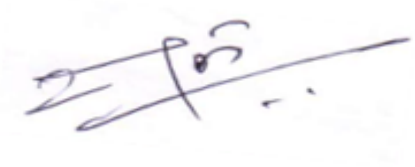
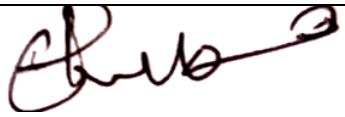
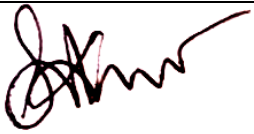
The above corrections are incorporated and the Syllabi (Given in Annexure III) are approved by the BoS members

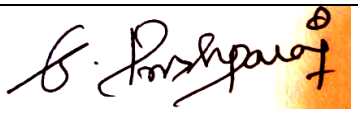
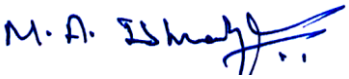
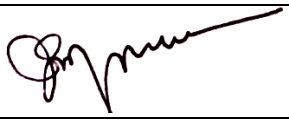
BOS/2021/MCT/UG/3.5: The Vision, Mission, Programme Educational Objectives and Programme Specific Outcomes of Mechatronics Engineering department are revised, have been presented in the second BoS meeting. **It was approved by BoS members and given in Annexure- IV.**

BOS/2021/MCT/UG/3.6:	The uniqueness of the Curriculum such as Employability Enhancement Course, Foreign language /IELTS as a Skill Development Courses, NPTEL/MOOC Courses, Mandatory courses etc, were discussed and appreciated by the BoS members
BOS/2021/MCT/UG/3.7:J	Innovative Teaching / Practices Methodology adopted to handle the emerging / Advanced Technological concept courses was discussed and appreciated the great learning platform

The meeting was concluded at 3:40PM with vote of thanks by Dr. G. Balamuruga Mohan Raj, Chairman, Board of Studies, Department of Mechatronics Engineering, Sri Manakula Vinayagar Engineering College.

Board Chairman
Dr. G. Balamuruga Mohan Raj
Professor and Head
Department of Mechatronics Engineering,

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. G. Balamuruga Mohan Raj** Professor and Head Department of Mechatronics Engineering, SMVEC	Chairman	
External Members			
2	**Dr.Shankar Krishnapillai,** Professor, Indian Institute of Technology, Chennai – 600 036.	Pondicherry University Nominee	
3	**Dr.D.Dinakaran,** Professor, Hindustan Institute of Tech. & Science, Chennai – 103	Subject Expert	
4	**Dr.R.Parameshwaran,** Professor, Kongu Engineering College, Erode – 638 606	Subject Expert	
5	**Mr.P.Ramesh** Managing Director, Switching Technologies Gunther Ltd., Tambaran, Chennai – 600045	Industry Expert	
Internal Members			
6	**Dr. A.G.Ganesh Kumar, M.E., Ph.D** Professor	Member	
7	**Prof. P. Ramesh Kumar, M.E,** Assistant Professor	Member	
8	**Dr. R. Kurinjimalar, M.E., Ph.D.,** Associate Professor	Member	

9	**Prof. Pushaparaj, M.E.** Assistant Professor	Member	
Co-opted Members			
10	**Prof. N. Vijayan** Assistant Professor / Mathematics	Member	
11	**Dr. A. Rajappa** Associate Professor / Chemistry	Member	
12	**Dr. M. A. Ishrath Jahan** Associate Professor / English	Member	
13	**Dr. T. Sivaranjani** Associate Professor / Physics	Member	

Annexure- I

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MCT61	Embedded System Design	PC	2	2	0	3	25	75	100
2	U19MCT62	Fluid Power Systems	PC	3	0	0	3	25	75	100
3	U19MCT63	Industrial Robotics	PC	2	2	0	3	25	75	100
4	U19MCT64	Design of Mechanical Elements	PC	2	2	0	3	25	75	100
5	U19MCE6X	Professional Elective - III[#]	PE	3	0	0	3	25	75	100
6	U19XXO6X	Open Elective – III[$]	HS	3	0	0	3	25	75	100
Practical										
7	U19MCP61	Embedded System Design Lab	PC	0	0	2	1	50	50	100
8	U19MCP62	Fluid Power Systems Lab	PC	0	0	2	1	50	50	100
9	U19MCP63	Industrial Robotics Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19MCC6X	Certification Course – IV**	EEC	0	0	4	-	100	-	100
11	U19MCS61	Skill Development Course 7: Foreign Language / IELTS - II	EEC	0	0	2	-	100	-	100
12	U19MCS62	Skill Development Course 8: Technical Seminar	EEC	2	0	0	-	100	-	100
13	U19MCS63	Skill Development Course 9: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U19MCM61	Professional Ethics	MC	2	0	0	-	100	-	100
							21	800	600	1400

Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U19MCE61	Introduction to Finite Element Analysis
2	U19MCE62	Automotive Electronics
3	U19MCE63	VLSI Design
4	U19MCE64	Virtual Instrumentation
5	U19MCE65	Intelligent Control System

U20BST552	OPERATIONS RESEARCH FOR MECHATRONICS	L	T	P	C	Hrs
		2	2	0	4	60

Course Objectives

- To understand the role of operation research in decision making.
- To provide knowledge and training in using optimization techniques.
- To impart the various operation research models for effective problem solving.
- To know the basics and the methods of solving inventory theory and problems.
- To acquire knowledge in principles of Queuing theory.

