SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Department of Mechatronics

Minutes of Eighth BoS Meeting

Venue

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

Date & Time

09th September 2024
10:00 A.M.

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Department of Mechatronics

Minutes of Eighth Board of Studies Meeting

The Eighth Board of Studies meeting of Mechatronics Department was held on 09th September 2024 at 10:00 A.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
1. Head of the Department concerned (Chairperson)	
1	**Dr. G.Balamuruga Mohan Raj, M.Tech., Ph.D.,** Professor and Head Specialization: Manufacturing Years of Experience: 20 Sri Manakula Vinayagar Engineering College hodmechatronics@smvec.ac.in 9600989508
2. All faculty members of the Department	
2	**Mr. S.Saravanan** Asst. Professor Specialization: Energy Technology
3	**Mr.P.Ramesh Kumar,** Asst. Professor Specialization: Manufacturing
4	**Mr.S.Prakash,** Asst. Professor Specialization: Manufacturing
5	**Mr.S.Jagan.** Asst. Professor Specialization: Energy Technology
6	**Mr.S.Pushparaj** Asst. Professor Specialization: VLSI Design
7	**Mrs.S.Kalaimani** Asst. Professor Specialization: Embedded system Technologies
8	**Ms.M.Subitha** Asst.Professor Specialization: wireless communication
9	**Dr.T.Poovaragavan,** Assistant Professor Dept. of Mathematics

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10	**Dr.Samuvel.K** Assistant Professor Dept. of Physics,
11	**Dr. Balamurugan.A** Assistant Professor Dept. of Chemistry,
3. Two subject experts from outside the Parent University are nominated by the Academic Council.	
12	**Dr.B.Meenakshipriya** Professor/ Mechatronics Kongu Engineering College, Perundurai, Erode – 638060 E-Mail Id: bmp@kongu.ac.in; b.meenakshipriya@gmail.com Contact No: +91-9842799990, +91-9942699990
13	**Dr.RM.Kuppan Chetty,** Professor/School of Mechanical Engineering SASTRA Deemed to be University Thanjavur. Tamil Nadu, 613 401. E-Mail Id: kuppanchetty@mech.sastra.edu; rmkuppan@gmail.com Contact No: 9444030759 Specialization: Robotics
4. One expert is nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal as a University Nominee.	
14	**Dr.V.Sugumaran,** Professor, School of Mechanical Engg. & Building Sciences, VIT University – Chennai. E-Mail Id: v_sugu@yahoo.com Contact No: 9789923926 Specialization: Production Engineering
5. One representative from industry/corporate sector/allied areas is nominated by the Principal as a Industry Nominee	
15	**Dr.D.Dinakaran,** Senior Technical Manager Medical Division (Engg & Research) HCL, Sholinganallur E-Mail Id: dinakaran@hindustanuniv.ac.in Contact No: 9443124007 Specialization:Tool Wear & neuro Fuzzy Modelling
6. One member of the College alumni is nominated by the Principal.	
16	**A.Baranidharan** Associate System Engineer, TCS Bangalore, Contact No:9087965798 E-Mail Id:: vtc1516003@gmail.com, Specialization:B.Tech Mechatronics
7. Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the Principal.	
17	**Dr. Jegadeeshwaran.R** Professor and Head,

2.A.8.2

	Department of Mechatronics, School of Mechanical Sciences, VIT University – Chennai E-Mail Id: jegadeeshwaran.r@vit.ac.in Contact: 9865338366 Specialization:Neuro Fuzzy Modelling & Fault Diagnosis

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AGENDA OF THE MEETING

Item No. : BOS / 2024/MCT/UG /8.1	
	About College infrastructure facilities, Achievements, Awards and recognitions.
Item No. : BOS / 2024/MCT/UG /8.2	
	Consideration of the confirmation of minutes of the previous meeting held on 27th February 2024
Item No. : BOS / 2024/MCT/UG /8.3	
	Consideration of the revision of curriculum and syllabus of 5th and 6th semester of the B.Tech. Mechatronics and under Regulations 2023 to the students admitted from the academic year 2023–24
Item No. : BOS / 2024/MCT/UG /8.4	
	Consideration of Professional and Open electives of B.Tech. Mechatronics to be offered under Regulations 2023
Item No. : BOS / 2024/MCT/UG /8.5	
	Consideration of the various professional bodies, club activities, Skill Development Courses of the Academic Activities
Item No. : BOS / 2024/MCT/UG /8.6	
	Consideration of revision of the list of panel of question paper setters and Examiners for the examinations of UG programs for the academic year 2024–25
Item No. : BOS / 2024/MCT/UG /8.7	
	Any other item with the permission of the chair

Dr.G.BALA... ...OHAN RAJ
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Madagadip... ...05 107.

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Minutes of the Meeting

Dr. G. Balamuruga Mohan Raj, Chairman opened the BOS meeting by welcoming the external members and the internal members and the meeting there after deliberated on agenda items that had been approved by the Chairman.

BOS/2022/MCT/UG/8.2: Chairman, BoS, apprised the minutes of Seventh BoS, its implementation is confirmed.

Sl. No.	Regulations	Semester	Subject Name with Code	Particulars	Action Taken
1	R2023	III	Fluid Mechanics and Machinery U23MCT304	Few topics are modified(Unit-III)	Implemented
2	R2023	III	Analog and digital Electronics U23MCT305	Modified in theory	Implemented
3	R2023	III	Sensors,Transducers and measurement system U23MCB306	Modified in theory cum laboratory	Implemented
4	R2023	IV	Microprocessors and controllers for Mechatronics system U23MCT408	All the units topics are updated	Implemented
5	R2023	IV	Microprocessors and controllers laboratory U23MCP405	All the experiments are updated instead of 8085 Microprocessor replaced by 8086 Microprocessor	Implemented

Sl. No.	Regulations	Semester	Subject Name with Code	Particulars	Action Taken
1	R2023	III	Fluid Mechanics and Machinery U23MCT304	Same Course title with Civil Engineering	subject tittle is modified as Applied Fluid Mechanics and Machinery U23MCT304

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

BOS/2022/MCT/UG/8.3: Recommended to the Academic Council with following suggestions in the Curriculum and Syllabi of Regulation 2023.

Sl. No.	Regulations	Semester	Subject Name with Code	Unit	Particulars
1	R2023	V	PLC and Industrial Automation Systems U23MCT511	V	Case studies included

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2	R2023	V	Fluid Power Systems U23MCT512	V	Case studies included
3	R2023	V	Industrial Automation Laboratory U23MCP506	-	Experiment Tittle updated
4	R2023	VI	Industrial Robotics U23MCT617	II,III,&IV	Syllabus are rearranged and Modified
5	R2023	VI	Computer Aided Manufacturing Laboratory U23MCP610		Simulation base Experiment are included

The above corrections are incorporated and the Syllabi of the professional core courses of V and VI semesters are given in Annexure-II and approved by the BoS members

BOS/2022/MCT/UG/8.4: Recommended to the Academic Council with following suggestions in the Professional and open electives of Regulation 2023.

Sl. No.	Regulations	Semester	Subject Name with Code	Particulars
1	R2023	V	Robot operating System U23MCE502	Subject included Instead of Autonomous Mobile Robots
2	R2023	VI	Mobile Robotics U23MCE605	Subject included Instead of Consumer Electronics

The above corrections are incorporated and the Syllabi of the Professional and open electives of V and VI semesters are given in Annexure-III and approved by the BoS members

BOS/2022/MCT/UG/8.5: Recommended to the Academic Council, the Professional and open elective courses are offered under R-2020 and also various professional bodies, club activities, Skill Development Courses was discussed

The Lists of Professional and open elective courses offered under R-2020 are Given in Annexure-IV

BOS/2022/MCT/UG/8.6: The list of panels of question paper setters and Examiners for the End Semester Examinations of the academic year 2024–25 is discussed and recommended to the Academic Council and is given in **Annexure - V**.

BOS / 2024/MCT/UG /8.7

Any other item with the permission of the chair-Nil

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

Board Chairman
Dr. G. Balamuruga Mohan Raj

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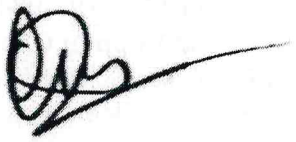
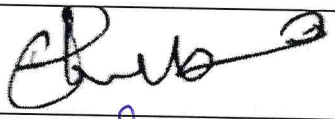
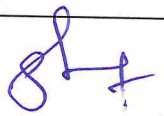
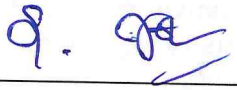
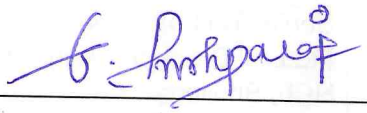
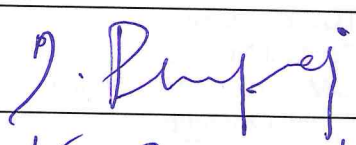
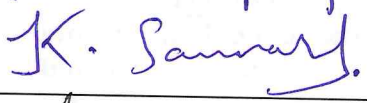
Sl. No.	Name of the Member	Signature
1. Head of the Department concerned (Chairperson)		
1	**Dr. G.Balamuruga Mohan Raj, M.Tech., Ph.D.,** Professor and Head Specialization: Manufacturing Years of Experience: 20 Sri Manakula Vinayagar Engineering College hodmechatronics@smvec.ac.in 9600989508	
2. All faculty members of the Department		
2	**Mr. S.Saravanan** Asst. Professor Specialization:Energy Technology	
3	**Mr.P.Ramesh Kumar,** Asst. Professor Specialization:Manufacturing	
4	**Mr.S.Prakash,** Asst. Professor Specialization: Manufacturing	
5	**Mr.S.Jagan.** Asst. Professor Specialization: Energy Technology	
6	**Mr.S.Pushparaj** Asst. Professor Specialization: VLSI Design	
7	**Mrs.S.Kalaimani** Asst. Professor Specialization: Embedded system Technologies	
8	**Ms.M.Subitha** Asst.Professor Specialization: wireless communication	
9	**Dr.T.Poovaragavan,** Assistant Professor Dept. of Mathematics	
10	**Dr.Samuvel.K** Assistant Professor Dept. of Physics,	
11	**Dr. Balamurugan.A** Assistant Professor Dept. of Chemistry,	
3. Two subject experts from outside the Parent University are nominated by the Academic Council.		

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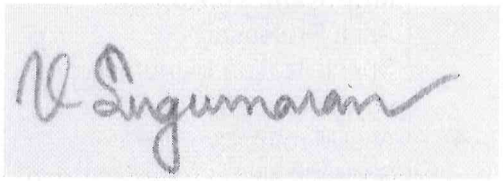
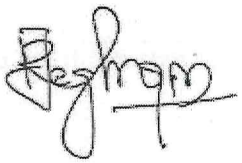
12	**Dr.B.Meenakshipriya** Professor/ Mechatronics Kongu Engineering College, Perundurai, Erode – 638060 E-Mail Id: bmp@kongu.ac.in; b.meenakshipriya@gmail.com Contact No: +91-9842799990, +91-9942699990	
13	**Dr.RM.Kuppan Chetty,** Professor/School of Mechanical Engineering SASTRA Deemed to be University Thanjavur. Tamil Nadu, 613 401. E-Mail Id:kuppanchetty@mech.sastra.edu; rmkuppan@gmail.com Contact No: 9444030759 Specialization: Robotics	
4. One expert is nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal as a University Nominee.		
14	**Dr.V.Sugumaran,** Professor, School of Mechanical Engg. & Building Sciences, VIT University – Chennai. E-Mail Id: v_sugu@yahoo.com Contact No: 9789923926 Specialization: Production Engineering	
5. One representative from industry/corporate sector/allied areas is nominated by the Principal as a Industry Nominee.		
15	**Dr.D.Dinakaran,** Senior Technical Manager Medical Division (Engg & Research) HCL, Sholinganallur E-Mail Id: dinakaran@hindustanuniv.ac.in Contact No: 9443124007 Specialization:Tool Wear & neuro Fuzzy Modelling	
6. One member of the College alumni is nominated by the Principal.		
16	**A.Baranidharan** Associate System Engineer, TCS Bangalore, Contact No:9087965798 E-Mail Id:: vtc1516003@gmail.com, Specialization:B.Tech Mechatronics	**ABSENT**
7. Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the Principal.		
17	**Dr. Jegadeeshwaran.R** Professor and Head, Department of Mechatronics, School of Mechanical Sciences, VIT University – Chennai E-Mail Id: jegadeeshwaran.r@vit.ac.in Contact: 9865338366 Specialization:Neuro Fuzzy Modelling & Fault Diagnosis	

ANNEXURE - I

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Department	**Mechatronics**	Programme : **B.Tech.**					
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23MCT304**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**APPLIED FLUID MECHANICS AND MACHINERY**	3	0	0	3	25	75	100

Prerequisite	Basic Concepts of Fluids	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic fluid Properties and Flow Characteristics	**K2**
	CO2 Illustrate the fluid flow in flow through pipes and Jet on plates	**K3**
	CO3 Complete knowledge in Dimensional and Model Analysis	**K3**
	CO4 Calculate the force, Power and efficiency in turbines	**K4**
	CO5 Understand the working of Centrifugal pump and Reciprocating pumps.	**K2**

UNIT – I	**Fluid Properties And Flow Characteristics**	**Periods:09**
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity-Pressure Measurements.		**CO1**
UNIT – II	**Flow Through Pipes and Impact of Jets**	**Periods:09**
Introduction-losses of energy in pipes-Loss of energy due to friction-Minor energy head losses-Flow through pipes in series and parallel-equivalent pipe-branched pipes. Flow Measurements: Applications of Bernoulli's Equations. Principles of Turbo Machinery: Fluid Machines – Classification – Impact of Fluid Jet on Stationary plates, Moving Plates– Unit and Specific Quantities.		**CO2**
UNIT – III	**Dimensional and Model Analysis**	**Periods:09**
Introduction Derived Quantities-dimensional Homogeneity-Methods of dimensional analysis-Rayleigh's method-Bucking of л-Theorem-model analysis-simulated types of similarities.		**CO3**
UNIT – IV	**Hydraulics Turbines**	**Periods:09**
Classification – Impulse Turbine – Pelton Wheel – Reaction Turbines – Francis and Kaplan Turbines – Draft Tube Theory – Velocity Triangle – Estimation of force, Power and efficiency – General Characteristics of Turbine – Similarity Study – Governing of Turbine – Cavitation in Turbine.		**CO4**
UNIT – V	**Hydraulics Pumps**	**Periods:09**
Classification - Centrifugal Pump – Velocity Triangle – Estimation of Power Required and efficiency – General characteristics - Similarity study – Cavitation in Pump – Reciprocating– Ideal and Actual Indicator Diagram – Estimation of Power Required, percentage Slip and Efficiency – Cavitation in Reciprocating pump.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 2010.
2. Kumar, K.L., "Engineering Fluid Mechanics", SchandPublications (P) Ltd., New Delhi (8th edition), 2009
3. Rajput.R.K "Fluid Mechanics and Hydraulics Machines", S. Chand Limited, 2008.

Reference Books

1.Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 2010.
2.White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2016.
3.Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2011.
4.K. Subramanya "Hydraulic Machines" Tata McGraw-Hill Education, 2013.
5.Goyal, Manish Kumar "Fluid Mechanics and Hydraulic Machines" PHI Learning Pvt. Ltd., 31-Aug-2015

Web References

1.https://nptel.ac.in/courses/112104118/

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2.https://nptel.ac.in/courses/112104117
3.http://fm-nitk.vlabs.ac.in
4.https://www.coursera.org/courses?query=fluid%20mechanics
5.https://www.virtulearn.in/course/fluid-mechanics-and-hydraulic-machines-online-classes

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics - I	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
4	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
5	U23ESTC02	Engineering Mechanics	ES	2	1	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English - I	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23MCC1XX	Certification Course - I**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23MCM101	Induction Programme	MC	2 Weeks			-	-	-	-
TOTAL							**22**	**425**	**575**	**1000**

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics – II	BS	3	1	0	4	25	75	100
2	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
3	U23MCT201	Manufacturing Technology	PC	3	0	0	3	25	75	100
4	U23MCT202	Thermodynamics and Heat Transfer	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values-II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC01	Basic Electrical and Electronics Engineering Laboratory	ES	0	0	2	1	50	50	100
8	U23MCP201	Thermal Engineering Laboratory	PC	0	0	2	1	50	50	100
9	U23MCP202	Manufacturing Technology Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23MCC2XX	Certification Course – II**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23MCM202	Sports, Yoga and NSS	MC	2	0	0	-	100	-	100
TOTAL							**21**	**525**	**575**	**1100**

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SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23MCT303	Analog and Digital Electronics	PC	3	0	0	3	25	75	100
4	U23MCT304	Applied Fluid Mechanics and Machinery	PC	3	0	0	3	25	75	100
5	U23MCT305	Mechanics of Solids	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23MCB306	Sensors, Transducers and Measurement systems	PC	2	0	2	3	50	50	100
Practical										
7	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
8	U23ENPC01	General Proficiency – I	HS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23MCP303	Analog and Digital Electronics Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23MCC3XX	Certification Course – III**	AEC	0	0	4	-	100	-	100
12	U23MCS301	Skill Enhancement Course- I	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23MCM303	Climate Change	MC	2	0	0	-	100	-	100
TOTAL							**23**	**675**	**625**	**1300**

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23EETC02	Power Electronics and Drives	PC	3	0	0	3	25	75	100
4	U23MCT407	Microprocessors and controllers for Mechatronics Systems	PC	3	0	0	3	25	75	100
5	U23MCT408	Theory of Machines	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23MCB409	IoT for Mechatronics	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23EEPC02	Power Electronics and Drives Laboratory	PC	0	0	2	1	50	50	100
10	U23MCP404	Microprocessors and Controllers Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23MCC4XX	Certification Course – IV**	AEC	0	0	4	-	100	-	100
11	U23MCS402	Skill Enhancement Course- II	AEC	0	0	2	-	100	-	100
Mandatory Course										
12	U23MCM404	Right to Information and Good Governance	MC	2	0	0	-	100	-	100
TOTAL							**23**	**675**	**625**	**1300**

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SEMESTER – V

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23MCT510	PLC and Industrial Automation Systems	PC	3	0	0	3	25	75	100
3	U23MCT511	Fluid Power Systems	PC	3	0	0	3	25	75	100
4	U23ICTC03	Linear Control Systems	PC	2	1	0	3	25	75	100
5	U23MCE5XX	Professional Elective – I#	PE	3	0	0	3	25	75	100
6	U23XXOCXX	Open Elective - I$	OE	3	0	0	3	25	75	100
Practical										
7	U23MCP505	Industrial Automation Laboratory	PC	0	0	2	1	50	50	100
8	U23MCP506	Simulation of Instrumentation Laboratory	PC	0	0	2	1	50	50	100
9	U23MCP507	Fluid Power Systems Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23MCW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23MCC5XX	Certification Course – V**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23MCM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
TOTAL							21	700	600	1200

SEMESTER – VI

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MCT612	Computer Aided Manufacturing	PC	3	0	0	3	25	75	100
2	U23MCT613	Embedded System for Mechatronics	PC	3	0	0	3	25	75	100
3	U23MCT614	Design of Mechanical Elements	PC	3	0	0	3	25	75	100
4	U23MCT615	Industrial Robotics	PC	3	0	0	3	25	75	100
5	U23MCE6XX	Professional Elective – II#	PE	3	0	0	3	25	75	100
6	U23XXOCXX	Open Elective - II$	OE	3	0	0	3	25	75	100
Practical										
7	U23MCP608	Embedded System Laboratory	PC	0	0	2	1	50	50	100
8	U23MCP609	Computer Aided Manufacturing Laboratory	PC	0	0	2	1	50	50	100
9	U23MCP610	Industrial Robotics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23MCW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23MCC6XX	Certification Course – VI**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23MCM606	Gender Equality	MC	2	0	0	-	100		100
TOTAL							22	600	600	1200