Course Outcomes

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

CO1 - Understand the characteristics of different types of decision making environments.
CO2 - Solve Transportation Models and Assignment Models.
CO3- Design new simple models by using critical path method.
CO4- Understand the applications of inventory and replacement concepts
CO5- Apply Queuing theory and solve problems related to it.

UNIT I LINEAR PROGRAMMING (12 Hrs)

Stages of Development of Operations Research – Applications of Operations Research – Limitations of Operations – Introduction to Linear Programming – Graphical Method – Simplex Method – Duality.

UNIT II TRANSPORTATION PROBLEMS (12 Hrs)

Basic feasible solution by different methods – Fixing optimal solutions – Stepping stone method – MODI method – Assignment problem – Formulation – Optimal solution.

UNIT III NETWORKS MODELS (12 Hrs)

Shortest Path Problem – Floyd's Algorithm – Minimum Spanning Tree Problem – CPM/PERT – Crashing of a Project network.

UNIT IV INVENTORY ANALYSIS AND REPLACEMENT MODELS (12 Hrs)

Inventory cost – Classification of Fixed first order Quantity Inventory Models- Inventory models with Deterministic Demand- Inventory models with probabilistic Demand. Replacement Models –types of failures- Replacement of items that deteriorate.

UNIT V QUEUING THEORY (12 Hrs)

Basic Waiting Line Models: (M/M/1):(GD/α/α) – (M/M/1):(GD/N/α) – (M/M/C):(GD/α/α) – M/M/C):(GD/N/α).

Text Books

1. Michael W.Carter, Camille C.Price, GhaithRabadi, "Operation Research – A Practical Introduction", Chapman and Hall/CRC, 2nd Edition 2018.
2. Jiongmin Yong, "Optimization Theory: A Concise Introduction", World scientific publishing company, 2018.
3. John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queuing Theory", 5th Edition,2018.

Reference Books

1. A.RaviRavindran, "Operations Research Methodologies", Taylor and Francis, 2019.
2. Hastings, Kevin J. "Introduction to the Mathematics of Operations Research with Mathematics", Taylor and Francis, 2019.
3. Er.Prem Kumar Gupta, Dr.D.S.Hira," Operations Research" S. chant& Company Pvt. Ltd, 7th Edition,2014.

4. J. K. Sharma. “Operations Research Theory and Applications”, Macmillan India Ltd, 5th Edition, 2013.

Web Resources

1. https://www.researchgate.net/publication/313880623
2. https://nptel.ac.in/courses/117/103/117103017
3. https://nptel.ac.in/courses/111/107/111107128/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	-	-	-	-	-	1	3	2	2
2	3	2	1	1	-	1	-	-	-	-	-	1	3	2	2
3	3	2	1	1	-	1	-	-	-	-	2	1	3	2	2
4	2	1	-	-	-	1	-	-	-	-	2	1	3	2	2
5	3	2	1	1	-	1	-	-	-	-	2	1	3	2	2

U19MCT64 U20MCT616	DESIGN OF MECHANICAL ELEMENTS	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives:

- To familiarize the various steps involved in the design process.
- To design shafts, keys and couplings
- To plan gears and analyzing the influence of stresses on it
- To propose brakes and clutches for automobiles with appropriate assumptions
- To devise bearings and springs with appropriate assumptions

Course Outcomes:

CO1 - Interpret the influence of steady and variable stresses in machine component design.(K2)
CO2 - Make use of concepts of shafts, keys and couplings with proper assumptions. (K3)
CO3 - Analyse of spur, helical, bevel, worm gear drives and multi speed gear box (K4)
CO4 - Function of clutches and braking systems (K4)
CO5 - Evaluate bearings and springs problems.(K5)

UNIT I DESIGN FUNDAMENTALS (12 Hrs)

Design Process – Computer aided design – Optimum design – Material Standards – Industrial design form and shape design, embodiment design and design for manufacture. Types of loads –Stresses – Static, varying, thermal, impact and residual. Factors of safety – Theories of failure – Stress concentration factors – S-N curves and its applications.

UNIT II SHAFTS AND COUPLINGS (12 Hrs)

Design of Shafts, Keys and Couplings: Design of Solid and Hollow shafts – Based on strength, rigidity and deflection – Torsional rigidity – Lateral rigidity – Material constants. Design of Keys – Types – Keyways. Design of rigid and flexible couplings.

UNIT III DESIGN OF SPUR, HELICAL GEARS (12 Hrs)

Principles of gear tooth action – Gear correction – Gear Materials- Gear tooth failure modes. Design of spur, helical gears – Multi speed gear box design –Spur gear – Forward Traverse.