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SEMESTER – VII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MCDC01	Automation in Manufacturing Systems	PC	3	0	0	3	25	75	100
2	U23MCT716	Design of Mechatronics System	PC	3	0	0	3	25	75	100
3	U23MCE7XX	Professional Elective - III#	PE	3	0	0	3	25	75	100
4	U23MCE7XX	Professional Elective - IV#	PE	3	0	0	3	25	75	100
5	U23XXOCXX	Open Elective - III$	OE	3	0	0	3	25	75	100
Practical										
6	U23MCP711	Seminar	PC	0	0	2	1	100	-	100
Project Work										
7	U23MCW703	Project Phase – I	PA	0	0	4	2	50	50	100
8	U23MCW704	Internship / Inplant Training	PA	-	-	2	1	100	-	100
TOTAL							**19**	**375**	**425**	**800**

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23MCE8XX	Professional Elective – V#	PE	3	0	0	3	25	75	100
3	U23MCE8XX	Professional Elective – V I #	PE	3	0	0	3	25	75	100
Project Work										
4	U23MCW805	Project Phase – II	PA	0	0	16	8	50	100	150
Total							**17**	**125**	**325**	**450**

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PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE501	Computer Integrated Manufacturing
2	U23 ECEC01	Digital Image processing
3	U23ADDC01	Computer Network and Security
4	U23MCE502	Robot Operating Systems
5	U23ICECO1	Virtual Instrumentation
Professional Elective – II (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE603	Heating Ventilation and Air-Conditioning
2	U23CSEC02	Introduction to Industry 4.0
3	U23MCE604	Digital Manufacturing
4	U23MCE605	Mobile Robotics
5	U23MEDC02	Product Design and Development
Professional Elective – III (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE706	Sustainable Manufacturing
2	U23MCE707	Automotive Mechatronics
3	U23MEDC01	Production Planning and Cost Estimation
4	U23MCE708	Smart Mobility and Intelligent Vehicles
5	U23ADDC02	Principle of Artificial Intelligence and Machine Learning
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE709	Operations Research for Mechatronics
2	U23MCE710	Product Lifecycle Management
3	U23MCDC02	Building Automation
4	U23MCE711	Robots Navigation and Obstacle Avoidance
5	U23MCE712	Aircraft Mechatronics
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE813	Unconventional Machining processes
2	U23MCE814	Mechatronics Systems Applications
3	U23MCE815	Smart Manufacturing
4	U23MCE816	Unmanned Aerial Vehicle
5	U23MCDC05	Simulation Modeling of Manufacturing System
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCDC03	Non Destructive Testing
2	U23MEDC03	Supply Chain Management
3	U23MCE817	Reliability and Maintenance Engineering
4	U23MCDC04	Robots and Systems in Smart Manufacturing
5	U23MCE818	Intelligent Control Systems

Open Electives		
1	U23MCDC01	Automation in Manufacturing systems
2	U23MCDC02	Building Automation
3	U23MCDC03	Non Destructive Testing
4	U23MCDC04	Robots and Systems in Smart Manufacturing

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OPEN ELECTIVE COURSES

S. No.	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester V/VI)				
1	U23EEDC01	Electrical Safety Engineering	EEE	ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS,CSBS
2	U23EEOC02	Solar Photovoltaic Fundamental and Applications	EEE	ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS,CSBS
3	U23ECOC01	Engineering Computation with MATLAB	ECE	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, Mechatronics
4	U23ECOC02	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U23CSOC01	Structured Query Language	CSE	ECE, EEE, ICE, MECH, CIVIL, BME and MECHTRONICS
6	U23CSOC02	Computer Peripherals and Networking	CSE	Offered to all Branches
7	U23ITOC01	Database System: Design & Development	IT	EEE, ECE, ICE, BME,MECH,CIVIL, MECHATRONICS
8	U23ITOC02	Computer Hardware and Troubleshooting	IT	EEE, ECE, ICE, CCE, BME, MECH, MECHATRONICS
9	U23MEOC01	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
10	U23MEOC02	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
11	U23CEOC01	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics
12	U23CEOC02	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS
13	U23ICOC01	Sensors and Transducers	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, CSBS, AI&DS
14	U23ICOC02	Instrumentation for Industry 4.0	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, CSBS, AI&DS, Mechatronics
15	U23BMOC01	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics, AI&DS
16	U23BMOC02	Telemedicine	BME	EEE, ECE, CSE, IT, ICE, CCE, AI&DS
17	U23CCOC01	Introduction to Communication Technologies	CCE	EEE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AIDS
18	U23CCOC02	Introduction to Computer Networks	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME, AIDS
19	U23CBOC01	Business Applications of Game Theory	CSBS	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME, CCE

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20	U23CBOC02	Cryptology and Analysis	CSBS	EEE, MECH, CIVIL, ICE, Mechatronics, BME
21	U23ADDC01	Principles of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
22	U23ADOCO2	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics,
23	U23MCDC01	Automation in Manufacturing systems	MCTR	EEE,MECH&ICE
24	U23MCDC02	Building Automation	MCTR	MECH,EEE,ECE&ICE
25	U23FTOC01	Textile Arts and Crafts	FT	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS
26	U23FTOC02	Garment Manufacturing Technology	FT	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS
Open Elective – II (Offered in Semester VII)				
1	U23EEOC03	Electric and Hybrid Vehicles	EEE	ECE, ICE, MECH, MCTR, CCE, BME, AI&DS
2	U23EEOC04	Energy Conservation and Management	EEE	ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, AI&DS
3	U23ECOC03	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, FT
4	U23ECOC04	RFID System Design and Testing	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics
5	U23CSOC03	Web Programming	CSE	ECE, EEE, ICE, MECH, CIVIL, BME AND MECHTRONICS
6	U23CSOC04	Cloud Technology	CSE	ECE, EEE, ICE, MECH, CIVIL, BME and MECHTRONICS
7	U23ITOC03	Essentials of Data Science	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, CCE, BME, MECHATRONICS
8	U23ITOC04	Big Data Technologies	IT	EEE, ICE, MECH, CIVIL, CCE, BME
9	U23MEOC03	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
10	U23MEOC04	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
11	U23CEOC03	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS
12	U23CEOC04	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS
13	U23ICOC03	Fuzzy Logic and Neural Networks	ICE	CSE, IT, MECH, CSBS, AI&DS, Mechatronics
14	U23ICOC04	Industrial Automation	ICE	ECE, CSE, IT, MECH, CCE, CSBS, AI&DS

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15	U23BMOC03	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics, AI&DS
16	U23BMOC04	Telehealth Technology	BME	EEE, ECE, ICE, CCE
17	U23CCOC03	Web App Development	CCE	EEE, ECE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AIDS
18	U23CCOC04	Network Essentials and Security	CCE	EEE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AIDS
19	U23CBOC03	Engineering Economics	CSBS	EEE, ECE, CSE, IT, MECH, CIVIL, ICE, Mechatronics, BME, AIDS, CCE, FT
20	U23CBOC04	Conversational AI	CSBS	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
21	U23ADOC03	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE
22	U23ADOC04	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
23	U23MCDC03	Non-Destructive Testing	MCTR	MECH,EEE,ECE&ICE
24	U23MCOC04	Robots and Systems in Smart Manufacturing	MCTR	MECH,EEE,ECE&ICE
25	U23FTOC03	Fundamentals of Fashion Design	FT	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS
26	U23FTOC04	Pattern Making	FT	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS

Open Elective – I / Open Elective – II/ offered in Semester V/VI

S.No	Course Code	Course Title	Offering Department	Permitted Departments
1	U23HSOC01	Intellectual Property Rights	MBA	(Offered in Semester V for EEE, ECE, ICE, CIVIL,BME, CCE, FT) (Offered in Semester VI for CSE, IT, MECH, Mechatronics, AI&DS)
2	U23HSOC02	New Product Development		
3	U23HSOC03	Finance for Engineers		
4	U23HSOC04	Economics for Engineers		
5	U23HSOC05	Marketing Management		

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Annexure – III

EMPLOYABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

Sl. No.	Course Code	Course Title
1	U23MCCX01	3ds Max
2	U23MCCX02	Advance Structural Analysis of Building using ETABS
3	U23MCCX03	Advanced Java Programming
4	U23MCCX04	Advanced Python Programming
5	U20MCCX05	Analog System Lab Kit
6	U23MCCX06	Android Medical App Development
7	U23MCCX07	Android Programming
8	U23MCCX08	ANSYS -Multiphysics
9	U23MCCX09	Artificial Intelligence
10	U23MCCX10	Artificial Intelligence and Edge Computing
11	U23MCCX11	Artificial Intelligence in Medicines
12	U23MCCX12	AutoCAD for Architecture
13	U20MCCX13	AutoCAD for Civil
14	U23MCCX14	AutoCAD for Electrical
15	U23MCCX15	AutoCAD for Mechanical
16	U23MCCX16	Azure DevOps
17	U23MCCX17	Basic Course on ePLAN
18	U23MCCX18	Basic Electro Pneumatics
19	U23MCCX19	Basic Hydraulics
20	U23MCCX20	Bio Signal and Image Processing Development System
21	U23MCCX21	Blockchain
22	U23MCCX22	Bridge Analysis
23	U20MCCX23	Building Analysis and Construction Management
24	U23MCCX24	Building Design and Analysis Using AECO Sim Building Designer
25	U23MCCX25	CATIA
26	U23MCCX26	CCNA (Routing and Switching)
27	U23MCCX27	CCNA (Wireless)
28	U23MCCX28	Cloud Computing
29	U23MCCX29	Computer Programming for Medical Equipments
30	U23MCCX30	Corel Draw
31	U23MCCX31	Creo (Modeling and Simulation)
32	U23MCCX32	Cyber Security
33	U23MCCX33	Data Science and Data Analytics
34	U23MCCX34	Data Science using Python
35	U23MCCX35	Data Science using R
36	U23MCCX36	Deep Learning
37	U23MCCX37	Design and Documentation using ePLAN Electric P8
38	U23MCCX38	Design of Biomedical Devices and Systems

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39	U23MCCX39	Digital Marketing
40	U23MCCX40	Digital Signal Processing Development System
41	U23MCCX41	DigSILENT Power Factory
42	U23MCCX42	Electro Hydraulic Automation with PLC
43	U23MCCX43	Embedded System using Arduino
44	U23MCCX44	Embedded System using C
45	U23MCCX45	Embedded System with IoT
46	U23MCCX46	ePLAN Data Portal
47	U23MCCX47	ePLAN Electric P8
48	U23MCCX48	ePLAN Fluid
49	U23MCCX49	ePLAN PPE
50	U23MCCX50	Fusion 360
51	U23MCCX51	Fuzzy Logic and Neural Networks
52	U23MCCX52	Google Analytics
53	U23MCCX53	Hydraulic Automation
54	U23MCCX54	Industrial Automation
55	U23MCCX55	Industry 4.0
56	U23MCCX56	Internet of Things
57	U23MCCX57	Introduction to C Programming
58	U23MCCX58	Introduction to C++ Programming
59	U23MCCX59	IoT using Python
60	U23MCCX60	Java Programming
61	U23MCCX61	Machine Learning
62	U23MCCX62	Machine Learning and Deep Learning
63	U23MCCX63	Machine Learning for Medical Diagnosis
64	U23MCCX64	Mechatronics
65	U23MCCX65	Medical Robotics
66	U23MCCX66	Microsoft Dynamics 365 ERP for HR , Marketing and Finance
67	U23MCCX67	Mobile Edge Computing
68	U23MCCX68	Modeling and Visualization using Micro station
69	U23MCCX69	MX Road
70	U23MCCX70	Photoshop
71	U23MCCX71	PLC
72	U23MCCX72	Pneumatics Automation
73	U23MCCX73	Project Management
74	U23MCCX74	Python Programming
75	U23MCCX75	Revit Architecture
76	U23MCCX76	Revit Inventor
77	U23MCCX77	Revit MEP
78	U23MCCX78	Robotics
79	U23MCCX79	Search Engine Optimization
80	U23MCCX80	Software Testing
81	U23MCCX81	Solar and Smart Energy System with IoT
82	U23MCCX82	Solid Works

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83	U23MCCX83	Solid Works with Electrical Schematics
84	U23MCCX84	Speech Processing
85	U23MCCX85	STAAD PRO V8i
86	U23MCCX86	Structural Design and Analysis using Bentley
87	U23MCCX87	Total Station
88	U23MCCX88	Video and Image Processing Development System
89	U23MCCX89	VLSI Design
90	U23MCCX90	Web Programming - I
91	U23MCCX91	Web Programming - II

Annexure – IV

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	**Skill Enhancement Course I**	
	U23MCS301	3D Printing
	Skill Enhancement Course II:	
2	U23MCS402	Training on Arduino / Power Transmission Systems / Non-Destructive Testing

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ANNEXURE - II

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SEMESTER – V

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23MCT510	PLC and Industrial Automation Systems	PC	3	0	0	3	25	75	100
3	U23MCT511	Fluid Power Systems	PC	3	0	0	3	25	75	100
4	U23ICTC03	Linear Control Systems	PC	2	1	0	3	25	75	100
5	U23MCE5XX	Professional Elective – I#	PE	3	0	0	3	25	75	100
6	U23XXOCXX	Open Elective - I$	OE	3	0	0	3	25	75	100
Practical										
7	U23MCP505	Industrial Automation Laboratory	PC	0	0	2	1	50	50	100
8	U23MCP506	Simulation of Instrumentation Laboratory	PC	0	0	2	1	50	50	100
9	U23MCP507	Fluid Power Systems Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23MCW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23MCC5XX	Certification Course – V**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23MCM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
TOTAL							21	700	600	1200

SEMESTER – VI

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MCT612	Computer Aided Manufacturing	PC	3	0	0	3	25	75	100
2	U23MCT613	Embedded System for Mechatronics	PC	3	0	0	3	25	75	100
3	U23MCT614	Design of Mechanical Elements	PC	3	0	0	3	25	75	100
4	U23MCT615	Industrial Robotics	PC	3	0	0	3	25	75	100
5	U23MCE6XX	Professional Elective – II#	PE	3	0	0	3	25	75	100
6	U23XXOCXX	Open Elective - II$	OE	3	0	0	3	25	75	100
Practical										
7	U23MCP608	Embedded System Laboratory	PC	0	0	2	1	50	50	100
8	U23MCP609	Computer Aided Manufacturing Laboratory	PC	0	0	2	1	50	50	100
9	U23MCP610	Industrial Robotics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23MCW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23MCC6XX	Certification Course – VI**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23MCM606	Gender Equality	MC	2	0	0	-	100		100
TOTAL							22	600	600	1200

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Department	MBA	Programme: B.Tech						
Semester	V	Course Category Code: HS			*End Semester Exam Type: TE			
Course Code	U23HSTC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	RESEARCH METHODOLOGY	2	0	0	2	25	75	100

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	***On completion of the course, the students will be able to***	**BT Mapping (Highest Level)**
	CO1 Interpret the different types of research and explain how research methods can be used to address engineering problems.	**K2**
	CO2 Discuss the research problems, conduct comprehensive literature reviews, and utilize tools and services for effective information retrieval.	**K2**
	CO3 Apply appropriate methods to design experiments, analyze data, and interpret results using both numerical and graphical techniques.	**K3**
	CO4 Analyze and apply ethical guidelines to structure and write research papers and dissertations, ensuring academic integrity and avoiding plagiarism.	**K4**
	CO5 Examine the fundamentals of intellectual property rights to protect and enforce them, with emphasis on their role in fostering innovation and entrepreneurship in engineering.	**K3**

UNIT-I	**Introduction to Research**	**Periods: 6**
Meaning and Importance of Research, Types of Research: Overview of Basic, Applied, and Developmental Research, Overview of the Research Process, Defining a Research Problem: Key Considerations, Setting Research Objectives and Research Questions, Introduction to Research Design: Basic Concepts, Approaches to Research: Quantitative vs. Qualitative.		**CO1**
UNIT-II	**Problem Formulation and Literature Review**	**Periods: 6**
Identifying and Formulating Research Problems, conducting a Literature Review: Essential Steps, Referencing and Citation Methods: Basic Techniques. Sources of Information: Overview of Libraries and Online Databases.		**CO2**
UNIT-III	**Research Methods and Data Analysis**	**Periods: 6**
Introduction to Experimental Research, Developing Hypotheses: Basic Approach. Data Collection Methods: Sampling and Surveys, Basics of Data Analysis: Numerical and Graphical Analysis, Introduction to Inferential Statistics.		**CO3**
UNIT-IV	**Writing and Presenting Research**	**Periods: 6**
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, Conclusion). Referencing and Citation: Brief Overview.		**CO4**
UNIT-V	**Ethics and Intellectual Property in Research**	**Periods: 6**
Ethical Considerations in Research: Introduction to Scientific Misconduct. Basics of Intellectual Property Rights - Introduction to Patents, Copyrights, and Trademarks – Case studies on ethical dilemmas in research.		**CO5**

Lecture Periods: 30	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 30**

Text Books

1. Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, 5th Edition, SAGE Publications, 2019.
2. Ram Ahuja, *Research methods*, Rawat Publications, 2nd edition, 2022
3. Creswell, J. W., and Creswell, J. D. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications, 2018.

Reference Books

1. Thiel DV. Research methods for engineers. Cambridge: Cambridge University Press; 2014.
2. Ganesan R. Research methodology for engineers. Chennai: MJP Publishers; 2024.

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3. Agarwal C, Sharma V. Research methodology in sociology. New Delhi: Commonwealth Publishers; 2012.
4. Thody A. Writing and presenting research. 2nd edition, London: SAGE Publications; 2006.
5. Kothari CR. Research methodology – methods and techniques. 5th edition, New Delhi: New Age International Publishers; 2023.

Web References

1. https://conjointly.com/kb/
2. https://owl.purdue.edu/owl/research_and_citation/conducting_research/writing_a_literature_review.html
3. https://files.eric.ed.gov/fulltext/ED536788.pdf
4. https://researcheracademy.elsevier.com/
5. https://www.wipo.int/
6. https://www.scholastic.com /7-steps-to-successful-research-report.html
7. https://www.futurelearn.com/info/courses/business-research-methods- investigation.
8. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	2	-	-	2	2	3	2	2	3
CO2	3	1	1	3	1	-	2	-	-	1	2	-	1	2	2
CO3	1	3	3	1	3	-	2	-	-	2	2	-	1	2	3
CO4	-	-	1	2	-	-	2	3	2	2	-	2	1	2	3
CO5	2	2	2	2	2	2	3	3	2	2	3	2	1	1	2

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.A.8.31

Department	Mechatronics	Programme : B.Tech.						
Semester	V	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23MCT510	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	PLC AND INDUSTRIAL AUTOMATION SYSTEMS	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Knowledge about analog and digital circuit	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Identify the main components of PLC architecture and list the specifications that define PLC capabilities.	K1
	CO2 Apply arithmetic functions in a PLC program to calculate the total production output based on individual item counts and production rates.	K3
	CO3 Illustrate the different types of sequencer instructions in PLC programming by creating examples that demonstrate their application in an industrial automation scenario.	K3
	CO4 Interpret the design and functionality of a single-channel data acquisition system, discussing its advantages and limitations in specific applications.	K3
	CO5 Analyze the performance of different types of data loggers, comparing their capabilities and applications in various control scenarios.	K4

UNIT - I	**Basics of PLC**	**Periods: 09**
Definition and History of PLC – PLC Architecture and specifications – PLC hardware components Analog and digital I/O modules, CPU and memory module – Types of PLCs – PLC Programming language – Relay logic – Ladder logic – Programming of Gates – connecting PLC to computer - PLC Troubleshooting and Maintenance.		**CO1**
UNIT - II	**PLC Programming**	**Periods: 09**
Programming of Timers – Introduction - ON delay, OFF delay, Retentive Timers – PLC Timer functions – Examples of timer function Industrial application. Programming Counters – up/down counter – Combining counter - Examples of counter function Industrial application – PLC Arithmetic Functions – PLC number Comparison function.		**CO2**
UNIT - III	**PLC Data Handling Functions**	**Periods: 09**
PLC Program Control Instructions: Master Control Reset - Skip – Jump and Move Instruction. Sequencer instructions - Types of PLC Analog modules and systems, PLC analog signal processing – Case study of Tank level control system, bottle filling system and Sequential switching of motors.		**CO3**
UNIT - IV	**Data Acquisition Systems**	**Periods: 09**
Sampling theorem – Sampling and Quantizing – Sample and hold circuit – Practical implementation of sampling and digitizing – Data Acquisition System Block Diagram – Single Channel Data Acquisition System - Multiplexed channel Data Acquisition System – Computer Based Data Acquisition System.		**CO4**
UNIT - V	**Advanced Topics in Automation**	**Periods: 09**
Need for computer in a control system-Functional block diagram of a computer control system-Data loggers-Supervisory computer control- Direct digital control – SCADA. Introduction to networked control systems- Plant wide control - Internet of Things- Cloud based Automation - Safety PLC.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Frank. D. Petrezuella, Programmable logic controllers, McGrewhill, Third edition, 2010.
2. Dilip Patel, 'Introduction Practical PLC (Programmable Logic Controller) Programming', GRIN Verlag, February 2018.
3. Keith Stouffer, Victoria Pillitteri, Suzanne Lightman, Marshall D. Abrams, Adam Lee Hahn, 'Guide to Industrial Control Systems (ICS) Security' U.S. Department of Commerce, National Institute of Standards and Technology, 2015.

Reference Books

1. William Bolton, "Programmable Logic Controllers", Elsevier Science, April 2011.
2. Maurizio Di Paolo Emilio," Data Acquisition Systems from Fundamentals to Applied Design", Springer New York., March 2013.
3. John w.Webb & Ronald A.Reis., "Programmable logic controllers- principles and applications", 5th Edition – PHI Learning Pvt. LTd, New Delhi -2010

2.A.8.32

4. Rajesh Mehra, "PLCs & SCADA – Theory And Practice", University Science Press, 2012.
5. Nathan Clark, "PLC Programming Using RSLogix 500", Amazon Digital Services LLC - Kdp, October 2018.

Web References

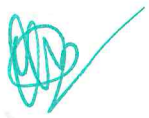
1. https://www.youtube.com/watch?v=l_9Pwyxhe40
2. https://www.nielit.gov.in/calicut/content/online-course-industrial-automation-plc-scada
3. https://onlinecourses.nptel.ac.in/noc20_me39/preview
4. https://nptel.ac.in/courses/108/105/108105062/
5. https://kanchiuniv.ac.in/coursematerials/PLC_K_Saraswathi.pdf

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100



2.9.8.33

Department	Mechatronics	Programme : B.Tech.						
Semester	V	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23MCT511	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	FLUID POWER SYSTEMS	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Knowledge of Fluid Mechanics and Machinery		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Illustrate the fundamentals of hydraulic systems and determine losses incurred in hydraulic circuit and Identify the hydraulic and pneumatics symbols.	K2
	CO2	Experiment with the suitable pump and actuators for particular application.	K3
	CO3	Make use of various hydraulic valves.	K3
	CO4	Analyze various fundamentals of pneumatic systems.	K4
	CO5	Apply hydraulic and pneumatic circuits for simple application	K3

UNIT - I	**Introduction to Fluid Power Systems**	**Periods: 09**	
Introduction to fluid power – History – Pascal's law – Components - Advantages – Drawbacks – Applications. Hydraulic fluids: Functions, Properties. Frictional Losses in pipes- valves and fittings – Fluid power symbols			**CO1**
UNIT - II	**Hydraulic Pumps And Actuators**	**Periods: 09**	
Positive and Non-positive displacement pumps – Pumping theory – Pump classification – Construction and working principle of Gear, Vane and Piston pumps. Pump performance – Pump performance curves. Hydraulic cylinder (double acting) – Construction & Working principle – Double rod cylinder – Telescopic cylinder.			**CO2**
UNIT - III	**Hydraulic Valves**	**Periods: 09**	
Directional control valves: Check valve – Pilot operated check valve – 3/2 valves – 4/2 valves – methods of valve actuation – Shuttle valve. Pressure control valves: Pressure relief valves - Pressure reducing valve, Unloading valves, Counter balance valves - Flow control valves- Servo valves: Mechanical type			**CO3**
UNIT - IV	**Pneumatic Systems**	**Periods: 09**	
Introduction – Properties of air – gas laws – Compressors: Piston compressor, Screw compressor and Vane compressor. Fluid conditioners: Air filters, Air pressure regulators, Air lubricators, Pneumatic silencers and Air dryers. Pneumatic actuators: Pneumatic cylinders, Rotary air motors – Performance curves			**CO4**
UNIT - V	**Design of Hydraulic and Pneumatic Circuits**	**Periods: 09**	
Sequential circuit design for simple applications: Drilling, Punching, Step counter method & Cascade methods(two / three cylinder circuits) – PLC applications in fluid power control.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.S. R. Majumdar, Oil Hydraulics, Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2014

2.James L. Johnson, Introduction to Fluid Power, Delmar Thomson Learning, 2013

3. Patrick J. Klette "Fluid Power Systems" American Technical Publishers, Incorporated, 2014

Reference Books

1. Anthony Esposito, Fluid Power with Applications, Pearson Education New Delhi, 2015.
2. Md Faiyaz Ahmed "Fluid Power Control Systems"Lulu.com. – 2016.
3. R.Srinivasan, Hydraulic and Pneumatic Controls, Second Edition, Vijay Nicole Imprints PVT, 2006.
4. Yaobao Yin "Electro Hydraulic Control Theory and Its Applications Under Extreme Environment"Butterworth-Heinemann– 2019
5. P.K. Guha "Hydraulic Pumps & Motors and their Applications" Dog Ear Publishing. 2018

Web References

1. https://nptel.ac.in/courses/112/104/112104117/
2. https://nptel.ac.in/courses/112/105/112105206/
3. https://swayam.gov.in/nd1_noc20_me55/preview
4. https://www.youtube.com/watch?v=S_4anj7GpRo
5. www.engineeringstudymaterial.net/ebook/fluid-power-with-applications/

2.A.8.34

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.4.8.35

Department	Instrumentation and control Engineering	Programme: **B.Tech.**					
Semester	V	Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ICTC03**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CA M	ESE	TM
Course Name	**LINEAR CONTROL SYSTEMS**	**2**	**1**	**0**	**3**	**25**	**75**	**100**
(Common to ICE and Mechatronics)								
Prerequisite	Basic Mathematics, Physics							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic concepts on the modelling of control systems.	K2
	CO2 Determine the time response analysis of systems.	K4
	CO3 Perform the frequency response analysis of control systems.	K4
	CO4 Analyze the stability of the system.	K2
	CO5 Design the compensation techniques.	K3

UNIT – I	**Mathematical Modeling of Systems**	**Periods:09**
Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Electrical Analogy of Mechanical and thermal systems -Transfer function - D.C and A.C Servo Motor - Block Diagram Reduction Techniques - Signal Flow Graphs.		**CO1**
UNIT – II	**Time Response Analysis**	**Periods:09**
Standard Test Signals -Time Response of First and Second Order System, Time Domain-Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.		**CO2**
UNIT – III	**Frequency Response Analysis**	**Periods:09**
Sinusoidal Transfer Function- Frequency Domain Specifications - Correlation between Time and Frequency Response – Constructionof Bode Plots - Determination of Gain and Phase Margin from Bode Plots - Polar plots - Determination of Phase Margin and Gain margin from Polar plots – Gain Adjustment using polar plots.		**CO3**
UNIT – IV	**Stability of Control Systems**	**Periods:09**
Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of PoleZero Additions on Root Locus - Nyquist Stability Criterion.		**CO4**
UNIT – V	**Compensator and State Space Analysis**	**Periods:09**
Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Leadcompensation on system performance and design using bode plot - Concepts of state – state Variable and state models – physical, phase and canonical model.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. Nagrath I J and Gopal M, Control System Engineering, New Age International Pvt Ltd, Sixth Edition, 2017
2. Ogata K, —Modern Control Engineeringl, Prentice-Hall of India Pvt Ltd., New Delhi, Fifth Edition, 2015.
3. Benjamin C Kuo, —Automatic Control Systems ll, Prentice Hall India Pvt. Ltd, Ninth Edition, 2014.

Reference Books

1. Norman S Nise, Control System Engineering , John Wiley and sons, inc., Seventh Edition, 2015
2. SmarajithGhosh, —Control Systems Theory and Applicationsll, Pearson Education, Singapore, Sixth Edition, 2015
3. Richard C. Dorf, Robert H Bishop, —Modern Control Systemsll, Pearson Education, Twelfth Edition, 2017.
4. Gopal, M., "Control Systems, Principles and Design", Tata McGraw-Hill Pub. Co., 4th Edition, New Delhi, 2012.
5. Nagoor kani. A., 'Control System Engineering', CBS Publishers and Distributors, 2021.

Web References

2.A.8.36

2. https://www.smartzworld.com/notes/control-systems-pdf-notes-cs.
3. https://easyengineering.net/control-systems-engineering-by-nagoor-kani/
4. https://civildatas.com/download/control-systems-engineering-by-i-j-nagrath
5. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf.

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.9.8.37

Department	**Mechatronics**		Programme : **B.Tech.**					
Semester	**V**		Course Category: **PC**			End Semester Exam Type: **LE**		
Course Code	**U23MCP505**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL AUTOMATION LABORATORY**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
Mechatronics									
Prerequisite	Knowledge of control system and Sensors and Transducers								
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)
	CO1	Identify the different types of Programmable Logic Controllers (PLCs) and their specifications, such as input/output configurations, processing speed, and memory capacity.							K1
	CO2	Describe the differences between Ladder Diagram (LD) and Structured Text (ST) in terms of their syntax, structure, and applications in industrial automation.							K2
	CO3	Apply Functional Block Diagrams (FBD) to solve simple problems like controlling a motor or light switch based on sensor inputs, using blocks like logic gates and timers.							K3
	CO4	Analyze the flow control loop by examining how the PLC processes sensor input data and adjusts the actuator's output to maintain a stable flow rate, addressing any disturbances in the system.							K4
	CO5	Examine the security measures in place for the SCADA system, analyzing vulnerabilities and proposing enhancements to protect the system from unauthorized access and cyber threats.							K4

L List of Experiments

1. Study of different PLCs and their specification
2. Study of installations and troubleshooting of PLC.
3. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications.
4. Development of an application by using timer and counter of PLC.
5. Solving simple problems using Functional Block Diagram (FBD) programming in PLC
6. Interfacing between PLC and Process loop (temperature)
7. Interfacing between PLC and Process loop (level)
8. Interfacing between PLC and Process loop (flow)
9. Verification and testing of PID controller in a process loop.
10. Develop one application using SCADA system.
11. Motor speed control using PLC and VFD

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Frank D Petruzella, "Programmable Logic Controllers", McGraw Hill, New York,2016
2. Process Control Instrumentation Technology By. C.D. Johnson, PHI, Eighth Edition, 2014.
3. Hugh Jack, "Automating Manufacturing Systems with PLCs", Lulu.com, 2010, eBook
4. Frank D Petruzella, "Programmable Logic Controllers", McGraw Hill, New York, 2016
5. Popovic Bhatkar and Vijay P. Bhatkar, "Distributed Computer control for Industrial Automation", Imprint-Routledge, New York, 2017

Web References

1. https://fac.ksu.edu.sa/sites/default/files/lab-manual_v3.pdf
2. http://iotmumbai.bharatividyapeeth.edu/media/pdf/lab_manuals/Manual_EE5l_EIA_2252 6.pdf
3. https://pdfcoffee.com/automation-lab-manual-5-pdf-free.html
4. https://doi.org/10.1201/9781315141404.
5. https://support.industry.siemens.com/cs/ww/en/view/63314183

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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
CO1	3	2	1	-	-	-	-	-	3	1	2	1	3	2	-
CO2	3	2	1	-	-	-	-	-	3	2	2	2	3	3	-
CO3	3	2	1	-	-	-	-	-	3	1	2	3	3	2	-
CO4	3	2	1	-	-	-	-	-	3	2	2	1	3	3	-
CO5	3	2	1	-	-	-	-	-	3	2	2	3	3	2	-

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

2.A.8.39

	Mechatronics	Programme : **B.Tech.**						
Semester	**V**	Course Category: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23MCP506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SIMULATION OF INSTRUMENTATION LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Knowledge of Sensors and Transducers		
Course Outcomes	On completion of the course, the students will be able to		BT Mapping (Highest Level)
	CO1	Explain how shift registers and feedback nodes function in a GSD context, illustrating their importance in controlling data flow and state retention in loops.	K2
	CO2	Discuss the role of sequence structures in ensuring the logical progression of tasks within a GSD program, emphasizing how they help prevent logical errors in execution.	K2
	CO3	Demonstrate the process of creating a waveform graph in GSD, including how to configure the properties and settings to effectively visualize real-time data.	K3
	CO4	Analyze the performance implications of using different array structures in GSD, comparing the efficiency of one-dimensional versus multi-dimensional arrays for specific tasks.	K4
	CO5	Contrast buffered versus unbuffered file I/O operations, discussing how each approach affects the efficiency of data reading and writing in GSD applications.	K4

List of Experiments

Repetition and Loops:
1. GSD using For loops, while loops with shift registers / feedback nodes
2. GSD using Local variables and Global variables

Structures
3.GSD using Case structures and Sequence structures
4.GSD using Timed structures, Formula nodes and Event structures

Plotting data:
5. GSD using Waveform graph, Waveform chart, XY graph

Strings:
6. GSD using string functions, editing, formatting and parsing string

Arrays and clusters:
7. GSD using arrays functions and multi-dimensional arrays
8. GSD using clusters operations: assembling clusters and disassembling clusters

Modular Programming:
9. Creating sub VIs from section of a VI
10. File Input / File Output function Read / Write a file.

Data Acquisition system (DAQ or My Rio):
11. GSD for real time measurement using Thermistor / Piezo-electric sensor
12. GSD for real time monitoring using Seven-Segment LED Display/ Motor/ Buzzer/ Speaker

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Seborg, Dale E., Duncan A. Mellichamp, Thomas F. Edgar, and Francis J. Doyle, "Process dynamics and control", 4th edition, John Wiley & Sons, 2016.
2. Stephanopoulos, George, "Chemical Process Control: An Introduction to Theory and Practice", Pearson India.
3. LabVIEW. Basics Course Manual, National Instruments Corp., USA, 2010.
4. Popovic Bhatkar and Vijay P. Bhatkar, "Distributed Computer control for Industrial Automation", Imprint- Routledge, New York, 2017.
5. Education Services, 2015 LabView Tutorial Manual, National InstrumentsCorp., 2010 (www.ni.com).

Web References

1. https://www.unibo.it/en/teaching/course-unit-catalogue/course-unit/2013/376395
2. https://jecassam.ac.in/wp-content/uploads/2018/10/12Virtual-Instrumentation-lab_.pdf
3. https://www.bits-pilani.ac.in/uploads/Pilani_Upload/EEE/VIRTUAL%20INSTRUMENTATION.pdf
4. http://www.plasma.uaic.ro/ro/downloads/cat_view/59-instrumentatie-virtuala
5. https://doi.org/10.1201/9781315141404.

2.A.8.40

Cos Mapping with POs and PSOs

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

2.A.8.41

Department	Mechatronics	Programme : B.Tech.						
Semester	V	Course Category: PC			End Semester Exam Type: LE			
Course Code	U23MCP507	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	FLUID POWER SYSTEMS LABORATORY	0	0	2	1	50	50	100

Mechatronics

Prerequisite	Basic Knowledge of Valves and Pumps	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the actuators and valves for the design of fluid power circuits.	K2
	CO2 Describe the operation and maintenance of common fluid power components and simulate the fluid power circuits using software tool	K2
	CO3 Apply the fluid power circuits using suitable actuators and valves	K3
	CO4 Analyze the design and simulate the fluid power circuits using software tool	K4
	CO5 Discriminate the fluid power circuits using simulation software for industrial applications	K4

List of Experiments

Cycle-I

Pneumatics

1. Study experiment on pneumatic components and their symbolic representation.
2. Experiment on actuation of single acting cylinder by 3/2 D.C. valve.
3. Experiment on actuation of double acting cylinder by 5/2 D.C. valve.
4. Experiment on direct control of double acting cylinder by 5/2 D.C. Valve
5. Indirect actuation of double acting cylinder using 5/2 way double pilot operated valve.
6. Experiment on speed control of single acting cylinder using one way flow control valve.
7. Experiment on speed control of double acting cylinder using one way flow control valve
8. Experiment on Speed control of double acting cylinder using Quick exhaust valve.
9. Experiment on Pneumatic circuits double acting cylinder operating with logic controls – AND valve and OR valve.
10. Experiment on Actuation of single acting cylinder by using solenoid operated valve.
11. Design and testing of Electro Pneumatic sequential circuit with limit switches.

Cycle-II

Hydraulics

12. Experiment on use of pressure relief valve with double acting cylinder.
13. Experiment on use of 2- way flow control valve with double acting cylinder.