UNIT IV DESIGN OF BRAKES AND CLUTCHES (12 Hrs)

Brakes – Types – Dynamic and thermal aspects of Braking – Braking system in automobiles. Design of clutches – Single plate – Multi plate –Conical clutch – Over running clutch.

UNIT V DESIGN OF BEARINGS AND SPRINGS (12 Hrs)

Study of Bearings – Design of Bearings – Sliding contact –Rolling contact – Cubic mean load. Design of Journal Bearings – Calculation of Bearing dimensions – Springs - Design of Helical spring, Leaf springs – Types of springs – Wahl factor – Problems.

Text book:

1. Bhandari***V***.B., Design of Machine Elements,4th edition, McGraw Hill Education India ,2017
2. Ganesh Babu K., K. Srithar, Design Of Machine Elements,1st Edition, McGraw Hill,2009
3. Spotts M.F., Shoup T.E., Hornberger L.E., Design of Machine Elements: 8th edition, Pearson /Prentice Hall,2003

Reference books:

1. Hamrock B.J., Fundamentals of Machine Elements, 2nd edition, McGraw Hill,2004
2. Juvinall R.C. ,K.M. Marshek, Fundamentals of machine component design: 6th edition, John Wiley.2011

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCT52 / U20MCT510	CONTROL SYSTEM FOR MECHATRONIC SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the elements of control system and their modelling using various techniques.
- To revise the procedures for analysing the time response in a system.
- To find out the frequency response and analysing the system.
- To be familiar with the stability of systems.
- To establish the state variable analysis method.

Course Outcomes

After completion of the course, the students are able to

CO1 - Demonstrate the various control system elements and their representations.(K2)
CO2 – Develop the various time domain parameters. (K3)
CO3 - Analyze the various frequency response plots and its system. (K3)
CO4 - Estimate the concepts of various system stability criterions.(K3)
CO5 - Design various transfer function of digital control system using variable models. (K3)

UNIT I CONTROL SYSTEM MODELING (9 Hrs)

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modelling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS (9 Hrs)

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation.

UNIT III FREQUENCY RESPONSE ANALYSIS (9 Hrs)

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, Lead Lag Compensators.

UNIT IV STABILITY ANALYSIS (9 Hrs)

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability.

UNIT V STATE VARIABLE ANALYSIS (9 Hrs)

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems.

Text Books

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

Reference Books

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
4. John J.D'Azzo& Constantine H.Houpis, "Linear Control System Analysis and Design'", Tata McGraw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

Web References

1. https://en.wikibooks.org/wiki/Control_Systems/Resources
2. https://www.tutorialspoint.com/control_systems/control_systems_useful_resources.htm
3. https://mechatronics.colostate.edu/resources/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCT54	THERMAL ENGINEERING AND HEAT TRANSFER	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives:

- To discuss first law of thermodynamics with respect to closed and open systems
- To impart the knowledge on second law of thermodynamics and entropy
- To recognize various modes of heat transfer in steady and transient condition.
- To discuss convective heat transfer in various systems.
- To describe radiation heat transfer for various geometries.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 Understand the basic concepts associated with the first law of thermodynamics.(K2)
CO2 Understand the basic concepts associated with the second law of thermodynamics.(K2)
CO3 Analyze steady state and transient heat conduction problems of real life Thermal systems.(K4)
CO4 Understand the convective heat transfer problems in various thermal systems.(K2)
CO5 Analyze radiation heat transfer problems in various thermal systems.(K4)

UNIT I IC ENGINES (12 Hrs)

Classification of IC engines – petrol and diesel engines; two stroke and four stroke engines – scavenging in two stroke engines - port and valve timing diagram - fuel supply system in SI and CI engines - ignition system and its types – cooling system and its types – lubrication system and its types - lubricants - governing of IC engines – engine operating characteristics – power – cruising – idle and low engine speed – high engine speed – cold start - performance characteristics – heat balance test for IC engines.

UNIT II JET PROPULSION (12 Hrs)

Principle of jet propulsion – air craft jet engines – jet engine cycle – turbojet – turbofan – turboprop – turbofan engines - engine performance – thrust and efficiency, thrust power, propulsion power, propulsion efficiency and thermal efficiency – engine aircraft matching. Rocket engines – introduction – space missions

UNIT III - CONDUCTION (12 Hrs)

Introduction of heat transfer – conduction - convection and radiation – Laws – General equation of heat conduction – Derivation in Cartesian - cylindrical and spherical coordinates – One dimensional steady state heat conduction in simple geometries – plane wall - cylinder and sphere –Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts

UNIT IV - CONVECTION (12 Hrs)

Boundary layer theory – Hydrodynamic and Thermal Boundary Layer- Dimensional Analysis-Flow over a flat– Flow over cylinders -spheres - tube bank.