Design assignments and simulation

14. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio/Fluid SIM software.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Bireswar Majumdar "Fluid Mechanics with Laboratory Manual" PHI Learning Pvt. Ltd – 2016
2. R. V. Raikar "Laboratory Manual Hydraulics And Hydraulic Machines " PHI Learning Pvt. Ltd – 2012
3. Cameron Tropea, Alexander L. Yarin, John F. Foss "Springer Handbook of Experimental Fluid Mechanics" Springer Science & Business Media – 2007
4. Zh. Zhang "Hydraulic Transients and Computations "Springer International Publishing, 2020
5. Sposito Anthony, "Fluid Power with Applications", 7th Edition, Pearson Higher Education, New York, 2015

Web References

1. http://fmc-nitk.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/fluid-machinarylab/index.html
3. https://archive.nptel.ac.in/courses/112/106/112106175/https://autocadtutorials.com

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

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Department	**Mechatronics**	Programme: **B. Tech.**						
Semester	**V**	Course Category Code: **PA**				*End Semester Exam Type: -		
Course Code	**U23MCW501**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICRO PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**

Mechatronics

Prerequisite	Electrical Engineering, Electronics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the micro project work through the literature survey	**K2**
	CO2 Choose the proper components as per the requirements of the design/ system.	**K2**
	CO3 Apply the acquainted skills to develop final model/system	**K3**

There shall be a Micro Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the micro project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Micro-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Micro Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Micro Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

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	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

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

Evaluation Method

Assessment	Review 1			Review 2				Total Marks
	Novelty	Presentation	Viva	Presentation	Demonstration	Viva	Report	
Marks	10	20	10	20	20	10	10	100

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Department	**Mechatronics**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam Type: -			
Course Code	**U23MCC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	-							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as "pass" on satisfactory completion. A letter grade "P" is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)		Total Marks
	Attendance	MCQ Test	
Marks	10	90	100

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Department	Mechatronics	Programme: B.Tech.					
Semester	V	Course Category Code: MC			*End Semester Exam Type: -		
Course Code	U23MCM505	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	-	100	-	100

Common to ALL Branches

Prerequisite	-	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Familiarize with the philosophy of Indian culture	K2
	CO2 Distinguish the Indian languages and literature	K2
	CO3 Describe the philosophy of ancient, medieval and modern India	K2
	CO4 Illustrate the information about the fine arts in India	K2
	CO5 Describe the contribution of scientists of different eras	K2

UNIT- I	Introduction To Culture	Periods:06
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India		CO1
UNIT- II	**Indian Languages, Culture and Literature**	**Periods:06**
Indian Languages and Literature - I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature		CO2
UNIT- III	**Religion and Philosophy**	**Periods:06**
Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)		CO3
UNIT- IV	**Fine Arts in India (Art, Technology and Engineering)**	**Periods:06**
Indian Painting, Indian handicrafts, Music, divisions of Indian classical music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India		CO4
UNIT-V	**Education System in India**	**Periods:06**
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India		CO5

Lecture Periods:30	Tutorial Periods: -	Practical Periods: -	Total Periods:30

Reference Books

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200
4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978 - 8120810990, 2014

Web References

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/101/104/101104065/
3. https://nptel.ac.in/courses/109/108/109108158/
4. https://nptel.ac.in/courses/109/106/109106059/
5. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ae01/

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

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Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23MCT612	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	COMPUTER AIDED MANUFACTURING	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Manufacturing Technology	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Understand the basic concepts of CAM application and understand CIM wheel	K2
	CO2 Describe the CNC programs for manufacturing of different geometries on milling and lathe machines	K2
	CO3 Differentiate the components using different techniques of group technology.	K3
	CO4 Explain the layouts of FMS and AGV for industrial applications.	K3
	CO5 Apply the concept of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM.	K3

UNIT - I	**Introduction of CAM**	**Periods: 9**
CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions.		**CO1**
UNIT - II	**NC/CNC Machine Tools**	**Periods: 9**
NC and CNC Technology: Types, Classification, Specification and components, Axis designation, NC/CNC tooling. Fundamentals of Part programming, Types of format, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric subroutines		**CO2**
UNIT - III	**Group Technology and CAPP**	**Periods: 9**
Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits.		**CO3**
UNIT - IV	**Flexible Manufacturing System**	**Periods: 9**
Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing.		**CO4**
UNIT - V	**Integrated Production Management System**	**Periods: 9**
Introduction, PPC fundamentals, Problems with PPC, MRP-I, MRP-II, Just in Time philosophy, Concepts of Expert System in Manufacturing and Management Information System.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, Third Edition, July 2017.
2. P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 2018
3. Robotics Technology and Flexible Automation, by S R Deb, S Deb, McGraw Hill Education Private Limited, 2010

Reference Books

1. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993.
2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education,January 2008.
3. Flexible Manufacturing Cells and Systems, Prentice Hall, Englewood Cliffs, New Jersey, 1991
4. CAD / CAM: Theory and Practice, Ibrahim Zied, McGraw-Hill, 2nd edition, June 2009
5. Computer Aided Manufacturing S. Vishal-S. K. Kataria & Sons-Delhi, 2004

Web References

1. https://nptel.ac.in/courses/112104188
2. https://nptel.ac.in/courses/112104031
3. https://archive.nptel.ac.in/courses/112/102/112102101/
4. https://archive.nptel.ac.in/courses/112/102/112102103/
5. https://archive.nptel.ac.in/courses/112/104/112104289/

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

Department	**Mechatronics**	Programme : **B.Tech.**						
Semester	**VI**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23MCT613**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Embedded System For Mechatronics**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Mechatronics

Prerequisite	Basic Concepts of Programming and Micro Controllers	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Define the key components of an embedded system, including the processor, hardware units, and embedded software.	K1
	CO2 Explain the working of bus arbitration and how it facilitates communication between different components of an embedded system.	K2
	CO3 Demonstrate the configuration and operation of a timer and counter in an embedded microcontroller for time-related tasks.	K3
	CO4 Analyze the performance implications of dynamic memory allocation and fragmentation in real-time systems.	K4
	CO5 Examine the relationships between different UML diagrams to trace how system behaviors, data flow, and interactions are captured from the conceptual to the detailed design phase.	K4

UNIT – I	**INTRODUCTION TO EMBEDDED SYSTEM**	**Periods:09**
Embedded system processor, hardware unit, software embedded into a system, Example of an embedded system, Embedded Design life cycle, Embedded System modelling [flow graphs, FSM, Petri nets], Layers of Embedded Systems.		**CO1**
UNIT – II	**PROCESSOR AND MEMORY ORGANIZATION**	**Periods:09**
Bus Organization, Memory Devices and their Characteristics, Instruction Set Architecture [RISC, CISC], Basic Embedded Processor/Microcontroller Architecture [8051, ARM, DSP, PIC], memory system architecture [cache, virtual, MMU and address translation], DMA, Co-processors and Hardware Accelerators, pipelining.		**CO2**
UNIT – III	**I/O DEVICES AND NETWORKS**	**Periods:09**
I/O Devices [Timers, Counters, Interrupt Controllers, DMA Controllers, A/D and D/A Converters, Displays, Keyboards, Infrared devices], Memory Interfacing, I/O Device Interfacing [GPIB, FIREWIRE, USB, IRDA], Networks for Embedded systems (CAN, I2C, SPI, USB, RS485, RS 232), Wireless Applications [Bluetooth, ZigBee, Evolution of internet of things(IoT)].		**CO3**
UNIT – IV	**OPERATING SYSTEMS**	**Periods:09**
Basic Features of an Operating System, Kernel Features [polled loop system, interrupt driven system, multi rate system], Processes and Threads, Context Switching, Scheduling[RMA, EDF, fault tolerant scheduling], Inter process Communication, real Time memory management [process stack management, dynamic allocation], I/O[synchronous and asynchronous I/O, Interrupts Handling, Device drivers], RTOS [VxWorks, RT-LINUX].		**CO4**
UNIT – V	**EMBEDDED SYSTEM DEVELOPMENT**	**Periods:09**
Design Methodologies [UML as Design tool, UML notation, Requirement Analysis and Use case Modeling],Design Examples[Telephone PBX, Inkjet Printer, PDA ,Elevator Control System, ATM System], Fault toleranceTechniques, Reliability Evaluation Techniques.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. Rajkamal, Embedded System-Architecture, Programming, Design, Mc Graw Hill, 2013.
2. M. A. Mazidi, S. Naimi, S. Naimi, The AVR Microcontroller and Embedded Systems Using Assembly and C, Pearson, 2015.
3. Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, 2013

Reference Books

1. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The

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2. Elicia White, Making Embedded Systems, O Reilly Series, SPD,2011.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design (The Morgan Kaufmann Series in Computer Architecture and Design)", 5th Edition, 2022.
4. Manuel Jiménez Rogelio,PalomeraIsidoroCouvertier "Introduction to Embedded SystemsUsing Microcontrollers and the MSP430" Springer Publications, 2014.
5. Ivan Cibrario Bertolotti, Tingting Hu, Embedded Software Development, CRC Press 2017.

Web References

1. https://www.inspirenignite.com/anna-university/introduction-to-embedded-systems-mechatronics
2. https://www.edn.com/mechatronics-based-embedded-design/
3. https://www.intechopen.com/books/design-control-and-applications-of-mechatronic-systems-in-
4. https://digital-library.theiet.org/content/books/ce/pbce109e
5. https://onlinecourses.nptel.ac.in/noc24_cs25/preview

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23MCT614	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	DESIGN OF MECHANICAL ELEMENTS	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Knowledge of Engineering Mechanics and Mechanics of solids		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	List the various step involved in the design process	K1
	CO2	Explain the components under static loading conditions.	K2
	CO3	Understand and apply principles of gear design to spur and helical gears.	K1
	CO4	Analyze and demonstrate the design procedures for Brakes and Clutches	K4
	CO5	Experiment an expertise in design of journal bearing and springs in industrial applications.	K4

UNIT - I	**INTRODUCTION OF MACHINE DESIGN**	**Periods: 9**
Introduction: Machine design, classification of machine design, design consideration, Factor of Safety, design procedure for simple and combined stresses (No Numerical). Introduction to Stress Concentration, Stress concentration Factor and its effects (theory only). Introduction to Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion Energy Theory.		**CO1**
UNIT - II	**DESIGN OF SHAFTS, KEYS AND COUPLINGS**	**Periods: 9**
Design of Shafts: Design for strength and Rigidity with Steady loading, Design of Keys: Types of keys, Design of keys, Design of Couplings: Flange coupling, Bush and Pin type coupling.		**CO2**
UNIT - III	**DESIGN OF SPUR AND HELICAL GEARS**	**Periods: 9**
Design of Spur Gears: Beam strength of spur gear, Stresses in gear teeth (Lewis equation), dynamic tooth load and design for wear. Design of helical gears: Beam strength of helical gear, Stresses in gear teeth (Lewis equation), dynamic tooth load and design for wear.		**CO3**
UNIT - IV	**DESIGN OF BRAKES AND CLUTCHES**	**Periods: 9**
. Brakes – Types , Braking system in automobiles , Design of drum and Band brakes , Design of clutches – Single plate – Multi plate –Conical clutch		**CO4**
UNIT - V	**DESIGN OF BEARINGS AND SPRINGS**	**Periods: 9**
Design of Journal Bearings: Types of bearings, bearing characteristic number, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials. Design of Springs - Design of Helical spring, Leaf spring.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Bhandar.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
3. Ansel C. Ugural, Mechanical Design of Machine Components, SI Version CRC Press, 2018·
4. Wei Jiang, Analysis and Design of Machine Elements. Wiley, 2019
5. Vijay Kumar Jadon, Suresh Verma, Analysis and Design of Machine Elements, I.K. International Publishing House Pvt. Limited, 2010

Web References

1. https://mech.iitm.ac.in/meiitm/course/design-of-machine-elements/
2. https://nptel.ac.in/courses/112/105/112105125/
3. http://www.nptelvideos.in/2012/12/design-of-machine-elements.html

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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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	**Mechatronics**	Programme : **B.Tech.**					
Semester	**VI**	Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23MCT615**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL ROBOTICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Mechatronics

Prerequisite	Knowledge of Kinematics and Dynamics of Machinery	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the components and parameters of industrial robots	K2
	CO2 Discuss forward kinematics, inverse kinematics and Jacobian for serial and parallel robots	K2
	CO3 Apply the classification of end effectors	K3
	CO4 Examine the kinematic calculations to the industrial robots	K4
	CO5 Compare the trajectory planning to the robots	K4

UNIT - I	**INTRODUCTION**	**Periods: 9**
A brief history – Definition - Laws of Robotics - Basic components of robot - concept of work cell - degrees of freedom (DOF) – Resolution – Accuracy – Repeatability – Payload – Precision - classification of Industrial robot manipulator - common kinematic arrangement.		**CO1**
UNIT - II	**END EFFECTORS**	**Periods: 9**
Unilateral Vs Multilateral end effectors - mechanical grippers: gripping force estimation with payload under acceleration – vacuum - magnetic - air operated grippers Remote centre compliance - Robot cell layouts.		**CO2**
UNIT - III	**KINEMATICS OF ROBOT MANIPULATOR**	**Periods: 9**
Representing position and rotation - rotation in plane - rotation in three dimension - Rotational transformation - Rotation with respect to the current frame and fixed frame - Rule for composition of rotational transformation - Parameterization of rotation - Euler angle, Roll, Pitch, Yaw angles Axis/angle representation - rigid motion - Homogeneous transformation.		**CO3**
UNIT - IV	**ROBOT DYNAMICS AND TRAJECTORY PLANNING**	**Periods: 9**
Euler Lagrange equation, kinetic and potential energy, Equation of motion, Newton Euler formulation - Trajectory planning for point to motion - Cubic polynomial - Quintic polynomial trajectory - Linear segment with parabolic bend (LSPB) minimum time trajectory - trajectory for path specified by via point.		**CO4**
UNIT - V	**ROBOT APPLICATIONS**	**Periods: 9**
Industrial robots for welding, painting and assembly, remote Controlled robots, Robots for nuclear thermal and chemical plants, Industrial automation, typical example of automated industries, application of visual inspection.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, "Industrial Robotics:Technology, Programming and Applications", McGraw Hill Book Company, 2012
2. Ashitava Ghosal, Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2008

Reference Books

1. J.J. Craig, Introduction to Robotics: Mechanics and Control, Prentice Hall Inc. / Pearson Education, 2008
2. Tsai, L. W., Robot Analysis: The Mechanics of Serial and Parallel Manipulators, John Wiley & Sons, Inc, New York, 1999.
3. Ramachandran Nagarajan "Introduction to Industrial Robotics" Pearson Education India, 2016
4. TadejBajd, MatjazMihelj, JadranLenarcic, Ales Stanovnik, Marko Munih "Robotics (Intelligent Systems, Control and Automation: Science and Engineering)'Springer 2012
5. James Perlberg" Industrial Robotics" Cengage Learning, 2016.

Web References

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://swayam.gov.in/nd1_noc20_me03/preview
3. https://www.youtube.com/watch?v=xrwz9lxpMJg

2.A.8.56

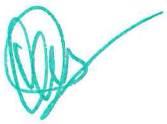
COs/POs/PSOs Mapping

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100



2.A.8.57

Department	**Mechatronics**	Programme : **B.Tech.**						
Semester	**VI**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23MCP608**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**EMBEDDED SYSTEM LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Mechatronics

Prerequisite	Basic Concepts of Programming and Micro Controllers	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the working principle of 7-segment displays and their application in voltmeters.	K2
	CO2 Explain the working principle of segment displays and their integration with the MCS 51 microcontroller for real-time clock display.	K2
	CO3 Demonstrate how to configure timers in the microcontroller for generating clock signals in a digital clock system.	K3
	CO4 Modify the data transfer protocol to improve transmission efficiency and reduce errors in the FM link between the two microcontrollers.	K3
	CO5 Analyze the control system's response in terms of achieving and maintaining the desired temperature under varying external conditions.	K4

List of Experiments

1. Voltage Measurement with display
2. Designing a voltmeter to measure voltage from 0 to 5volts and displaying the measured value using 7segment displays
3. Design of Real Time Clock using MCS 51 using segment Displays.
4. Design of Water Pump Controller to sense the water level in a tank
5. Digital Clock with LCD display a. Temperature Measurement with 7 segment display
6. Design of Single Channel Data Acquisition System
7. Interfacing the microcontroller to a PC through RS232 interface and displaying the messages sent by the microcontroller on the PC using Visual Basic program running in PC
8. Remote Control through FM Link
9. Establishing an FM link between two microcontrollers for data transfers.
10. Hot Chamber Controller to maintain the temperature at the set point.
11. Obstacle Detector using ultrasonic transmitter-receiver
12. Moisture sensor and sprinkler controller design

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Simon Monk," Make Action-with Arduino and Raspberry Pi,SPD ,2016.
2. Manish K. Patel "The 8051 Microcontroller Based Embedded Systems" Tata McGraw-Hill Education. – 2014
3. Perry Xiao "Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed" John Wiley & Sons– 2018
4. Jonathan W. Valvano "Embedded Systems: Introduction to Robotics" Independently Published, 2019
5. James K. Peckol "Embedded Systems: A Contemporary Design Tool" John Wiley & Sons.- 2019

Web References

1. https://nptel.ac.in/courses/106/105/106105159/
2. https://www.youtube.com/watch?v=9Q-3c0gQcok
3. https://www.youtube.com/watch?v=G9_pQzt1sts
4. http://www1.cs.columbia.edu/~sedwards/classes/2004/4840/
5. https://nptel.ac.in/courses/106/105/106105148/

2.A.8.58

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

2.A.8.57

Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PC				End Semester Exam Type: LE		
Course Code	U23MCP609	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	COMPUTER AIDED MANUFACTURING LABORATORY	0	0	2	1	50	50	100

Mechatronics

Prerequisite	Basic Knowledge of CNC Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the features and specifications of CNC machines.	K2
	CO2 Describe the process planning sheets and tool layouts.	K2
	CO3 Illustrate the CAM software and its programming.	K3
	CO4 Analyze the CAM software and prepare CNC part programs.	K4
	CO5 Categorize the part program and machine the component as per the production drawing.	K4

List of Experiments

1. Study of Manual part programming and Computer aided part programming
2. Study of G codes and M codes for machining centre and turning centre
3. Manual part programming for step turning operation in CNC turning center
4. Manual part programming for Turning and Facing using CNC turning centre
5. Simulating and Machining of Turning and Facing for given component using CNC turning centre
6. Manual part programming for Step turning using CNC turning centre
7. Simulating and Machining of Step turning for given component using CNC turning centre
8. Manual part programming for turning, Chamfering and fillet using CNC turning centre
9. Simulating and Machining of turning, Chamfering and fillet for given component using CNC turning centre
10. Manual part programming of Milling using VMC
11. Simulating and Machining of Milling for given component using VMC
12. Manual part programming of Drilling and Reaming using VMC
13. Simulating and Machining of Drilling and Reaming for given component using VMC

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 30	Total Periods: 30

Reference Books

1. Peter Smid "CNC Control Setup for Milling and Turning: Mastering CNC Control Systems"Industrial Press Inc - 2010
2. Dennis A. Keeling "How to Use a Cnc Router: A Practical Guide for Beginners "Create Space Independent Publishing Platform, 2017
3. James A. Harvey" CNC Trade Secrets: A Guide to CNC Machine Shop Practices" Industrial Press, Incorporated, 2014

Web References

1. https://www.youtube.com/watch?v=pPwyYFvRLts
2. https://www.youtube.com/watch?v=HpIEeBtJupY
3. https://mech.iitd.ac.in/content/cnc-lab

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Cos Mapping with POs and PSOs

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

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Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PC			End Semester Exam Type: LE			
Course Code	U23MCP610	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	INDUSTRIAL ROBOTICS LABORATORY	0	0	2	1	50	50	100

Mechatronics

Prerequisite	Basic Knowledge of Theory of Machines		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Identify the key features of robotic simulation and programming software used in industrial robotics applications.	K1
	CO2	Explain the fundamental differences between point-to-point motion and continuous path motion in robotic manipulators.	K2
	CO3	Describe the role of synchronization between the robot and the conveyor system during material handling or sorting operations.	K2
	CO4	Demonstrate how to program an industrial robot for a basic material handling operation, such as moving objects between predefined locations.	K3
	CO5	Analyze the performance of the robot's sorting operation, focusing on the accuracy and speed of detection and sorting based on sensor data.	K4

List of Experiments

1. Study of the major components of the robot.
2. Study of the robotic simulation/ programming software.
3. Study of forward and reverse kinematics, to program the sequence of motion of a robot.
4. Programming an industrial robot for performing various applications involving Point-to-point motion of the manipulator arm.
5. Programming an industrial robot for performing various applications involving continuous path motion of the manipulator arm.
6. Interfacing an industrial robot with a belt conveyor.
7. Developing program for an industrial robot to perform pick and place operation.
8. Programming of Industrial Robot for material handling application
9. Programming of industrial robot for processing application
10. Simulation of various Robot work cells (SOFT WARE).
11. Programming an industrial robot for a sorting operation using a sensing system.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 30	Total Periods: 30

Reference Books

1. Rex Miller, Mark R. Miller "Robots and Robotics: Principles, Systems, and Industrial Applications "McGraw Hill Professional, 2017
2. Bruno Siciliano, OussamaKhatib "Springer Handbook of Robotics"Springer. – 2016
3. Kevin M. Lynch, Frank C. Park "Modern Robotics" Cambridge University Press - 2017
4. Thomas R. Kurfess "Robotics and Automation Handbook" CRC Press. – 2018
5. Mark W. Spong, Seth Hutchinson, M. Vidyasagar "Robot Modeling and Control" John Wiley & Sons. 2020

Web References

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://swayam.gov.in/nd1_noc20_me03/preview
3. https://www.youtube.com/watch?v=xrwz9lxpMJg
4. http://dx.doi.org/10.1108/eum0000000004148
5. http://dx.doi.org/10.1109/23.57398.

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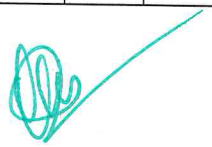
COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P 11	O12	PSO1	PSO2	PSO3
1	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
2	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
3	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
4	3	2	3	3	2	-	-	-	3	-	-	2	2	2	3
5	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100



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Department	Mechatronics	Programme: B. Tech.						
Semester	VI	Course Category Code: PA				*End Semester Exam Type: -		
Course Code	U23MCW602	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	MINI PROJECT	0	0	2	1	100	-	100

Mechatronics

Prerequisite	Electrical Engineering, Electronics, C Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the mini project work through the literature survey	**K2**
	CO2 Choose the proper components as per the requirements of the design/ system.	**K2**
	CO3 Apply the acquainted skills to develop final model/system	**K3**

There shall be a Mini Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the mini project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Mini-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Mini Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Mini Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 30	Total Periods: 30

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	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	2	2	2

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

Evaluation Method

Assessment	Review 1			Review 2				Total Marks
	Novelty	Presentation	Viva	Presentation	Demonstration	Viva	Report	
Marks	10	20	10	20	20	10	10	100

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Department	Mechatronics	Programme: B. Tech.						
Semester	VI	Course Category: AEC			End Semester Exam Type: -			
Course Code	U23MCC6XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	CERTIFICATION COURSE - VI	0	0	4	-	100	-	100
Mechatronics								
Prerequisite	-							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as "pass" on satisfactory completion. A letter grade "P" is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)		Total Marks
	Attendance	MCQ Test	
Marks	10	90	100

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2.A.B.85

Department	Mechatronics	Programme: B. Tech.						
Semester	VI	Course Category: MC			End Semester Exam Type :TE			
Course Code	U23MCM606	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	GENDER EQUALITY	2	0	0	-	100	-	100

Prerequisite	-	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe the general identity, social construction of gender roles.	K2
	CO2 Illustrate the causes and issues of gender discrimination in Indian society.	K2
	CO3 Describe the workplace discrimination, media influences on gender and culture.	K2
	CO4 Familiarize with international and Indian frameworks on gender equality.	K2
	CO5 Illustrate the current challenges in gender equality, including the glass ceiling and the role of technology.	K2

UNIT – I	Introduction to Gender Equality	Periods:06
Gender equality – exploring gender identity and expression, Understanding the social construction of general roles and norms, historical perspectives on gender roles, Analyzing key milestones in the fight for gender equality.		CO1

UNIT – II	Gender Inequality and Its Manifestations	Periods:06
Gender discrimination in Indian society – causes of gender inequality – Illiteracy, patriarchal set up, lack of awareness, social beliefs, practice and custom – Issues of gender discrimination – Child marriage, child domestic work, poor education and health, violence and exploitation in workplace.		CO2

UNIT – III	Gender and Culture	Periods:06
Workplace discrimination, Media influences on gender and culture, Gender and power dynamics in society. Strategies for promoting gender equality and cultural understanding.		CO3

UNIT – IV	Promoting Gender Equality	Periods:06
Gender Equality and Human Rights – International frameworks and Conventions on Gender Equality – Equality under the Indian Constitution – Policies and initiatives for gender mainstreaming – Strategies for promoting Gender Equality in various contexts.		CO4

UNIT – V	Contemporary Challenges and Future Directions	Periods:06
Current challenges and emerging issues in gender equality – Glass ceiling – role of technology in continuing or challenging gender inequality – Exploring possibilities for transformative change and envisioning a gender-equal future.		CO5

Lecture Periods: 30	Tutorial Periods: -	Practical Periods: -	Total Periods: 30

Text Books

1. "Gender and Society" by Raewyn Connell – This book provides a comprehensive overview of gender roles, power dynamics, and the social construction of gender.
2. "The Second Sex" by Simone de Beauvoir – A historical and philosophical examination of women's oppression and gender inequality.
3. "Women and Gender in the Indian Society" by Neera Desai and Usha Thakkar – Focuses on the context of gender roles, inequality, and feminist movements in India.

Reference Books

1. Woman in early Indian societies, New Delhi: Manohar Publications. Sita A. Raman (2009).
2. A social and Cultural history, Volume1. Connecticut: Oxford: Praeger. Sita Raman (2009).
3. A social and Cultural history, Volume2. Connecticut: Oxford: Praeger.
4. Iftikhar R. (2016). Indian Feminism: Class, Gender and Identity in Medieval Ages. Chennai: Notion Press. Iftikhar, R. (2012).

Web References

1. https://www.unwomen.org
2. https://ncw.nic.in
3. https://en.unesco.org/themes/gender-equality
4. https://www.weforum.org/reports
5. https://wcd.nic.in

2.A.8.66

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

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ANNEXURE - III

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PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE501	Computer Integrated Manufacturing
2	U23ECEC01	Digital Image processing
3	U23ADDC01	Computer Network and Security
4	U23MCE502	Robot Operating System
5	U23ICECO1	Virtual Instrumentation
Professional Elective – II (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23MCE603	Heating Ventilation and Air-Conditioning
2	U23CSEC02	Introduction to Industry 4.0
3	U23MCE604	Digital Manufacturing
4	U23MCE605	Mobile Robotics
5	U23MEDC02	Product Design and Development

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2.A.8.71

Department	Mechatronics	Programme : B.Tech.						
Semester	V	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23MCE501	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	COMPUTER INTEGRATED MANUFACTURING	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Knowledge of Computer aided design and Aided Manufacturing		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Describe the knowledge of computer integrated manufacturing and communication.	K2
	CO2	Identify the required DBMS architecture and product design details for various systems.	K2
	CO3	Apply the knowledge of Concurrent engineering and process planning in manufacturing planning.	K3
	CO4	Demonstrate the methods for Automated Data Collection and Quality inspection, as required.	K3
	CO5	Analyze the additive manufacturing techniques and hybrid communication.	K4

UNIT - I	**INTRODUCTION TO CIM AND COMMUNICATION**	**Periods: 9**	
Introduction to CIM, Evolution, Benefits, Computers in Manufacturing: Factory tasks for Computer Integration, CIM Hardware and Software.Fundamentals of Communication: Representation of data, Coding, Transmission, Medium, Types of Communication Lines, Network Architectures and topology.			**CO1**
UNIT - II	**DATABASE MANAGEMENT SYSTEMAND PRODUCT DESIGN**	**Periods: 9**	
Data base: Introduction, Manufacturing data, Data base models, Data base Management, Data base required for a shop floor control (Fundamentals only) Product Design: Design Process, CAD – areas of Application, Benefits, Fundamentals of CAD. CAM, CAE.			**CO2**
UNIT - III	**CONCURRENT ENGINEERING AND PROCESS PLANNING**	**Periods: 9**	
Concurrent / Simultaneous engineering: Introduction, Design for manufacturing and assembly, and other product design objectives. Advanced Manufacturing Planning. Introduction to Reverse Engineering. Process Planning: CAPP, Retrieval and Generative Model.			**CO3**
UNIT - IV	**DATA COLLECTION AND QUALITY INSPECTION**	**Periods: 9**	
Automated Data Collection – Bar Codes, OCR, Image Processing, Computer vision, RF Identification, Magnetic Identification and Voice Technology. CAQC, Contact &Non-Contact type inspection, Introduction to CMM, Application of Various Techniques and Equipments in inspection.			**CO4**
UNIT - V	**ADDITIVE MANUFACTURING SYSTEMS**	**Periods: 9**	
Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mikell. P. Groover, 'Automation, Production Systems and computer integrated manufacturing'. Prentice Hall of India, New Delhi, 2007
2. P. Radhakrishnan , S. Subramanyan, V. Raju, 'CAD/CAM/CIM', New Age International (P) Ltd. New Delhi, 2000.
3. Bedworth, Henderson & Wolfe, 'Computer Integrated Design and Manufacturing', McGraw Hill.
4. William. W. Luggen, 'Flexible Manufacturing Cells and System', Prentice Hall, New jersy
5. Rao. P, N Tewari & T. K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000

Reference Books

1. S. Kant Vajpayee, 'Principles of Computer Integrated Manufacturing', Prentice Hall of India, 2003.
2. Teicholtz, Orr, 'CIM Handbook', McGraw Hill publishing.
3. Roger Hanman, 'Computer Intergrated Manufacturing', Addison Wesley, 1995.
4. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach"
6. James A. Rehg, H. W. Kraebber, "Computer Integrated Manufacturing, 2nd edition, Pearson Education

Web References

1. www.cimlearningzone.co.uk/

2.A.8.22

2. http://nptel.ac.in/courses/112102101/
3. http://nptel.ac.in/courses/112102103/
4. http://elearning.vtu.ac.in/06ME72.html
5. https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecture-notes/

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	Electronics and Communication Engineering	Programme: B.Tech.						
Semester	Professional Elective–V	Course Category:PE			End Semester Exam:TE			
Course Code	U23ECEC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Digital Image Processing	3	0	0	3	25	75	100
Mechatronics								
Prerequisite	Students should have an introduction to signal processing or an equivalent course.							

Course Outcome			BT Mapping
	On completion of the course, the students will be able to		
	CO1	Understand fundamentals, visual perception, and pixel relationships.	K2
	CO2	Correlate the various image processing technique with the help of mathematical preliminaries	K3
	CO3	Apply different types of image enhancement and restoration techniques in various applications	K3
	CO4	Illustrate the significance of Colour Image Processing and Image Segmentation techniques	K4
	CO5	explore image compression techniques, coding methods, and pattern recognition based on matching.	K4

UNIT-I	DIGITAL IMAGE FUNDAMENTALS	Periods:09
Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels., simple image formation model, Brightness, contrast, hue, saturation, Mach band effect		CO1
UNIT-II	**IMAGE TRANSFORM**	**Periods:09**
Two-dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT- Image transforms – 1D DFT, 2D DFT, Discrete Cosine transform, Discrete Sine transform, Hadamard transform, Haar transform, Slant transform, KL transform, SVD transform, Wavelet transform.		CO2
UNIT-III	**IMAGE ENHANCEMENTAND IMAGE RESTORATION**	**Periods:09**
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters. Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.		CO3
UNIT-IV	**COLOUR IMAGE PROCESSING AND IMAGE SEGMENTATION**	**Periods:09**
Colour fundamentals – Colour models – HIS to RGB and RGB to HIS. Detection of Discontinuities– Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation. Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm		CO4
UNIT-V	**IMAGE COMPRESSION AND RECOGNITION**	**Periods:09**
Need for compression – Coding Redundancy - Interpixel Redundancy - Psycho visual Redundancy - Bit plane coding - Variable length coding – Adaptive coding – Arithmetic coding – LZW coding – Hybrid coding – Wavelet – JPEG – MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Textbooks

1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, 2017, 4th edition, PearsonEducation, USA
2. Anil K. Jain, Fundamentals of Digital Image Processing, 2015, 1st edition, Pearson India, India
3. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.

2.A.8.74

Reference Books

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
4. John C. Russ, F. Brent Neal-The Image Processing Handbook, Seventh Edition, The Kindle edition (2016), CRC Press,Taylor & Francis Group.
5. P.Ramesh Babu, Digital Image Processing, Scitech Publications., 2003

Web References

1. http://eeweb.poly.edu/~onur/lectures/lectures.html
2. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html
3. https://nptel.ac.in/courses/117/105/117105079/
4. https://nptel.ac.in/courses/117/105/117105135/
5. https://www.csie.nuk.edu.tw/

* TE – Theory Exam, LE – Lab Exam

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	Artificial Intelligence and Data Science	Programme: B.Tech.						
Semester	IV	Course Category Code: ES			*End Semester Exam Type: TE			
Course Code	U23ADDC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Computer Networks and Security	3	0	0	3	25	75	100

(Common to AI & DS , Mechatronics)

Prerequisite	Digital System Design and Programming Logic	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze and evaluate the cyber security needs of an organization	**K2**
	CO2 Analyze the security issues in networks and computer systems to secure an infrastructure.	**K2**
	CO3 Design operational cyber security strategies and policies.	**K3**
	CO4 Apply critical thinking and problem-solving skills to detect current and future attacks on an organization's computer systems and networks.	**K3**
	CO5 Examine the various network security threats and solutions	**K3**

UNIT-I	**Introduction to Computer Networks**	**Periods: 9**
Introduction to computer networks-Basics of data communication-Types of networks: LAN, WAN, MAN-Network topologies: bus, star, ring, mesh-Network architectures: client-server, peer-to-peer-OSI model overview-TCP/IP protocol suite-Network addressing and subnetting		**CO1**
UNIT-II	**Network Security Fundamentals**	**Periods: 9**
Understanding the need for network security-Common security threats: malware, phishing, DoS attacks-Vulnerability assessment and risk management-Security policies and best practices-Principles of cryptography: encryption, decryption, hashing-Types of encryption algorithms: symmetric, asymmetric-Public Key Infrastructure (PKI)-Digital signatures and certificates		**CO2**
UNIT-III	**Authentication and Access Control**	**Periods: 9**
Authentication methods: passwords, tokens, biometrics-Single Sign-On (SSO) and multi-factor authentication-Role-based access control (RBAC) and discretionary access control (DAC)-Access control lists (ACLs)-Identity management systems-Secure authentication protocols: Kerberos, OAuth, SAML-Federation and identity federation		**CO3**
UNIT-IV	**Network Defense Techniques**	**Periods: 9**
Firewall technologies: stateful, stateless, next-generation-Intrusion Detection Systems (IDS) and Intrusion- Prevention Systems (IPS)-Network segmentation and DMZ (Demilitarized Zone)-Virtual Private Networks (VPNs): site-to-site, remote access-Secure communication protocols: SSL/TLS, SSH, IPsec-Endpoint security measures: antivirus, anti-malware, endpoint detection and response (EDR)-Security information and event management (SIEM) systems		**CO4**
UNIT-V	**Wireless Network Security**	**Periods: 9**
Wireless networking standards: Wi-Fi, Bluetooth, Zigbee-Wireless security protocols: WEP, WPA, WPA2, WPA3-Wireless encryption techniques: TKIP, AES-Security challenges in wireless networks: rogue access points, evil twin attacks-Wireless Intrusion Detection Systems (WIDS) and Wireless Intrusion Prevention Systems (WIPS)-Mobile device security considerations		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Tanenbaum, Computer Networks, Pearson Education, 5th Edition, 2013

2.William Stallings. Data and computer communications. Pearson Education India, 2013.

Reference Books

1.Perlman, R., Kaufman, C., and Speciner, M. (2016). Network security: private communication in a public world. Pearson Education India.

2.Stevens, W. R., Fenner, B., and Rudoff, A. M. (2018). UNIX Network Programming Volume 1. SMIT-SMU.

Web References

1. https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2. https://www.geeksforgeeks.org/computer-network-tutorials/
3. https://www.geeksforgeeks.org/what-is-computer-networking/
4 https://www.javatpoint.com/computer-network-tutorial
5. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	Mechatronics	Programme : B.Tech.						
Semester	V	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23MCE502	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Robot Operating Systems	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Basics of Robotic system	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Recall the key milestones in the history of ROS and its development.	K1
	CO2 Explain the significance of process commands in managing system resources and their relationship to file system security.	K2
	CO3 Describe the process of trajectory interpolation and its significance in smooth motion planning.	K2
	CO4 Use inverse dynamics control to calculate the required joint torques for a given trajectory and implement this in a simulation.	K3
	CO5 Apply differential drive steering algorithms to program a robot to navigate through an obstacle course.	K3

UNIT – I	Introduction to ROS	Periods:9
Introduction - ROS file system level - ROS community level –The ROS Equation - History - distributions - difference from other meta-operating systems– services - ROS framework – operating system – releases.		CO1
UNIT – II	**File System Security**	**Periods:9**
File system security - Changing access rights– process commands – compiling, building and running commands – handling variables. File system - packages – stacks – messages – services – catkin workspace – working with catkin workspace – working with ROS navigation and listing commands.		CO2
UNIT – III	**Trajectory Planning**	**Periods:9**
Trajectory Planning: Robot workspace analysis, joint space trajectories, path and trajectory planning of a robot, Trajectory Interpolation, Set point tracking, Actuator Dynamics. Cartesian-Space Trajectories, Continuous trajectory recording		CO3
UNIT – IV	**Motion Control**	**Periods:9**
The control problem, Joint space control, Decentralized control, Computed torque feed forward control, Centralized control, PD Control with gravity compensation, Inverse dynamics control, Operational space control. Configuration Space - Collision matrix - Motion planning methods - Motion planning using ROS - ROS Controllers.		CO4
UNIT – V	**Mobile Robot Navigation in ROS**	**Periods:9**
GPS and Inertial sensing unit Fusion of odometry and LIDAR Differential drive steering algorithms Map and path Making Move base Navigation stack. Applications: Navigation stack - tf - sensors - odometer - imu - laser scan - base controller.		CO5

Lecture Periods: 45	Tutorial Periods: 15	Practical Periods: -	Total Periods: 45

Text Books

1. Lentin Joseph, "Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018.
2. Aaron Martinez, Enrique Fernández, "Learning ROS for Robotics Programming", Packt Publishing Ltd, 2013.
3. Lentin Joseph. (2015). Mastering ROS for Robotic Programming, Packt Publishing.

Reference Books

1. Jason M O'Kane, "A Gentle Introduction to ROS", CreateSpace, 2013.
2. Anis Koubaa, "Robot Operating System (ROS) – The Complete Reference (Vol.3), Springer, 2018.
3. R. Patrick Goebel. (2012). ROS by Example: A Do-It-Yourself Guide to the Robot Operating System. Lulu.
4. Marco Ceccarelli, Fundamentals of Mechanics of Robotic Manipulation, Springer International Publishing, 2022, March.
5. Kumar Bipin, Robot Operating System Cookbook, Packt Publishing, 2018.

Web References

1. https://www.udemy.com/course/ros-for-beginners/

2.9.8.78

3.	https://accelerationrobotics.com/ros.php
4.	https://www.geeksforgeeks.org/introduction-to-ros-robot-operating-system/
5.	https://www.edx.org/course/robotics-kin ... nnx-robo1x

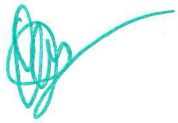
COs/POs/PSOs Mapping

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100



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Department	Mechatronics	Programme: B.Tech.						
Semester	VI	Course Category Code: PE			*End Semester Exam Type: TE			
Course Code	U23ICEC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	VIRTUAL INSTRUMENTATION	3	0	0	3	25	75	100
	(Common to ICE and Mechatronics)							
Prerequisite	Nil							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the concepts of virtual instruments	K3
CO2	Apply the Programming concepts in VI	K3
CO3	Familiarize in the concepts of instrument interfacing by VI tools.	K3
CO4	Acquaint the various instrument control interfaces.	K3
CO5	Elucidate the concepts of VI in real time applications.	K3

UNIT – I	INTRODUCTION	Periods:09
Evolution of LabVIEW - Block diagram and architecture of a virtual instrument – Graphical programming and comparison with conventional programming - Controls and indicators- Labels and Text –Shape, size and color – Data type, Format, Precision and representation – Data types – Data flow programming-Editing – Debugging and Running a Virtual Instrument.		CO1

UNIT – II	PROGRAMMING STRUCTURE	Periods: 09
Front panel - Block diagram - VIS and sub-VIS, Display types – Digital – Analog – Chart – Oscilloscopic types, Loops: For Loops, While Loops, arrays, clusters, Charts and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.		CO2

UNIT – III	DATA ACQUISITION	Periods: 09
Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.		CO3

UNIT – IV	INSTRUMENT CONTROL	Periods: 09
Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office and Industrial applications, VISA and IVI.		CO4

UNIT – V	APPLICATIONS	Periods: 09
Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.		CO5

Lecture Periods:45	Tutorial Periods:	Practical Periods:-	Total Periods:45

Text Books

1. Gupta , Virtual Instrumentation Using Lab view 2nd Edition, Tata McGraw-Hill Education, 2010
2. Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI Learning Pvt. Ltd., 2010

Reference Books

1. Gary Jonson, "Labview Graphical Programming", Fourth Edition, McGraw Hill, New York, 2012
2. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition and Process Control", Second Edition, Instrument Society of America, 2012.
3. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 2013.