UNIT V - RADIATION (12 Hrs)

Radiation heat transfer –Thermal radiation – Laws of radiation – Black body concept – Greay body radiation - Emissive power – Radiation shape factor-radiation heat exchange between surfaces – Electrical Analogy – Radiation Shields-Radiation through gases.

Text book:

1. Nag P. K., Engineering Thermodynamics, McGraw Hill Education India Pvt. Ltd, 2017.
2. Sachdeva R. C., Fundamentals of Heat and Mass Transfer, New AgeInternationalPublishers, 2017.
3. Rajput R K "A text book of Engineering Thermodynamics", S. Chand publishers, 2016

Reference books:

1. Moran and Shapairo, Principles of Engineering Thermodynamics, 8th Edition, Wiley, 2015
2. Yunus A. Cengel, Heat and Mass Transfer: Fundamentals and Applications, McGraw Hill Education, 2016.
3. Frank P. Incropera and David P. Dewitt, Incropera's principles of Heat and Mass Transfer, Wiley India Edition, 2018.
4. C. P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers, 2018.
5. Arora C.P, "Thermodynamics", 25th Reprint, McGraw-Hill, New Delhi, 2013.

Web References

1. https://nptel.ac.in/courses/112105266/
2. https://nptel.ac.in/courses/112108148/
3. https://nptel.ac.in/courses/112/103/112103275/
4. https://www.linkedin.com/company/heat-transfer-and-process-design-htpd
5. https://www.udemy.com/course/an-introduction-to-heat-transfer/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

Annxure – II

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MCT71 U20MCT717	PLC and Data Acquisition Systems	PC	3	0	0	3	25	75	100
2	U19MCT72 U20MCT718	Design of Mechatronics System	PC	2	2	0	3	25	75	100
3	U19MCE7X U20MCE7XX	Professional Elective – IV#	PE	3	0	0	3	25	75	100
4	U19XXO7X U20XXO7XX	Open Elective – IV$	OE	3	0	0	3	25	75	100
Practical										
5	U19MCP71 U20HSP703	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U19MCP72 U20MCP713	Computer Aided Engineering Lab	PC	0	0	2	1	50	50	100
7	U19MCP73 U20MCP714	Industrial Automation Laboratory	PC	0	0	2	1	50	50	100
8	U19MCP74 U20MCP715	Comprehensive Viva-voce	PC	0	0	2	1	50	50	100
Project Work										
9	U19MCW71 U20MCW701	Project Phase – I	PW	0	0	4	2	50	50	100
10	U19MCW72 U20MCW702	Internship / Inplant Training	PW	0	0	0	2	100	-	100
							20	550	450	1000

SEMESTER – VIII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MCT81 U20MCT819	Artificial Intelligence and Machine Learning	PC	2	2	0	3	25	75	100
2	U19MCE8X U20MCP8XX	Professional Elective – V#	PC	3	0	0	3	25	75	100
3	U19MCE8X U20MCE8XX	Professional Elective – VI#	PC	3	0	0	3	25	75	100
Practical										
4	U19MCP81 U20HSP804	Entrepreneurship Management	PC	0	0	2	1	100	-	100
Project Work										
5	U19MCW81 U20MCW803	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U19MCS81 U20MCS609	Skill Development Course 10: NPTEL / MOOC -II	EEC	0	0	0	-	100	-	100
							18	315	285	600

PROFESSIONAL ELECTIVE COURSES

Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U19MCE71 U20MCE716	Non-Destructive Testing Methods
2	U19MCE72 U20MCE717	Product Design and Development
3	U19MCE73 U20MCE718	Automated Material Handling System
4	U19MCE74 U20MCE719	Autonomous Mobile Robots
5	U19MCE75 U20MCE720	Digital Image Processing and Machine Vision

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19MCE80 U20MCE821	Reliability Engineering
2	U19MCE81 U20MCE822	Automation in Manufacturing Systems
3	U19MCE82 U20MCE823	Mechatronics System Applications
4	U19MCE83 U20MCE824	Robotics and Machine Vision
5	U19MCE84 U20MCE825	Project Management

Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19MCE85 U20MCE826	Power Plant Instrumentation and Control
2	U19MCE86 U20MCE827	Unconventional Machining Processes
3	U19MCE87 U20MCE828	Unmanned Aerial Vehicles
4	U19MCE88 U20MCE829	Building Automation
5	U19MCE89 U20MCE830	Industrial Engineering

Annxure – III

		L	T	P	C	Hrs
U19MCT72 **U20MCT72**	**DESIGN OF MECHATRONICS SYSTEM**	**3**	**0**	**0**	**3**	**45**

Course Objectives

- Mechatronics system design and simulation, ergonomics and safety
- Theoretical and practical aspects of computer interfacing, real time data acquisition and control
- Design of motion control, motion converter and temperature control
- To gain knowledge on real time interfacing
- To undergo case studies on Mechatronic system

Course Outcomes

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

CO1- Understand the basics and key elements of Mechatronics design process(K2)
CO2- Familiar with basic system modeling(K2)
CO3- Realize the concepts of real time interfacing and data acquisition(K1)
CO4- Realize the concepts of real time interfacing and data acquisition(K1)
CO5- Understanding the concepts of design of Mechatronic system through case studies(K2)

UNIT I INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM (9 Hrs)

Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.

UNIT II BASIC SYSTEM MODELLING (9 Hrs)

Basic building blocks of system modelling. Modelling of mechanical system- Modelling of mechanical and electrical systems - Simple exercises in linear, rotary motions.

UNIT III INTERFACING AND DATA ACQUISITION (9 Hrs)

Sensor selection, Real-time interfacing – Introduction - Elements of data acquisition and control and Frequency Domain- Applications.

UNIT IV ALGORITHMS FOR ADVANCED CONTROL (9 Hrs)

Advanced applications in Mechatronics: Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics

UNIT V Case Studies on Design of Mechatronics System (9 Hrs)

Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir – Pick and place robot – Carparking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control

Text Books

1. S Devdas shetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition,Cengage Learning 2011
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL’s, John wiley and sons Ltd, 2003.

Reference Books

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.
3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
4. Theory and Practice of Mechatronics System, Pearson Education, 2007.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	2	1	3	2	3
2	3	2	2	2	-	-	-	-	-	-	2	2	3	2	3

3	3	2	2	2	-	-	-	-	-	-	2	3	3	2	3
4	3	2	2	2	-	-	-	-	-	-	2	1	3	2	3
5	3	2	2	2	-	-	-	-	-	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCE71 **NON-DESTRUCTIVE TESTING METHODS**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To study various Non-Destructive Evaluation and Testing methods, theory and their industrial applications.
- To impart knowledge in various methods of Non Destructive Testing.
- To overview the concepts, principles, and methods employed for NDT of structures and materials.
- To evolve eddy current testing methods.
- To characterization of ultrasonic testing and acoustic emission systems

Course Outcomes

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

CO1- Observe various Non-Destructive Testing and characterization of industrial components.(K1)
CO2- Interpret basic principles of various NDT methods.(K2)
CO3- Estimate various NDT and industrial applications.(K3)
CO4- Distinguish NDT methods and other techniques tools.(K4)
CO5- Understand specifications related to non-destructive testing technology.(K2)

UNIT I INTRODUCTION OF NDT (9 Hrs)

NDT Versus Mechanical testing, Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS (9 Hrs)

Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism. (Image Processing)

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (9 Hrs)

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation

UNIT IV ULTRASONIC TESTING AND ACOUSTIC EMISSION (9 Hrs)

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-scan, B-scan, C-scan(Conversion). Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications

UNIT V RADIOGRAPHY (9 Hrs)

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed

Text Books

1. Mayorkinos Papaelias, Fausto Pedro Garcia Marquez, Alexander Karyotakis "Non-Destructive Testing and Condition Monitoring Techniques for Renewable "Butterworth-Heinemann - 2019
2. Jean-Paul Balayssac, Vincent Garnier "Non-destructive Testing and Evaluation of Civil Engineering Structures" Elsevier. – 2017.
3. Baldev Raj, T. Jayakumar, M. Thavasimuthu Practical Non-destructive Testing, Woodhead 2002

Reference Books

1. J. B. Hull, Vernon John “Non-Destructive Testing” Macmillan International Higher Education. – 2015
2. Nathan Ida, Norbert Meyendorf “Handbook of Advanced Nondestructive Evaluation Springer International Publishing, 2019
3. Gerhard Huebschen, Iris Altpeter, Ralf Tschuncky “Materials Characterization Using Nondestructive Evaluation (NDE) Methods” Woodhead Publishing. – 2016
4. Songling Huang, Shen Wang “New Technologies in Electromagnetic Non-destructive Testing” Springer. – 2016
5. Raman Singh, Baldev Raj, U. Kamachi Mudali “Non-Destructive Evaluation of Corrosion and Corrosion-assisted Cracking” John Wiley & Sons. - 2019

Web Resources

1. https://nptel.ac.in/courses/113/106/113106070/
2. https://swayam.gov.in/nd1_noc20_mm07/preview
3. https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructive-testing-9872.
4. https://onlinecourses.nptel.ac.in/noc20_mm07/preview.
5. https://www.youtube.com/watch?v=oqMXbxk4RHI

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
2	3	2	1	-	-	-	-	-	-	-	2	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3
4	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
5	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCE81	AUTOMATION IN MANUFACTURING SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge in the field of Automated Manufacturing system.
- To illustrate the basic concepts of automation in production lines.
- To understand the fundamentals of automation in multi station assembly machines
- To describe the importance of automated material handling and storage systems.
- To understand automated inspection principles and strategies in manufacturing.