Web References

1. https://www.ni.com/
2. https://www.youtube.com/user/Labview/playlists

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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Department	Mechatronics	Programme: B.Tech.						
Semester	VI	Course Category Code: PE			*End Semester Exam Type:TE			
Course Code	U23MCE603	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	HEATING VENTILATION AND AIR CONDITIONING	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Thermodynamics and Heat Transfer	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply the law of thermodynamics for simple HVAC systems	K3
	CO2 Solve problems using refrigerant table / charts and psychrometric charts	K3
	CO3 Recognizing various components needed for HVAC systems	K2
	CO4 Able to estimate the heating and cooling loads to design HVAC units	K3
	CO5 Developing control systems for controlling the performance of HVAC units	K3

UNIT – I	Introduction	Periods:09
Fundamentals of Thermodynamics - Conservation of Mass, Laws of Thermodynamics, Thermodynamic Cycles, Fundamentals of Heat Transfer, Conduction, Convection, Thermal Radiation. HVAC - Scope of HVAC, Air-Conditioning Processes, Environment for Human Comfort.		CO1
UNIT – II	**Psychrometry**	**Periods: 09**
Psychrometrics, Ideal Gas Approximation, Fundamental Parameters, Equation of State, Humidity, Degree of Saturation, Wet Bulb Temperature, Partial Pressure of Water Vapor, Dew Point Temperature, Saturation, Enthalpy, Thermodynamic Wet Bulb Temperature, Properties of Moist Air, Psychrometric Chart, simple exercises using psychrometry		CO2
UNIT – III	**Air Conditioning Processes and Ventilation**	**Periods: 09**
Introduction, Basic processes - Heating and Cooling Process, Cooling with Dehumidification, Heating with Humidification, Adiabatic Mixing of Two Air Streams, Evaporative Cooling, Heating and Air Conditioning System Cycles. Basic air-conditioning system and zoned air-conditioning system. Indoor air quality and ventilation - Indoor Air Quality, Ventilation Procedure, Concentration of Air Pollutants, Indoor Air Quality Procedure, Filters – Types, Ozone, Ultraviolet Light		CO3
UNIT – IV	**Heating and Cooling Load Calculations**	**Periods: 09**
Emissivities of Materials, Heat Transfer Coefficient, Coefficient of Transmission, Thermal Conductivities of Materials, Thermal Resistances of Materials, Outdoor Air Load Components – introduction, Basic Concepts and Terminologies. Heating load calculations – Introduction, Calculating Design Heating Loads. Cooling load calculations - Basic Definitions, Transfer Function Method (TFM), Heat Sources and heat gains, CLTD / SCL / CLF Calculation Procedure, Cooling Load by CLTD/SCL/CLF Method		CO4
UNIT – V	**Digital Controls For HVAC Systems**	**Periods: 09**
Introduction, control types, Basic Control – open and closed loop controls, Typical Control Loops, Direct Digital Control – Introduction, control schemes, Direct Digital Control of an Air-Handler – Introduction, Schemes, Architecture and Advantages of Direct Digital Controls.		CO5

Lecture Periods:45	Tutorial Periods:	Practical Periods:-	Total Periods:45

Text Books

1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
2. Joseph Wagner, Kirk VanGelder "Automotive Heating, Ventilation, and Air Conditioning" Jones & Bartlett Learning, 2018.
3. A. Vedavarz, S. Kumar, M. Hussain, "Heating, Ventilation and Air Conditioning Handbook", Industrial Press Inc., 2006

Reference Books

1. Red-Hot Careers "Heating, Ventilation, and Air Conditioning (HVAC) "CreateSpace Independent Publishing Platform, 2018– 2018
2. Jan F. Kreider, "Handbook of Heating, Ventilation, and Air Conditioning", Taylor & Francis Limited, 2019.
3. Amrutha Rao MALLI, "A Practical Approach on Heating Ventilation and Air Conditioning Technology", Independently Published, 2017.
4. Russell E. Smith, "Electricity for Refrigeration, Heating, and Air Conditioning", Cengage Learning- 2018

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5. David W. Beard, "Indoor Air Quality and HVAC Systems", Routledge, 2019.

Web References

1. https://nptel.ac.in/courses/112/105/112105129/
2. https://swayam.gov.in/nd1_noc19_me58/preview
3. https://drive.google.com/open?id=0B7JWdKw_4Q07VWNrLVNkRXpyUmM
4. https://www.google.com/url?sa=t&source=web&rct=j&url=https://ocw.mit.edu/courses/architecture/4-401-environmental-technologies-in-buildings-fall-2018/lecture-slides-lec17.pdf&ved=&usg=AOvVaw3XYdn
5. https://www.epa.gov/iaq-schools/heating-ventilation-and-air-conditioning-systems-part-indoor-air-quality-design-tools

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.A.8.82

Department	Mechatronics	Programme: B.Tech.						
Semester	VI	Course Category Code: PE			*End Semester Exam Type:TE			
Course Code	U23CSEC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Introduction to Industry 4.0	3	0	0	3	25	75	100

Prerequisite	Nil	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand key Industry 4.0 Concepts and Technologies.	K1
	CO2 Explore advanced technologies like AI, Big Data and Robotics.	K2
	CO3 Comprehend the working of Cloud Computing Technologies	K3
	CO4 Learn how AR/VR improves Industrial Automation and Safety.	K2
	CO5 Apply design thinking and explore IIOT Use Cases and Cyber security.	K3

UNIT – I	Foundations of Industry 4.0 and Smart Systems	Periods:09
Introduction to Industry 4.0 - The Fourth Industrial Revolution - Globalization and Emerging Issues Lean Production Systems - Smart and Connected Business Perspectives - Cyber-Physical Systems (CPS) - Introduction to Sensing and Actuation - Introduction to IIoT (Industrial Internet of Things) - FDM Machine and 3D Printing Demonstration - Case Studies in Industry 4.0.		CO1
UNIT – II	**Key Technologies And Advanced Analysis in Industry 4.0**	**Periods: 09**
Next-Generation Sensors - Collaborative Platforms and Product Lifecycle Management (PLM) - Artificial Intelligence (AI) in Industry 4.0 - Big Data and Advanced Analytics - Introduction to Robotics - Introduction to UAVs (Drones) - Energy-Efficient Technologies - Collaborative Robots (Cobots) - Artificial Intelligence and Data Analytics for Predictive Maintenance.		CO2
UNIT – III	**Cloud Computing Technologies and Industrial Applications**	**Periods: 09**
Introduction to Cloud Technologies - Top Cloud Service Providers - Cloud Computing in Industry 4.0 -Azure IoT Hub and Cloud Services - Edge and Fog Computing - Hybrid Cloud Solutions - Cloud-Based Big Data Platforms - Cloud Security - Cloud Solutions for Smart Cities.		CO3
UNIT – IV	**Augmented Reality (AR), Virtual Reality (VR), And Industrial Automation**	**Periods: 09**
Introduction to AR and VR in Industry 4.0 - Industrial Use Cases of AR and VR - AR/VR in Maintenance and Inspection - Mixed Reality (MR) and Digital Twins - Automation Tools and Techniques -VR for Industrial Safety and Training - Challenges in AR/VR Adoption.		CO4
UNIT – V	**Design Thinking, IIOT, and Case Studies**	**Periods: 09**
Introduction to Design Thinking - Design Thinking Process - Human-Centered Design for Industrial Applications - Basics of Industrial IoT (IIoT) - Industrial Processes and Automation - Cybersecurity in Industry 4.0 - Real-time Use Cases - Drones and UAVs in Industry - UAV Regulations and Safety Standards - Future of Industry 4.0.		CO5

Lecture Periods:45	Tutorial Periods:	Practical Periods:-	Total Periods:45

Text Books

1. Ravi Kant, Hema Gurung, "Industry 4.0: Concepts, Processes and Systems", CRC Press,2023.
2. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress,2016.
3. Emre Cevikcan, Alp Ustundag, "Industry 4.0: Managing The Digital Transformation", Sprniger,2017.

Reference Books

1. Soumya Das, "Industry 4.0 with SAP", Rheinwerk,2024.
2. Abhinav Sharma, Arpit Jain, Paawan Sharma, Mohendra Roy, "Recent Trends and Best Practices in Industry 4.0", River Publishers,2023.
3. Anand Nayyar, Mohd Naved, Rudra Rameshwar, New Horizons for Industry 4.0 in Modern Business, Springer,2023.
4. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits, Industry 4.0 for SMEs: Challenges, Opportunities and Requirements, Palgrave Macmilla,2020.
5. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, "Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work", Emerald Publishing Limited,2019.

Web References

2.A.8.83

1. https://onlinecourses.nptel.ac.in/noc20_cs69/preview
2. https://www.oracle.com/in/industrial-manufacturing/industry-4-components/
3. https://aws.amazon.com/blogs/iot/tag/industry-4-0/

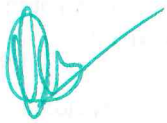
COs/POs/PSOs Mapping

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

Correlation Level: 1 - Low, 2 - Medium, 3 – High Evaluation Methods

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100



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Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23MCE604	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	DIGITAL MANUFACTURING	3	0	0	3	25	75	100

Prerequisite	**Mechatronics**		
	Knowledge of Manufacturing and IoT		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Define key concepts related to digitalization in manufacturing and list common tools used in digital manufacturing.	K1
	CO2	Describe the functions and benefits of digital process twins in manufacturing environments.	K2
	CO3	Demonstrate the use of real-time production information capturing techniques using IoT devices and cloud services.	K3
	CO4	Analyze the role of reverse engineering in the product development cycle and its implications for manufacturing process modeling.	K4
	CO5	Examine the relationship between capacity planning and material planning, identifying potential bottlenecks and their impact on production efficiency.	K4

UNIT - I	**Introduction**	**Periods: 9**	
Overview of digitalization of manufacturing process – Concepts and common tools for digital manufacturing – Digital design and modeling – Common modeling and analysis tools			**CO1**
UNIT - II	**Digital design and fabrication**	**Periods: 9**	
Digital twins and applications – Digital process twins in manufacturing - Agile (Additive) Manufacturing Systems - Mass Customization - Smart Machine Tools - Robotics and Automation (perception, manipulation, mobility, autonomy) – Sensor networks and Devices			**CO2**
UNIT - III	**IoT and cloud based manufacturing**	**Periods: 9**	
Architecture of IoT based Manufacturing system - Integration framework of Real-time manufacturing - Work logic of IoT-MS - Concept of cloud manufacturing - Real-time production information perception and capturing - Cloud service selection - Cloud Machine model			**CO3**
UNIT - IV	**Virtual Manufacturing and Simulations**	**Periods: 9**	
Direct digital manufacturing - 3D printing - Laser engineered shaping - reverse engineering – manufacturing process modelling, simulation and analysis - Assembly planning and Validation			**CO4**
UNIT - V	**Manufacturing support systems**	**Periods: 9**	
Real-time information based scheduling - capacity planning - material planning - Real time production monitoring techniques with smart sensors - Configuration of smart shop floor - traceability and call back of defective products			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mikell P. Groover, 'Automation, Production Systems, and Computer-Integrated Manufacturing'. Pearson Education, New Delhi, 2015, Sep.
2. Andrew Kusiak, Smart Manufacturing, Publisher, Taylor & Francis, 2018.
3. Kaushik Kumar, Divya Zindani, J. Paulo Davim, 'Digital Manufacturing and Assembly Systems in Industry 4.0, CRC Press, 2021, March.

Reference Books

1. Alexandre Dolgui, Boris Sokolov, Dmitry Ivanov, 'Scheduling in Industry 4.0 and Cloud Manufacturing', Springer International Publishing, 2020, June.
2. R. K. Amit, Kulwant S. Pawar, R. P. Sundarraj, 'Advances in Digital Manufacturing Systems', Springer, 2023, Jan
3. P.N.Rao, CAD/CAM: Principles and Applications-3rd Edition, Tata McGraw Hill, India, 2010..
4. Achim Ebert, Bahram Ravani, Benjamin Kirsch, Bernd Hamann, Jan C. Aurich, Ralf Müller, Tarek Zohdi, "Physical Modeling for Virtual Manufacturing Systems and Processes", Trans Tech Publications Limited, August 2017.
5. William MacDougall, Industrie 4.0: Smart Manufacturing for the Future, Germany Trade & Invest, 2014

Web References

1. www.cimlearningzone.co.uk/
2. http://nptel.ac.in/courses/112102101/
3. http://nptel.ac.in/courses/112102103/
4. http://elearning.vtu.ac.in/06ME72.html
5. https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecture-notes/

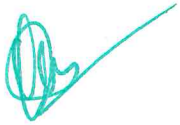
2.A.8.85

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100



Department	Mechatronics	Programme : B.Tech.						
Semester	VI	Course Category: PE				End Semester Exam Type: TE		
Course Code	U23MCE605	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	MOBILE ROBOTICS	3	0	0	3	25	75	100

Mechatronics

Prerequisite	Knowledge of Robotics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand mobile robot fundamentals, types, and autonomy.	K2
	CO2 Design and build mobile robots with various actuators and sensors.	K3
	CO3 Apply kinematic models for robot positioning and control.	K3
	CO4 Use sensors and localization techniques for robot navigation.	K3
	CO5 Distinguish path planning and motion control algorithms for navigation.	K4

UNIT – I	**Introduction to Mobile Robots**	**Periods:9**
Introduction to mobile Robots – Laws of Robots – Robot Anatomy – Basic Mechanics of Robots – Basic Electronics for Robots, Companion Robots – Space Robots – Defense Robots. Introduction to autonomous robotics, terrestrial and aerial locomotion.		**CO1**
UNIT – II	**Building of Mobile Robots**	**Periods:9**
Building of various types of mobile robots – Use of various Sensing methods. Actuation mechanism for robots – Mechanical Actuators and drive trains, Electric Actuators - DC Motors – Servo motor, stepper motor – Linear Actuators – Grippers – Motor drives.		**CO2**
UNIT – III	**Kinematics**	**Periods:9**
Kinematic Models and Constraints: Robot Position - Forward and Inverse Kinematic Models - mobile robot kinematic models, maneuverability, workspace, and kinematic control.		**CO3**
UNIT – IV	**Perception and Localization**	**Periods:9**
Sensors for mobile robots-Representing uncertainty-Feature extraction-Mobile robot localization- Markov Localization, EKF Localization Algorithm , EKF Localization with Unknown Correspondences Multi-Hypothesis Tracking.		**CO4**
UNIT – V	**Planning and Motion Control**	**Periods:9**
Introduction-Path planning overview - Global path planning - A* Algorithm - local path planning - Road map path planning - Cell decomposition path planning-Potential field path planning – Obstacle avoidance – Path control. Pure pursuit control for lateral movement, Stanley controller for lateral movement.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza , "Introduction to Autonomous Mobile Robots", Bradford Company Scituate, USA, 2011.
2. Ulrich Nehmzow. (2003). Mobile Robots - A practical introduction, Springer.
3. Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza. (2011). Introduction to Autonomous Mobile Robots. 2nd edition, The MIT Press.

Reference Books

1. S.R. DEB, S. DEB. (2011). Robotics Technology and Flexible Automation, McGraw-Hill.
2. Ulrich Nehmzow, (2012). Mobile Robotics: A Practical Introduction Second Edition. Springer.
3. Robotics, Vision and Control Fundamental Algorithms in MATLAB®. Second Edition.
4. Bruno Siciliano, Oussama Khatib , "Springer Hand Book of Robotics", Springer, 2008.
5. Riadh Siaer , "The future of Humanoid Robots- Research and applications", Intech Publications, 2012.

Web References

1. https://www.coursera.org/specializations/modernrobotics
2. https://journals.sagepub.com/doi/full/10.1177/1729881419839596
3. https://accelerationrobotics.com/ros.php

2.A.8.87

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.A.8.88

Department	Mechanical Engineering	Programme : B.Tech.						
Semester	VI	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23MEDC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	PRODUCT DESIGN AND DEVELOPMENT	3	0	0	3	25	75	100

(Common to Mechanical & Mechatronics)

Prerequisite	Computer Aided Design	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain conceptual product design techniques.	**K2**
	CO2 Identify Customer needs and products design specifications.	**K2**
	CO3 Use different systematic concept generation techniques in product design.	**K3**
	CO4 Use embodiment design principles in latest manufacturing methods.	**K3**
	CO5 Illustrate the concepts relating to simulating product performance and manufacturing processes	**K3**

UNIT- I	**Introduction of Product Design**	**Periods: 09**
Design versus Scientific method, Need for new designs, Considerations of a Good Design, Product Development process cycles, Organizations for Product Design, Technological Innovation and Business Strategies, Modern Product development and design theories, Design morphology- pioneer design phases and flow charting, Reverse engineering and redesign methodology.		**CO1**
UNIT- II	**New Product Idea**	**Periods: 09**
Market research, identifying customer needs, locating ideas for new products, Kano Diagram, Establishing Engineering Characteristics, Quality Function Deployment (QFD), Product Design Specification (PDS) Design information and sources.		**CO2**
UNIT - III	**Concept Generation**	**Periods: 09**
Freud's model, Creative thinking- brain storming, primary design, drawing, Systematic methods: Tear down and experimentation, Function structure, Morphological methods, Theory of Inventive Problem solving (TRIZ), Axiomatic Design (AD) Decision Theory, Evaluation methods, Comparison based on absolute criteria, Pugh's concept, Measurement scales, Weighted decision Matrix, Analytic Hierarchy process (AHP).		**CO3**
UNIT - IV	**Embodiment Design**	**Periods: 09**
Product Portfolios and Architecture, Configuration and Parametric design, detailed design, Design for Environment, Modeling and Simulation, Material selection for Design, Industrial design- Need and process. Robust Design, Optimization of design, quality assessment. Ergonomics and Aesthetics: Break even analysis.		**CO4**
UNIT - V	**Role of Technology in Designing**	**Periods: 09**
Integrating CAE, CAD, CAM tools, Simulating product performance and manufacturing process, Technology driven products, user driven products, assessing the quality of the product.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. George E Dieter, Engineering Design 3rd Edition McGraw Hill, 2001.
2. Karl T. Ulrich, Product Design and Development, Tata McGraw Hill International, 2003.
3. G. Lawrence Sanders, Developing New Products and Services, Publisher: Saylor Foundation 2013.

Reference Books

1. Steven W. Trimble and Abdelrahman N. Shuaib, Product Design and Development Handbook, Cognella Academic Publishing, 2022.
2. Neville Songwe Jr, Carmen Andrisani, An Industrial Design Guide Vol. 01, 2022.
3. Karl Ulrich, Steven Eppinger, Maria C. Yang. Product Design and Development McGraw Hill-2020.
4. Steven Eppinger, Karl Ulrich, Product Design and Development McGraw-Hill Higher Education, 2015.
5. Sven G. Bilén, Introduction to Engineering Design, McGraw Hill Learning Solutions, 2008.
6. Otto, Product Design, Pearson Education India, 2001.

Web References

1. https://www.digimat.in/nptel/courses/video/112107217/L01.html
2. https://nptel.ac.in/courses/112/104/112104230/
3. http://www.nptelvideos.com/lecture.php?id=15953
4. https://cosmolearning.org/video-lectures/mod-4-lec-14-product-design-development-8953/
5. https://www.udemy.com/course/product-design/

2.A.8.89

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

2.A.8.90

OPEN ELECTIVE - I

2.A.8.91

Department	Mechatronics	Programme : B.Tech.						
Semester	VII	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23MCDC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Building Automation	3	-	-	3	25	75	100

Prerequisite	Nil	
Course Outcome	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Describe the current philosophy, technology, terminology, and practices used in building automation	K2
	CO2 Compare the different fire standards, FAS Components, FAS loops, Architectures	K2
	CO3 Apply hardware and software for HVAC system	K3
	CO4 Demonstrate energy management system	K3
	CO5 Analyze the new concepts materials of building automation	K4

UNIT - I	**Introduction to BMS and Automation**	**Periods: 09**
Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.		**CO1**

UNIT - II	**FAS and Security Systems**	**Periods: 09**
Fire, Fire modes – Fire Alarm Systems components: Field components, panel components – FAS Architectures – Access Components, Access control system Design - CCTV camera types and operation –camera selection criteria – CCTV Applications. Security Systems Fundamentals: Introduction to Security Systems, Concepts. Perimeter Intrusion: Concept, Components, Technology. Security Design:Concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control – DAC, MAC, RBAC.		**CO2**

UNIT - III	**HVAC System**	**Periods: 09**
Fundamentals: HVAC Fundamentals, Basic Processes (Heating, Cooling etc) Basic Science: Air Properties, Psychometric Chart, Heat Transfer mechanisms. Human Comfort: Human comfort zones, Effect of Heat, Humidity, Heatloss. Processes: Heating Processes (Boiler, Heater),Cooling Process (Chiller), Ventilation Process(Central Fan System, AHU, Exhaust Fans), Unitary Systems(VAV, FCU).Control Theory: Instrumentation Basics, Field components & use, DDC &applications. Control Panel: HVAC Control Panel, MCC Basics, Panel Components.		**CO3**

UNIT - IV	**Energy Management System**	**Periods: 09**
ASHRAE Symbols Energy Management: Energy Savings concept & methods, lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples		**CO4**

UNIT - V	**Building Management System**	**Periods: 09**
IBMS (HVAC, Fire & Security) project cycle, Project steps BMS.Verticals: Advantages & Applications of BMS, Examples Integration: IBMS Architecture, Normal & Emergency operation. Advantages of BMS		**CO5**

Lecture Periods: 45	Tutorial Periods:	Practical Periods: -	Total Periods: 45

Text Books

1.Gerardus Blokdyk "Intelligent Building Automation Systems The Ultimate Step-By-Step Guide "5STARCooks, 2018.

2.A.8.93

2.Phil Zito "Building Automation Systems a to Z: How to Survive in a World Full of Bas "CreateSpace Independent Publishing Platform, 2016

3.Johnson, David. Programmable Controllers for Factory Automation, 2020, CRC Press. Sharma, K. L. S. Overview of industrial process automation, 2016, Elsevie

Reference Books

1. Jim Sinopoli "Smart Buildings", Butterworth-Heinemann imprint of Elsevier,2nd ed.,2010.

2. Albert Ting-Pat So, WaiLok Chan, Kluwer "Intelligent Building Systems" Academicpublisher,3rd ed., 2012.

3. James Sinopoli "Advanced Technology for Smart Buildings" Artech House. – 2016

4. Sibanjan Das, Umit Mert Cakmak "Hands-On Automated Machine Learning: A beginner's guide to building" Packt Publishing Ltd. – 2018

5.Gerard Blokdyk "Building Automation: Quickstart Administration" CreateSpace Independent Publishing Platform, 2017

Web References

1.https://www.youtube.com/watch?v=wNeYPfNV8QI

2. https://nptel.ac.in/courses/108/105/108105063/

3. https://swayam.gov.in/nd1_noc20_me39/preview

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

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

Evaluation Method

Assessment	Internal Assessment Marks (IAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

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2.A.9.24

OPEN ELECTIVE - II

2.A8.96

Department	MBA	Programme : B.Tech.						
Semester	V/ VI	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23HSOC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	INTELLECTUAL PROPERTY RIGHTS	3	0	0	3	25	75	100

(Common to ALL Branches)

Prerequisite	-

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Describe the Concept and Importance of Intellectual Property Rights (IPR).	K2
CO2	Describe the procedures for patent registration, including recognizing legal remedies for infringement.	K3
CO3	Apply copyright laws to hypothetical scenarios involving academic integrity and plagiarism.	K3
CO4	Infer the different types of trademarks and understand the registration process and infringement issues.	K4
CO5	Explain the legalities surrounding industrial designs, geographical indications, and their protection mechanisms.	K2

UNIT - I	Overview of Intellectual Property	Periods: 9
Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Trade Secret – International protection of IPR- Major International conventions and agreements: WTO/TRIPS Agreement, Paris Convention, The Berne Convention, Universal Copyright Convention, WIPO Convention, Madrid Agreement, Nice Agreement and TRIPS Agreement		CO1

UNIT - II	Law of Patents	Periods: 9
Meaning and Nature of Patent - Subject matter of Patent - Registration Procedure, Patentable and Non-patentable Inventions - Process and product Patent, Legal Requirements for Patents – Patent document: Specification and Claims - Granting of Patents - Transfer of Patent rights - Infringement of Patents and Remedies - Evergreening of Patents		CO2

UNIT - III	Law of Copyrights	Periods: 9
Meaning and Nature of Copyright - Subject matter of copyright - Law of Copyrights - Authorship and Ownership of copyright, Registration Procedure, Assignment and Licensing of copyright - Infringement of Copyrights and Remedies - Emerging new trends in Copyrights - Related Rights: Celebrity Rights, Academic Integrity or Plagiarism: An Intellectual Theft - Copyrights with special reference to software.		CO3

UNIT - IV	Law of Trademarks	Periods: 9
Meaning and Nature of Trademarks - Different kinds of Trademarks - Registrable and Non-Registrable Trademarks - Registration of Trademarks - Grounds for refusal of Registration: Absolute Ground and Relative Ground - Assignment and Licensing of trademarks - Infringement, Remedies and Penalties - Offenses relating to Trademarks - Passing off action – Deceptive similarity - Defenses - Emerging New trends in trademarks		CO4

UNIT - V	Other Forms of IPR	Periods: 9
Meaning and nature of Industrial Design - Subject Matter - Procedure for registration - Infringement of Copyrights in designs - Remedies for Infringement - Trade secret Law-Determination of Trade Secret Status - Liability for misappropriations of Trade Secrets- Protection for submission-Trade Secret litigation - Meaning and Nature of Geographical Indication (GI) - Procedure for registration - Infringement of Geographical indication - Remedies for Infringement.		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Nithyananda, K. V. Intellectual Property Rights: Protection and Management, 2nd edition, Cengage Learning India Private Limited, 2019.
2. Neeraj, P., and Khusdeep, D. Intellectual Property Rights, 2nd edition, PHI Learning Private Limited, 2018.

Reference Books

1. Ahuja, V. K. Law Relating to Intellectual Property Rights, 2nd edition, Lexis Nexis, 2017.
2. Bouchoux, Deborah E. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th edition, Cengage Learning, 2013.
3. Ganguli P. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw-Hill Publishing Company; 2022.
4. Jyoti Rattan. Intellectual Property Rights, 2nd edition, Bharat Law House, 2024.
5. Surendra Malik and Sudeep Malik, Supreme Court on Intellectual Property, Eastern Book Company, 2022.

Web References

1. https://www.wipo.int/about-ip/en/
2. https://www.uspto.gov/patents/basics/general-information-patents

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3.	https://www.wto.org/english/tratop_e/trips_e/trips_e.htm
4.	https://www.epo.org/about-us/annual-reports-statistics/annual-report.html
5.	https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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2.A.8.98

Department	MBA	Programme : B.Tech.						
Semester	V/ VI	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23HSOC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	NEW PRODUCT DEVELOPMENT	3	0	0	3	25	75	100
(Common to ALL Branches)								
Prerequisite	-							

		On completion of the course, the students will be able to	BT Mapping (Highest Level)
Course Outcome	CO1	Explain the stages and importance of new product development (NPD) in modern business contexts.	K2
	CO2	Apply market research to identify customer needs and translate them into product specifications.	K3
	CO3	Illustrate the product concepts using screening and scoring techniques to select the most viable option.	K3
	CO4	Examine product prototype that incorporates principles of product architecture and design for manufacturing.	K3
	CO5	Analyze a business plan and market strategy for the successful launch of a new product.	K4

UNIT - I	Introduction to New Product Development	Periods: 9
Introduction to New Product Development (NPD) - Product Development vs New Product Development - Stages of NPD - Role of Innovation and Creativity in NPD - Reverse Engineering and its Application in NPD - Business Models for New Products - Risk Management in New Product Development - Sustainability and Ethical Considerations in NPD		CO1
UNIT - II	**Market Research and Customer Needs**	**Periods: 9**
Identifying Market Opportunities for New Products - Conducting Market Research for NPD - Translating Customer Needs into Product Specifications - Establishing and Refining Product Specifications - Competitive Analysis and Benchmarking in NPD - Tools for Understanding Consumer Behaviour: Surveys, Focus Groups, and Ethnography		CO2
UNIT - III	**Concept Generation and Evaluation**	**Periods: 9**
Concept Generation Process: Continuous and External Idea Sources - Clarifying the Problem and Brainstorming Solutions - Design Thinking for New Products - Techniques for Concept Generation - Systematic Exploration of Concepts - Screening and Scoring Product Concepts - Concept Evaluation and Selection Methods - Prototyping Techniques		CO3
UNIT - IV	**Product Design and Development**	**Periods: 9**
Product Architecture and its role in NPD - Modular vs. Integral Product Architecture - Design for Sustainability - Environmental Considerations - Organizing Product Development Teams - Stages of team Development - Collaboration and Cross - Functional Teams in Product Development - Tools for Effective Product Design - Agile Product Development Methodologies		CO4
UNIT - V	**Launch, Strategy and Commercialization**	**Periods: 9**
Developing a New Product Strategy - Building Market Demand and Entry Strategies for New Products - Developing a New Product Business Plan - Preparing for Market Launch - Post - Launch Evaluation - Product Life Cycle - Continuous Improvement and Future Product Enhancements		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Ulrich KT, Eppinger SD. Product design and development. 7th edition. McGraw-Hill Education; 2020.
2. Crawford CM, Di Benedetto A. New products management. 11th edition. McGraw-Hill Education; 2014.
3. Cooper RG. Winning at new products: Creating value through innovation. 5th edition. Basic Books; 2017.

Reference Books

1. Trott, P. Innovation management and new product development 6th edition. Pearson Education. 2017
2. Thomke, S. Experimentation works: The surprising power of business experiments. Harvard Business Review Press. 2020
3. Blank, S. G., & Dorf, B. The startup owner's manual: The step-by-step guide for building a great company. Wiley. 2020
4. Brown, T. Change by design: How design thinking transforms organizations and inspires innovation. Harper Business. 2009
5. Kelley, T., & Littman, J. The ten faces of innovation: IDEO's strategies for beating the devil's advocate and driving creativity throughout your organization. Currency/Doubleday. 2006

Web References

1. https://conjointly.com/kb/

2.A.8.99

2.	https://www.entrepreneur.com/article/281999
3.	https://www.mindtools.com/pages/article/newSTR_66.htm
4.	https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy
5.	https://www.productplan.com/glossary/product-architecture/
6.	https://hbr.org/2019/09/why-design-thinking-works
7.	https://www.smartsheet.com/new-product-development.
8.	https://www.ptc.com/en/blogs/cad/best-practices-for-developing-new-products

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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2.A.8.100

Department	MBA	Programme : B.Tech.						
Semester	V/ VI	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23HSOC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	FINANCE FOR ENGINEERS	3	0	0	3	25	75	100
(Common to ALL Branches)								
Prerequisite	-							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the objectives, scope, and role of financial management in engineering, and differentiate between profit maximization and wealth maximization.	K2
CO2	Apply the concepts of the time value of money to engineering projects and use investment appraisal techniques such as NPV, IRR, and Payback Period for decision-making.	K3
CO3	Demonstrate the steps in the capital budgeting process and apply techniques like cost-benefit and sensitivity analysis for evaluating engineering projects.	K3
CO4	Analyze financial statements, including balance sheets and income statements, from an engineering perspective, and evaluate financial ratios to assess the financial performance of engineering projects.	K4
CO5	Analyze different types of costs, such as fixed, variable, and marginal costs, and evaluate cost-benefit analysis and break-even analysis for engineering decision-making.	K4

UNIT - I	**Introduction to Financial Management**	**Periods: 9**
Overview of Financial Management: Objectives, Scope, and Role in Engineering - Financial Planning and Strategy: Short-Term and Long-Term Planning - Basic Concepts: Profit Maximization vs Wealth Maximization - Role of Engineering Managers in Financial Decision - Making, Relationship between Finance and Other Engineering Disciplines.		CO1
UNIT - II	**Time Value of Money and Investment Decisions**	**Periods: 9**
Time Value of Money: Concept, Importance and Applications in Engineering Project, Present Value and Future Value Calculations - Investment Appraisal Techniques: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR) (Theory only) and Profitability Index (PI) - Risk Analysis in Investment Decision Making.		CO2
UNIT - III	**Capital Budgeting for Engineering Projects**	**Periods: 9**
Capital Budgeting Process: Steps and Key considerations, Techniques for Evaluating Engineering Project, Cash-Flow Estimation for Project, Cost - Benefit Analysis in Engineering Project, Sensitivity Analysis, and Decision Trees for Project Evaluation.		CO3
UNIT - IV	**Financial Statements and Ratio Analysis**	**Periods: 9**
Introduction to Financial Statements: Balance Sheet, Income Statement, and an Engineering Perspective on Financial Statement Interpretation - Financial Ratios: Liquidity, Profitability - Engineering Case Studies on Financial Performance Evaluation - Limitations of Ratio Analysis in Engineering Projects.		CO4
UNIT - V	**Cost Estimation and Engineering Economic Analysis**	**Periods: 9**
Introduction to Cost Estimation in Engineering - Types of Costs: Fixed, Variable, Marginal, and Sunk Costs, Cost-Benefit Analysis in Engineering Projects, Break-Even Analysis and Its Application in Engineering Decision Making - Engineering Economic Analysis: Replacement Analysis.		CO5

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Sullivan WG, Wicks EM, Koelling CP. Engineering Economy. 17th edition. Pearson; 2020.
2. Brealey RA, Myers SC, Allen F. Principles of Corporate Finance. 19th edition. McGraw-Hill Education; 2022.
3. Brigham EF, Houston JF. Fundamentals of Financial Management. 15th edition. Cengage Learning; 2019.

Reference Books

1. Ranganath BJ, Sinha KK. Financial Management for Engineers. 4th edition. Vikas Publishing House; 2018.
2. Crundwell F. Finance for Engineers: Evaluation and Funding of Capital Projects. Springer; 2017.

Web References

1. https://www.netsuite.com/portal/resource/articles/financial-management/financial-management.shtml
2. https://www.investopedia.com/ask/answers/033015/why-time-value-money-tvm-important-concept-investors.asp

2. A.S.101

3. https://omnicard.in/blogs/capital-budgeting-24042024
4. https://www.linkedin.com/pulse/role-capital-budgeting-process-engineering-studies-ashraf
5. https://corporatefinanceinstitute.com/resources/accounting/financial-ratios/
6. https://www.dau.edu/acquipedia-article/engineering-cost-estimation-method

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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2.A.8.102

Department	MBA	Programme : B.Tech.						
Semester	V/ VI	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23HSOC04	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	ECONOMICS FOR ENGINEERS	3	0	0	3	25	75	100
(Common to ALL Branches)								
Prerequisite	-							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 **Interpret** principles of managerial economics to real-world scenarios, utilizing demand analysis and forecasting techniques.	K2
	CO2 **Discuss** production functions and cost structures to **evaluate** their impact on managerial decision-making and market strategies.	K2
	CO3 **Examine** various market structures and pricing strategies, **synthesizing** their effects on market behavior and competitive dynamics.	K3
	CO4 **Apply** macroeconomic policies and their implications on business cycles, investment decisions, and economic stability.	K3
	CO5 **Analyze** recent economic trends, such as technological advancements and income inequality.	K4

UNIT - I	Introduction to Managerial Economics	Periods: 9
Managerial Economics: Meaning, Scope, and Importance - Functions of a Managerial Economist - Demand Analysis: Law of Demand, Elasticity of Demand, Law of Supply, Elasticity of supply and Market Equilibrium - Comparative statistics: Shift of a curve and movement along with the curve - Demand Forecasting: Criteria for Effective Forecasting - Qualitative Methods - Quantitative Methods.		CO1

UNIT - II	Production Function and Cost Concepts	Periods: 9
Production Function: Meaning, Types, Applications in Managerial Decision Making - Law of variable proportion and law of returns to scale - ISO Quants - Producer Surplus: Price ceiling and price floor - Cost concept: Types of Costs - Total, average and marginal cost - Revenue Concepts: Total Revenue (TR) - Marginal Revenue (MR) and Average Revenue (AR).		CO2

UNIT - III	Market Structure	Periods: 9
Market structure: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly - Pricing policies: Cost-Based Pricing, Demand - Based Pricing, Competition - Based Pricing, Psychological Pricing, Geographical Pricing, Dynamic Pricing, Bundle Pricing, Price Discrimination, Premium Pricing and practices.		CO3

UNIT - IV	Macroeconomics	Periods: 9
Globalization and Economic Policies - National Income Concepts: Methods of measuring national income - circular flow of income - Monetary policy and Fiscal Policy - Business Cycles concepts - Inflation, deflation and its types - Foreign Direct Investment (FDI) - Foreign Institutional Investment (FII).		CO4

UNIT - V	Recent Trends in Economics	Periods: 9
Digital Economy : E-commerce, Fintech, and Online Services - Role of Technology : Big Data, Artificial Intelligence and Automation in Economic Decision-Making - Gig Economy : Growth of Freelance and Contract Work - Impact on Global Economies - Income In - equality : Causes, Effects, and Socio - political Impact		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Samuelson, William F., and Marks, Stephen G. Managerial Economics: Theory, Applications, and Cases, 10th edition, Wiley, 2020.
2. Ahuja, H. L. Principles of Managerial Economics, 7th edition, Tata McGraw-Hill, 2017
3. Mithani, D. M. Managerial Economics, 3rd edition., Himalaya Publishing House,2021.

Reference Books

1. Varian, Hal R. Intermediate Microeconomics: A Modern Approach, 9th edition., W.W. Norton & Company, 2014.
2. Brickley, James A., Smith Jr., Clifford W., and Zimmerman, Jerold L. Managerial Economics and Organizational Architecture, 7th edition., McGraw-Hill Education, 2016.
3. Samuelson, Paul, and Nordhaus, William. Economics, 20th edition., McGraw-Hill Education, 2019.
4. Schiff, Peter, and Schotter, Andrew J. Introduction to Microeconomics, 3rd edition., Cengage Learning, 2012.
5. Moore, James C. Economic Theory and Operations Analysis, 2nd edition., Academic Press, 1970.