Course Outcomes

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

CO1 - Understand the basic types, levels, strategies of automation. **(K1)**

CO2 - Understand basic components and their functions of automated production line system.**(K2)**

CO3 - Apply the quantitative analysis and assembly systems.**(K2)**

CO4 – Examine various storage system and transportation requirements of automated systems.**(K2)**

CO5 - Evaluate the process control strategy to an automated system.**(K3)**

UNIT I INTRODUCTION (9 Hrs)

Facilities - Manual work systems, worker - machine systems and automated systems. Manufacturing support systems, Automation in Production systems - Automated Manufacturing systems, Computerized manufacturing support systems, Manual labour in Production systems, Automation principles and strategies.

UNIT II AUTOMATED PRODUCTION LINES (9 Hrs)

Fundamentals - System configurations, work part transfer mechanisms, Storage buffers, and Control of the production line. Applications - Machining systems and System Design Considerations. Analysis of Transfer lines - Transfer lines with No internal parts storage, Transfer lines with internal storage buffers.

UNIT III AUTOMATED ASSEMBLY SYSTEMS (9 Hrs)

System configurations, Parts delivery at workstations and applications, quantitative analysis of assembly systems - Parts Delivery System at Workstations, Multi - Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

UNIT IV AUTOMATED MATERIAL TRANSPORT & STORAGE SYSTEMS (9 Hrs)

Automated Material Transport & Storage systems: Automated Guided Vehicle (AGV) Systems, Types and applications, Vehicle Guidance Technology, Vehicle Management and Vehicle safety. Automated Storage and Retrieval Systems (ASRS) and Carousel Storage Systems.

UNIT V AUTOMATEDINSPECTIONSYSTEMS (9 Hrs)

Quality in Design and manufacturing, inspection principles and strategies, automated inspection, contact Vison-contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books

4. Beno Benhabib Manufacturing: Design, Production, Automation, and Integration, CRC Press, 2009.
5. R. Thomas Wright, Mich+ael Berkeihiser, 'Manufacturing and Automation Technology', 2011.
6. Mikell P. Groover, 'Automation, Production Systems and Computer-Integrated Manufacturing', Pearson Publisher, Fourth Edition, 2016.

Reference Books

1. P. Radhakrishnan, S. Subramanyan andV. Raju, 'CAD/CAM/CIM', New Age International (P) Ltd.,New Delhi,2009.
2. S.R.Deband Sankha Deb,'Robotics Technology and Flexible Automation',TataMcGrawHill,Second Edition, NewDelhi, 2010.
3. Peter Corke, 'Robotics, Vision and Control:Fundamental Algorithms in MATLAB', Springer,2011.
4. Nicholas Odrey, Mikell P Groover, Roger Nagel, Ashish Dutta, 'Industrial Robotics(SIE): Technology, Programming and Applications',McGraw Hill, 2012.
5. Caustic Kumar (Editor), Divya Zindani (Editor), J. Paulo Davim,' Digital Manufacturing and Assembly Systems in Industry 4.0', CRC Press, 2021
6.

Web Resources

1.https://nptel.ac.in/courses/108/105/108105063/
2.https://www.automationmag.com/
3.https://www.springer.com/gp/book/9783319771786.
4.https://library.automationdirect.com/industrial-automation-top-10-trends/
5. https://nptel.ac.in/courses/112/102/112102011/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
2	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	3	2	3	1	3
4	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
5	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCE84	PROJECT MANAGEMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concepts of Project Management for planning to execution of projects.
- To understand the time needed to successfully complete a project, considering factors such as task dependencies and task lengths
- To understand the feasibility analysis in Project Management and network analysis tools for time estimation.
- To comprehend the fundamentals of Contract Administration, Costing and Budgeting.
- To Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

Course Outcomes

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

CO1 - Explain project, project management, life cycle and influencing factors (k1)
CO2 - Analyze and manage project formulation in projects parametrics (K2)
CO3 - Manage time in projects through Gantt charts, CPM and PERT techniques, (K3)
CO4 – Optimize resources of projects using scheduling, fast tracking and re-estimation techniques (K3)
CO5 - Identify risk management in projects with emerging trends in project management (K2)

UNIT I PROJECT AND ITS PROCESS (9 Hrs)

Define project and process, boundaries of project, Objectives and functions of Project management, characteristics and types of projects, organization structure / styles, roles of project management group, project management office and its role, project knowledge area, project integration- process group interaction. Project flow, project life cycle- influencing factors.

UNIT II PROJECT FORMULATION (9 Hrs)

Generation and Screening of PM ideas- Triple Constraint – Time, Cost and Scope. TOR/ Project Charter/ SOW (Statement of Work) - Creation of project Charter. Preliminary planning and estimate. Types of estimate- Ball park, Parametric and Bottom up estimates. Project Presentation & Approval – Detailed Project Report & Approval (Technical and Budget Sanction).

UNIT III TIME MANAGEMENT (9 Hrs)

Project Scope Management - Work break down structure- Activity/ Task- Events- Case study. Project planning tools Rolling wave planning. Gantt Charts, Milestone chart, Program Progress chart- Creating milestone plan. Project Network- Fulkerson's rules – Activity-On-Arrow and Activity- On - Node networks. Analyze project time- Critical path method.

UNIT IV RESOURCE MANAGEMENT AND OPTIMIZATION (9 Hrs)

Types of resource - Balancing of resource - Resource Smoothing technique - Time constraint. Resource leveling technique- Resource constraint- Case study.

Resource optimization, Types of cost - Direct, Indirect and Total Cost. Variation of Cost with time. Schedule Compression Techniques- Crashing, Fast Tracking & Re-estimation- Crash time and crash cost. Optimize project cost for time and resource. CPM Cost model.

UNIT V RISK MANAGEMENT (9 Hrs)

Risk management – meaning and process, Risk identification and analysis techniques- FMEA and SWOT analysis- Risk reporting and monitoring- Case study.

Text Books

1. Dennis Lock, Project Management, Taylor & Francis, 2017
2. Albert Lester Project Management, Planning and Control Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards, Elsevier/Butterworth-Heinemann 2007

Reference Books

1. Terry Schmidt Strategic Project Management Made Simple Practical Tools for Leaders and Teams,Wiley,2009.
2. R. B. Khanna Project Management, PHI Learning 2011
3. Garth G.F. Ward Effective Project Management Guidance and Checklists for Engineering and Construction, Wiley, 2018.

Web Resources

1. https://nptel.ac.in/courses/110/104/110104073/
2. https://nptel.ac.in/courses/110/107/110107081/
3. https://www.youtube.com/watch?v=5pwc2DYlKQU
4. https://www.youtube.com/watch?v=wJ8HZ7hqUs8

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
2	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	3	2	3	1	3
4	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
5	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCE86	UNCONVENTIONAL MACHINING PROCESS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To differentiation between convention and unconventional machining process and need of unconventional machining in the current scenario.
- To know about the metal removal rate and surface finish of different materials using mechanical energy-based processes.
- To know about the metal removal rate and surface finish of different materials using electrical energy-based processes.
- To know about the metal removal rate and surface finish of different materials using chemical energy-based processes.
- To know about the metal removal rate and surface finish of different materials using thermal energy-based processes

Course Outcomes

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

CO1 - Understand the basic principle of conventional machining process(K1)

CO2 - Interpret the mechanical energy-based processes(K2)

CO3 - Familiarize on the various electrical energy-based processes(K3)

CO4 - Interpret the chemical energy-based processes(K3)

CO5 - Familiarize on the various thermal energy-based processes(K2)

UNIT I INTRODUCTION (9 Hrs)

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

UNIT II MECHANICAL ENERGY BASED PROCESSES (9 Hrs)

Abrasive Jet Machining - Water Jet Machining - Abrasive Water Jet Machining - Ultrasonic Machining. Working Principles - equipment used - Process parameters - MRR – Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES (9 Hrs)

Electric Discharge Machining (EDM) - working Principle - equipments - Process Parameters - Surface Finish and MRR - electrode / Tool - Power and control Circuits - Tool Wear - Dielectric - Flushing - Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES (9 Hrs)

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR Electrical Circuit-Process Parameters- ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES (9 Hrs)

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications

Text Books

1. T. Jagadeesha “Unconventional Machining Processes “I.K. International Publishing House Pvt. Limited, 2016.
2. Hassan El-Hofy “Fundamentals of Machining Processes: Conventional and Nonconventional Processes “CRC Press/Taylor & Francis Group, 2018.

Reference Books

1. Kumar, Kaushik, Kumari, Nisha, Davim, J. Paulo “Non-Conventional Machining in Modern Manufacturing Systems “ IGI Global. – 2018
2. Golam Kibria, B. Bhattacharyya, J. Paulo Davim “Non-traditional Micromachining Processes: Fundamentals and Applications” Springer. – 2017
3. Kaushik Kumar, J. Paulo Davim “Modern Manufacturing Processes” Elsevier Science & Technology, 2020
4. Kapil Gupta “Advanced Manufacturing Technologies“Springer – 2017
5. M. S. Shunmugam, M. Kanthababu “Advances in Micro and Nano Manufacturing and Surface Engineering “ Springer Nature - 2019

Web Resources

https://nptel.ac.in/courses/112/105/112105126/
https://swayam.gov.in/nd1_noc20_me17/preview
https://www.youtube.com/watch?v=gFB2PCULf0s

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3
2	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3
3	3	2	2	1	-	-	-	-	-	-	3	2	3	1	3
4	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3
5	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19MCE89	INDUSTRIAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the concepts, principles and framework of contents of Industrial Engineering
- To design and develop algorithms for solving industrial engineering related problems.
- To introduce the concepts of cost accounting and financial management practices as applied in industries.
- To acquaint the students with different aspects of Human Resource activities and Industrial Safety rules.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.