Web References

1. https://www.jaroeducation.com/blog/nature-and-types-of-managerial-economics/

2.A.8.103

2.	https://psu.pb.unizin.org/introductiontomicroeconomics/chapter/chapter-6-costs-and-production/
3.	https://corporatefinanceinstitute.com/resources/economics/market-structure.
4.	https://www.britannica.com/money/macroeconomics
5.	https://www2.deloitte.com/us/en/insights/economy/global-economic-outlook/weekly-update.html

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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2. A.8.104

Department	MBA	Programme : B.Tech.						
Semester	V/ VI	Course Category: OE			End Semester Exam Type: TE			
Course Code	U23HSOC05	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	MARKETING MANAGEMENT	3	0	0	3	25	75	100
(Common to ALL Branches)								
Prerequisite	-							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the importance of marketing and differentiate between marketing and selling.	K2
CO2	Apply the consumer decision-making process and differentiate between industrial and consumer buying behavior.	K3
CO3	Examine product life cycle management strategies and demonstrate the steps involved in new product development.	K3
CO4	Illustrate the role of distribution channels and design an effective channel distribution strategy for both consumer and industrial goods.	K3
CO5	Analyze emerging trends in marketing, including Customer Relationship Management and experiential marketing strategies.	K4

UNIT - I	Introduction to Marketing	Periods: 9
Marketing - Importance of Marketing - Difference between Marketing and Selling - Marketing Environment: The Macro and Micro Environment factors, Importance of environment analysis – Strategic Marketing planning: Introduction, Need, Framework of Strategic planning process and Steps in strategic planning - Ethical and Social Responsibility of Marketing - 4 Ps of Marketing		CO1

UNIT - II	Consumer Behaviour and Marketing Strategy	Periods: 9
Role of buyer - Types of Buying behavior - Factors influencing buying decisions - Consumer decision making process: Meaning and Steps in Consumer decision making Process – Organizational buying behaviour: Classification of organizational markets, Characteristics, Difference between Industrial and Consumer buying - Market Segmentation - Needs, Classification and Significance – Targeting, Positioning and Competitive Strategies.		CO2

UNIT - III	Product and Pricing Mix	Periods: 9
Product classifications - Product Life cycle - Strategies for managing Product Life cycle – Categories of New product, Importance and Steps in New Product Development – Packaging: Need for packaging, Essential qualities of packaging, kinds of packaging and advantages of packaging – Labelling: Functions, Types of labelling, advantages and disadvantages of labelling – Pricing objectives – Pricing strategies		CO3

UNIT - IV	Place and Promotion Mix	Periods: 9
Distribution Channel and Physical distribution: Meaning and Importance of distribution channel - Channel design decisions – Channels of distribution for consumer and industrial goods – Physical Distribution: Meaning, Objectives and components of physical distribution - Promotion: Objectives, Types of sales promotion: Consumer, Salesperson and Dealer sales promotion – Introduction to Integrated Marketing Communication		CO4

UNIT - V	Trends in Marketing	Periods: 9
Emerging trends in Marketing - Customer Relationship Management: Definition, features, Types and importance - Experiential Marketing: Meaning, strategies and benefits - Mobile Marketing: Definition and types of mobile marketing - Digital Marketing: Meaning, types of digital marketing – Inbound marketing: Meaning, fundamentals and difference between inbound and outbound marketing - Marketing Analytics: Meaning, importance, metrices of marketing analytics – An overview of Sustainable Marketing		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Keller, Philip and Kevin Lane Kotler "Marketing Management" 16th Edition, Pearson Education Limited, 2022.
2. V.S.Ramaswamy, S.Namakumari, 6th Edition, Sage Publications India Pvt Ltd, 2018

Reference Books

1. Prachi Gupta, Ashita Aggarwal, et al. "Marketing Management: Indian Cases" Pearson Education Limited, 2024
2. Arunkumar, Meenakshi.N, "Marketing Management" 3rd Edition, Vikas Publishing House, 2016

3. Rajan Saxena, "Marketing Management" 5th Edition, MacGraw Hill Publications, 2017
Web References
1. https://www.ama.org/
2. https://www.marketingprofs.com/
3. https://indianjournalofmarketing.com/
4. http://www.publishingindia.com/ijamm/
5. https://onlinecourses.swayam2.ac.in/imb20_mg36/preview

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

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

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2.A.8.106

ANNEXURE-IV

2.A.8.107

Batch : 2022 - 2026

Year/Sem: III / V

Name of the Open Elective:II Conventional and Non–Conventional Energy Sources

Subject Code: U20EEO503

Name list

S.NO	E.R.No.	Reg.No.	Name	Sec
1	221784	22UMT001	ABILASH G S	A
2	221962	22UMT002	ADHITYA R	A
3	221127	22UMT003	ALWINE CANDIDA R	A
4	221523	22UMT004	ARAVINDAN K	A
5	220947	22UMT005	AVINASH R	A
6	221645	22UMT006	CHANDRESH KUMAR RAJ J	A
7	220825	22UMT007	CHANDRU R	A
8	220529	22UMT008	DEEPAK M	A
9	221314	22UMT009	DHILIPKUMAR T	A
10	220463	22UMT010	DHINESH BABU E	A
11	221379	22UMT011	DHYANESHWAR H	A
12	221446	22UMT012	GANESHKUMAR S	A
13	221711	22UMT013	KAILASANATHAN D	A
14	222034	22UMT014	KAVYA M	A
15	220383	22UMT015	LOGARANJAN M	A
16	220854	22UMT016	MOHAMAD FAZIL J	A
17	221701	22UMT017	MOHAMED RIYAS M	A
18	220759	22UMT018	MONISHKUMAR N	A
19	222058	22UMT019	NAMIDHA S	A
20	221467	22UMT020	NARESH M	A
21	221106	22UMT021	NITHISH KUMAR E	A
22	221746	22UMT022	PRABANDHAN T	A
23	220834	22UMT023	ROHITH B	A
24	222134	22UMT024	SAI VISHVA V	A
25	222033	22UMT025	SANTHOSH A	A
26	220676	22UMT026	SENTHIL NATHAN A	A
27	221997	22UMT027	SREE VARSHAN S	A
28	220555	22UMT028	SUTHARSAN S	A
29	220837	22UMT029	SWAMINATH R	A
30	222070	22UMT030	THANESH T	A
31	221259	22UMT031	THIRUMURUGAN S	A
32	220402	22UMT032	VIGNESH S	A
33	222012	22UMT033	VIJAY @ ADHITHIYA S	A
34	220966	22UMT034	VIJAYA DURGA R	A
35	230460	22MTL001	ADHITHYARAJ D	A
36	230043	22MTL002	ANUSH RAGHAV V	A
37	231438	22MTL003	BHARANEEDHARAN K	A
38	230049	22MTL004	HARISH SEN S V	A
39	231155	22MTL005	KABILAN I	A
40	230028	22MTL006	KALIMUTHU C	A
41	230037	22MTL007	NARESH B	A
42	230036	22MTL008	RAJKUMAR B	A
43	230039	22MTL009	RITHICK ROSAN A	A
44	230038	22MTL010	SURYA K	A
45	230785	22MTL011	VIGNESH M	A

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF MECHATRONICS

ODD SEMESTER – JULY 2024 to NOVEMBER- 2024

Batch : 2022-2026 **Year/Sem: III / V**

S.NO	Name of the OPEN Elective Courses	Course Code	No of students opted
1	**Conventional and Non–Conventional Energy Sources**	**U20EEO503**	45
Total no of students			45

Class Advisor
(Mr.S.Pushparaj)

Programme Academic Coordinator
(Mr.S.Jagan)

HOD
(Dr.G.BalaMuruga MohanRaj)

Dean Academic
(Dr.S.Anbumalar)

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

DEPARTMENT OF MECHATRONICS

DETAILS OF PROFESSIONAL ELECTIVE COURSE

Batch : 2022 - 2026 **Year/Sem: III / V**

Name of the Professional Elective:II Automotive Electronics

Subject Code: U20MCE508

S.NO	E.R.No.	Reg.No.	Name	Sec
1	221784	22UMT001	ABILASH G S	A
2	221962	22UMT002	ADHITYA R	A
3	221127	22UMT003	ALWINE CANDIDA R	A
4	221523	22UMT004	ARAVINDAN K	A
5	220947	22UMT005	AVINASH R	A
6	221645	22UMT006	CHANDRESH KUMAR RAJ J	A
7	220825	22UMT007	CHANDRU R	A
8	220529	22UMT008	DEEPAK M	A
9	221314	22UMT009	DHILIPKUMAR T	A
10	220463	22UMT010	DHINESH BABU E	A
11	221379	22UMT011	DHYANESHWAR H	A
12	221446	22UMT012	GANESHKUMAR S	A
13	221711	22UMT013	KAILASANATHAN D	A
14	222034	22UMT014	KAVYA M	A
15	220383	22UMT015	LOGARANJAN M	A
16	220854	22UMT016	MOHAMAD FAZIL J	A
17	221701	22UMT017	MOHAMED RIYAS M	A
18	220759	22UMT018	MONISHKUMAR N	A
19	222058	22UMT019	NAMIDHA S	A
20	221467	22UMT020	NARESH M	A
21	221106	22UMT021	NITHISH KUMAR E	A
22	221746	22UMT022	PRABANDHAN T	A
23	220834	22UMT023	ROHITH B	A
24	222134	22UMT024	SAI VISHVA V	A
25	222033	22UMT025	SANTHOSH A	A
26	220676	22UMT026	SENTHIL NATHAN A	A
27	221997	22UMT027	SREE VARSHAN S	A
28	220555	22UMT028	SUTHARSAN S	A
29	220837	22UMT029	SWAMINATH R	A
30	222070	22UMT030	THANESH T	A
31	221259	22UMT031	THIRUMURUGAN S	A
32	220402	22UMT032	VIGNESH S	A
33	222012	22UMT033	VIJAY @ ADHITHIYA S	A
34	220966	22UMT034	VIJAYA DURGA R	A
35	230460	22MTL001	ADHITHYARAJ D	A
36	230043	22MTL002	ANUSH RAGHAV V	A
37	231438	22MTL003	BHARANEEDHARAN K	A
38	230049	22MTL004	HARISH SEN S V	A
39	231155	22MTL005	KABILAN I	A
40	230028	22MTL006	KALIMUTHU C	A
41	230037	22MTL007	NARESH B	A
42	230036	22MTL008	RAJKUMAR B	A
43	230039	22MTL009	RITHICK ROSAN A	A
44	230038	22MTL010	SURYA K	A
45	230785	22MTL011	VIGNESH M	A

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF MECHATRONICS

DETAILS OF PROFESSIONAL ELECTIVE COURSES

ODD SEMESTER – JULY 2024 to NOVEMBER- 2024

Batch : 2022-2026 **Year/Sem: III / V**

S.NO	Name of the Professional Elective Courses	Course Code	No of students opted
1	**Automotive Electronics**	**U20MCE508**	45
Total no of students			45

Class Advisor
(Mr.S.Pushparaj)

Programme Academic Coordinator
(Mr.S.Jagan)

HOD
(Dr.G.BalaMuruga MohanRaj)

Dean Academic
(Dr.S.Anbumalar)

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Department of Mechatronics

NPTEL NAME LIST

Batch : 2022 – 2026 **Year / Sem / Sec : III / V / A**

S.No.	Enroll No	Reg. No.	Name of the Student	Name of the Course	Duration
1.	221784	22UMT001	ABILASH.G.S	Power Plant Engineering	8 Weeks
2.	220825	22UMT007	CHANDRU.R	Product Design and Development	4 Weeks
3.	221314	22UMT009	DHILIPKUMAR.T	Python for Data Science	4 Weeks
4.	221446	22UMT012	GANESHKUMAR.S	Power Plant Engineering	8 Weeks
5.	220854	22UMT016	MOHAMAD FAZIL.J	Power Plant Engineering	8 Weeks
6.	221701	22UMT017	MOHAMED RIYAS.M	Power Plant Engineering	8 Weeks
7.	220834	22UMT023	ROHITH.B	Product Design and Development	4 Weeks
8.	222134	22UMT024	SAI VISHVA.V	Power Plant Engineering	8 Weeks
9.	222033	22UMT025	SANTHOSH.A	Introduction to Machine Learning	8 Weeks
10.	220676	22UMT026	SENTHIL NATHAN.A	Robotics	8 Weeks
11.	220837	22UMT029	SWAMINATH.R	Robotics	8 Weeks
12.	220402	22UMT032	VIGNESH.S	Power Plant Engineering	8 Weeks
13.	222012	22UMT033	VIJAY @ ADHITHIYA.S	Energy Conversion and Technologies	8 Weeks
14.	230460	22MTL001	ADHITHYARAJ.O	Product Design and Development	4 Weeks
15.	230043	22MTL002	ANUSH RAGHAV.V	Robotics	8 Weeks
16.	231438	22MTL003	BHARANEEDHARAN.K	Robotics	8 Weeks
17.	230028	22MTL006	KALIMUTHU.C	Robotics	8 Weeks
18.	230037	22MTL007	NARESH.B	Robotics	8 Weeks
19.	230036	22MTL008	RAJKUMAR.B	Robotics	8 Weeks
20.	230039	22MTL009	RITHICH ROSAN.A	Robotics	8 Weeks
21.	230038	22MTL010	SURYA.K	Robotics	8 Weeks
22.	230785	22MTL011	VIGNESH.M	Robotics	8 Weeks

Class Advisor **Head of the Department** **Dean Academics**

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF MECHATRONICS

NPTEL STUDENTS LIST

Year/Semester: IV/VII **Batch**: 2021 - 2025

S.No	Name of the Student	Roll no.	Name of the course studied	No. of weeks
1.	Adhavan P	21UMT002	Manufacturing Processes Casting and Joining	4
2.	Amarnaath S	21UMT003	Manufacturing Processes Casting and Joining	4
3.	Anuja K	21UMT004	Manufacturing Processes Casting and Joining	4
4.	Arjun T	21UMT005	Manufacturing Processes Casting and Joining	4
5.	Arun Prakash N A	21UMT006	Manufacturing Processes Casting and Joining	4
6.	Balajishree T	21UMT009	Manufacturing Processes Casting and Joining	4
7.	Bruno Anto E	21UMT011	Manufacturing Processes Casting and Joining	4
8.	Deepak Alex Thomas	21UMT013	Manufacturing Processes Casting and Joining	4
9.	Gokul M S	21UMT015	Product Design and Development	4
10.	Gokulavasan B	21UMT016	Manufacturing Processes Casting and Joining	4
11.	Gunaseelan N	21UMT017	Manufacturing Processes Casting and Joining	4
12.	Hariharan N	21UMT018	Manufacturing Processes Casting and Joining	4
13.	Harishwar B	21UMT019	Manufacturing Processes Casting and Joining	4
14.	Harishwaran S	21UMT020	Manufacturing Processes Casting and Joining	4
15.	Jeevabaskar A	21UMT023	Manufacturing Processes Casting and Joining	4
16.	Krishnakanth A	21UMT025	Manufacturing Processes Casting and Joining	4
17.	Maria Jeffrey S	21UMT026	Product Design and Development	4
18.	Mathews Talma A	21UMT027	Manufacturing Processes Casting and Joining	4

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19.	Navin Kumar A	21UMT028	Manufacturing Processes Casting and Joining	4
20.	Puzaghendi A	21UMT030	Manufacturing Processes Casting and Joining	4
21.	Ruthresh A	21UMT032	Introduction to IOT	8
22.	Sathiya S	21UMT033	Manufacturing Processes Casting and Joining	4
23.	Shakthivelu D	21UMT034	Manufacturing Processes Casting and Joining	4
24.	Sneha S	21UMT035	Manufacturing Processes Casting and Joining	4
25.	Vimalraj V	21UMT037	Manufacturing Processes Casting and Joining	4
26.	Yuvaraj Sellappa V	21UMT038	Manufacturing Processes Casting and Joining	4
27.	Chandru M	21MTL002	Product Design and Development	4
28.	Padmesh @ Bharatwaaj	21UMT004	Manufacturing Processes Casting and Joining	4

Class Advisor **Head of the Department** **Dean Academics**

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ANNEXURE-V

2.A.8.117

EXAMINER DETAILS
DEPARTMENT OF MECHATRONICS

S.NO	NAME	DESIGNATION	COLLEGE	CONTACT DETAILS
1	Dr. A. Murugan	Professor	Rajiv Gandhi College of Engineering and Technology, Puducherry,	Email: a_murugaa@rediffmail.com, Cell No: 9865522519.
2	Mr.D.George Oliver	Assistant Professor	CK College of Engineering and Technology,	Phone Number:9944026635 Email: dgoame@gmail.com
3	Dr.P.Lakshmikanthan	Assistant Professor	University College of Engineering Panruti	Email:lakanpec@gmail.com Mobile:9994190113
4	Dr.Krishnamoorthy Ramalingam	Assistant Professor	C.K College of Engineering &Technology	E-mail ID : kskrishnamech@gmail.com Mobile number : 9698922334
5	Dr.J. Prakash	Associate Professor,	Suriya Group of Institutions	Email ID:prakashphdjuly2014@gmail.com Mobile Number: 9789878126
6	Dr. G. Paramaguru	Associate Professor	Surya Group of Institutions,Villupuram	Email ID: paramaguru2020@gmail.com Contact No: 9786171968
7	Dr.G.Mohan	Assistant Professor	University college of Engineering Villupuram.	Email ID: mohang3004@gmail.com Contact No: 9486076394
8	Dr. K.Rajmohan	Assistant Professor	University college of Engineering Panruti	Email ID: rajnvl74@gmail.com Contact No: 9894102756
9	Dr.D.Mala	Assistant Professor	University college of Engineering Panruti	E-Mail ID: mala_lingam@yahoo.com Contact No: 8903804130
10	Dr.M.Loganathan	Professor	Annamalai University Chidambaram	Email ID: marimuthuloganathan@gmail.com Contact No: 9444049896
11	Dr.M.Purusothaman	Associate Professor	Sathyabama Institute of Science and Technology, Chennai	Email ID: purusothmani@gmail.com Contact No: 9042220783.
12	Dr.S.Muthukumaran	Assistant Professor	University college of Engineering Panruti	mkumaran.auttpc@gmail.com Contact No: 9486830689
13	Dr.K.Arun	Assistant Professor	University College of Engg, Villupuram	E-mail ID : arun.piping@gmail.com Mobile number : 9500641297
14	Mr.V.Karthikeyan	Assistant Professor	Sri venkateshwaraa College of Engineering & Technology, Ariyur, Pondicherry	Mail id: mail2karthikeyan.v@gmail.com Mobile: 9790578103
15	Dr.C.Subramaniyan	Associate Professor	V.R.S College of Engineering and Technology, Villupuram	E-mail ID : subuarchume2001@gamil.com Mobile number: 9443539356
16	Dr.P.Prakash	Assistant Professor	University College of Engg, Villupuram	Email ID: prakashtmk2002@gmail.com Mobile Number: 9788042104

HOD/MCTR

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF MECHATRONICS

MECHATRONICS OFFERING COMMON COURSES

S.No	Offering	Course code	Course Name	Sem	Department
1	MCTR	U23MCDC01	Automation in Manufacturing Systems	VII	MCTR
				V	MECH
2	MCTR	U23MCDC02	Building Automation	VII	MCTR
				V	ICE
				VI	MECH
3	MCTR	U23MCDC03	Non Destructive Testing	VIII	MCTR.
				VII	EEE,ECE,ICE&MECH
4	MCTR	U23MCDC04	Robots and Systems in Smart Manufacturing	VIII	MCTR
				VII	MECH
5	MCTR	U23MCDC05	Simulation and Modeling of manufacturing system	VIII	MCTR
				VII	MECH

HoD/MCTR

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