Course Outcomes

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

CO1 - Describe the scope, objectives, application, methods and tools of Industrial Engineering systems. (K1)
CO2 - Apply the various methods of Method study to Improve productivity (K2)
CO3 - Apply the various techniques of work measurement to Improve productivity (K3)
CO4 - Demonstrate the knowledge of designing plants and controlling production.(K3)
CO5 - Explain the decision support system methods to select the right solution to the concerned problems(K2)

UNIT I INDUSTRIAL ORGANISATION **(9 Hrs)**

Introduction to Industrial Engineering – Concepts - History and Development of Industrial engineering – Roles of Industrial Engineer – Applications – Productivity – Factors affecting productivity – Increasing productivity of resources – Kinds of productivity measures

UNIT II WORK DESIGN **(9 Hrs)**

Introduction to work study – Method study – Time study – stopwatch time study – Standard data - Method Time Measurement (M-T-M) – Work sampling – Ergonomics

UNIT III DEMAND FORECASTING AND ELEMENTS OF COST **(9 Hrs)**

Demand Forecasting and Elements of Cost Macro and micro economics - Demand and supply – Factors influencing demand – Elasticity of demand – Demand forecasting – Time series - Exponential smoothing casual forecast - Delphi method – Correlation and Regression - Barometric method – Long run and Short run forecast. Elements of cost – Determination of Material cost - Labour cost - Expenses – Types of cost.

UNIT IV PLANT LAYOUT AND GROUP TECHNOLOGY **(9 Hrs)**

Plant location - Factors - Plant layout - Types - Layout design process – Computerized Layout Planning – Construction and Improvement algorithms -ALDEP - CORELAP and CRAFT. Group technology Problem definition - Production flow analysis - Heuristic methods of grouping by machine matrices – Flexible Manufacturing System - FMS work stationsMaterial handling and Storage system-Cellular Manufacturing System

UNIT V PRODUCTION PLANNING AND CONTROL **(9 Hrs)**

Types of productions, Production cycle-Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing- Simple problems. Materials Planning – ABC analysis – Incoming materials control – Kanban system – Just in time. MRP systems- Master Production Schedule – Bill of Materials – MRP calculations

Text Books

1. O.P. Khanna, “Industrial engineering and management”, Dhanpat Rai Publications, 2018.
2. Martand T. Telsang, “Industrial Engineering and Production Management”,S. Chand Publishing, 2018.
3. Buffa E.S., Modern Production / Operational Management, John Wiley & Sons, 2009

Reference Books

1. Ravi, V. Industrial Engineering And Management” PHI Learning Pvt. Ltd – 2015
2. Pravin Kumar “Industrial Engineering and Management” Pearson Education India – 2015
3. Adedeji B. Badiru “Introduction to Industrial Engineering” CRC Press – 2018
4. Mr. Ashok Keshav Karande “The Story of Industrial Engineering: The Rise from Shop-Floor Management”-2019
5. Panneerselvam. R., Production/Operations Management, Prentice Hall of India, 2006

Web Resources

1. https://online.engineering.arizona.edu/online-programs/industrial-engineering/master-of science-in-industrial-engineering/
2. https://nptel.ac.in/courses/112/107/112107142/
3. https://swayam.gov.in/nd1_noc20_me43/preview
4. https://www.youtube.com/watch?v=aYcKw5q6JB4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3
2	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3
3	3	2	3	-	-	-	-	-	-	-	3	2	3	1	3
4	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3
5	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

Annxure – IV

DEPARTMENT VISION AND MISSION

Vision

To be a department with outstanding competencies in education and research in interdisciplinary field of Mechatronics Engineering for the prosperity of students and society.

Mission

M1 - Quality Integration: To uphold excellence in education by integrating the teaching learning process with hands-on trainings in updated technologies.

M2 - Research Exploration: To maintain a dynamic balance between learning and research by encompassing activities related to Research, Industrial projects and Innovation Contests.

M3 – Personality Development: To enrich the team spirit and entrepreneurship skills through training programmes on personality development for career prospects.

M4 – Social Ethics: To enhance the principle of highest ethical values by inculcating code of conduct for the betterment of the Society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Strong Knowledge

To provide comprehensive knowledge on Science, Mathematics & multiple Engineering disciplines, along-with the ability to apply the gained knowledge.

PEO2: Technical Competency

To produce graduates who can demonstrate technical competence in the field of Mechatronics Engineering and develop solutions to the complex problems.

PEO3: Task Orientation

To produce graduates who function effectively in a multi-disciplinary environment, individually and within a society towards accomplishing tasks.

PEO4: Team Work

To produce graduates who would be able to take individual responsibility and work as a part of a team towards the fulfillment of both individual and organizational goals.

PEO5: **Professional Competency**

To produce graduates with professional competence by life-long learning on advanced studies, professional skills and other professional activities related to Mechatronics Engineering society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understanding the Concepts

To comprehend the concepts of Mechatronics and their applications in the field of Automated Manufacturing Systems, Robotics, Automobile Technology, Aerial vehicles and other relevant areas.

PSO2: Application of Knowledge

To apply technical knowledge in modern hardware and software tools related to Mechatronics for solving real world problems.

PSO3: Solution Development

To develop the ability to analyze, comprehend and design mechatronics subsystems for a variety of engineering applications for the benefits of society