203200101 - Research Methodology & IPR

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Knowledge of Electronics and Communication Systems and Technologies. Basic Computer Skills Fundamental Knowledge of Area of Interest in relevant discipline.	
Course Objective	The objective of the course is intended to develop the research skills in a systematic manner which will impart the ability to select appropriate research methodology, experimental design, follow professional ethics and academic integrity, and develop oral and written presentation skills.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
2	0	0	2.00	60	20	-	-	100

SEE *- Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.	5	20
2	**Unit 2** Effective literature studies approaches, analysis Plagiarism, Research ethics,	5	15
3	**Unit 3** Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	5	15
4	**Unit 4** Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	5	20
5	**Unit 5** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	5	15
6	**Unit 6**	5	15

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.		
	Total	**30**	**100**

Reference Books

1.	**Intellectual Property Rights Under WTO** T. Ramappa; S. Chand, 2008
2.	**Research methodology: an introduction for science & engineering students** Stuart Melville and Wayne Goddard; Juta & Co Ltd
3.	**Research Methodology: An Introduction** Wayne Goddard, Stuart Melville; Juta and Company Ltd, 2004
4.	**Research Methodology : A Step by Step Guide for Beginners** Ranjit Kumar; PEARSON; 3rd
5.	**Resisting Intellectual Property** Halbert; Taylor & Francis Ltd., 2007
6.	**Industrial Design** Mayall; McGraw Hill, 1992
7.	**Product Design** Niebel; McGraw Hill, 1974
8.	**Introduction to Design** Asimov; Prentice Hall, 1962
9.	**Intellectual Property in New Technological Age** Robert P. Merges, Peter S. Menell, and Mark A. Lemley; 2016

Course Outcome

After Learning the Course the students shall be able to:

At the end of this course, students will be able to
1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

203200102 - English for Research Paper Writing

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Basic Knowledge about sentence formation using different words in present, past tenses and future time. Also, basic knowledge on use of suitable nouns, adjectives, verbs, preposition, etc.	
Course Objective	To provide a better insight for the effective use of grammar knowledge especially in writing and to put their own thoughts in to writing	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	Tutorial	Lab	Credit	T	T	P	P	
2	0	0	0.00	60	20	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	5	16
2	**Unit 2** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts., Introduction	5	17
3	**Unit 3** Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	5	17
4	**Unit 4** Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.	5	17
5	**Unit 5** Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.	5	16
6	**Unit 6** Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.	5	16
	Total	30	99

Reference Books	
1.	**Writing for Science** Goldbort R; Springer
2.	**How to Write and Publish a Scientific Paper** Day R; Cambridge University Press
3.	**Handbook of Writing for the Mathematical Sciences** Highman N; SIAM. Highman's book
4.	**English for Writing Research Papers** Adrian Wallwork; Springer New York Dordrecht Heidelberg London,; 2011

203200103 - Disaster Management

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Basics related to the disaster.	
Course Objective	To prepare for a leadership role in disaster management or the humanitarian field with in depth knowledge of resilience and risk reduction.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
2	0	0	0.00	60	20	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	5	17
2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss OfHuman And Animal Life, Destruction Of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	5	17
3	**Disaster Prone Areas In India:** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.	5	17
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	5	17
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's, Participation In Risk Assessment. Strategies for Survival.	5	16
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	5	16
	Total	30	100

Reference Books

1.	**Disaster Management in India: Perspect ives, issues and strategies** R. Nishith, Singh AK; 'New Royal book Company.
2.	**Disaster Mitigation Experiences And Reflections** Sahni, Pardeep Et.Al. (Eds.); Prentice Hall Of India, New Delhi.
3.	**Disaster Administration And Management Text And Case Studies** Goel S. L.,; Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Outcome

After Learning the Course the students shall be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response

2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives

3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations

4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

203200104 - Sanskrit for Technical Knowledge

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	-	
Course Objective	To learn Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power and also will help scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
2	0	0	0.00	60	20	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** • Alphabets in Sanskrit • Past/Present/Future Tense • Simple Sentences	10	33
2	**Unit 2** • Order • Introduction of roots • Technical information about Sanskrit Literature	10	33
3	**Unit 3** • Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	10	34
	Total	30	100

Reference Books

1.	**Abhyaspustakam** Dr.Vishwas; Samskrita-Bharti Publication, New Delhi
2.	**Teach Yourself Sanskrit** Prathama Deeksha-Vempati Kutumbshastri; Rashtriya Sanskrit Sansthanam, New Delhi Publication
3.	**India's Glorious Scientific Tradition** Suresh Soni; Ocean books (P) Ltd., New Delhi

Course Outcome
After Learning the Course the students shall be able to:
1. Understanding basic Sanskrit language 2. Ancient Sanskrit literature about science & technology can be understood 3. Being a logical language will help to develop logic in students

203200105 - Value Education

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	-	
Course Objective	This course prepares the students to understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
2	0	0	0.00	60	20	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** • Values and self-development: Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgments	6	20
2	**Unit 2** • Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, • Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism.Love for nature, Discipline	8	27
3	**Unit 3** • Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	8	27
4	**Unit 4** • Character and Competence Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence, Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	8	27
	Total	30	101

Reference Books	
1.	**Values and Ethics for organizations Theory and practice** Chakroborty, S.K.; Oxford University Press, New Delhi, 1999

Course Outcome
After Learning the Course the students shall be able to:
After Learning the course the students shall be able to: 1. Knowledge of self-development 2. Learn the importance of Human values 3.Develop the overall personality

203200151 - Constitution of India

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
-	2	-	0.00	-	-	-	40	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

203200152 - Pedagogy Studies

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
-	2	-	0.00	-	-	-	40	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit-1: Introduction and Methodology** Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education Conceptual framework, Research questions Overview of methodology and Searching	4	25
2	**Unit-2: Thematic overview** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries Curriculum, Teacher education.	2	13
3	**Unit-3: Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage** Quality assessment of included studies. How can teacher education (curriculum and practicum) andthe school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies	4	25
4	**Unit-4: Professional development** Alignment with classroom practices and follow-up support, Peer support Support from the head teacher and the community Curriculum and assessment Barriers to learning: limited resources and large class sizes	4	25
5	**Unit-5: Research Gaps**	2	12

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Research gaps andfuture directions, Research design, Contexts Pedagogy, Teacher education,Curriculum and assessment, Dissemination and research impact.		
	Total	**16**	**100**

203200153 - Stress Management by Yoga

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	Knowledge of Sanskrit & different languages to learn from different holy books	
Course Objective	Students will be able to manage the stress.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**T**	**T**	**P**	**P**	**Total Marks**
-	2	-	0.00	-	-	-	40	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** Definitions of Eight parts of yog. (Ashtanga)	8	33
2	**Unit 2** Yam and Niyam. Do`s and Donts in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8	34
3	**unit 3** Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8	33
	Total	24	100

Reference Books

1.	**Yogic Asanas for Group Tarining-Part-I** Janardan Swami; Yogabhyasi Mandal, Nagpur
2.	**Raja-Yoga; Or, Conquering the Internal Nature** Swami Vivekananda

Course Outcome
After Learning the Course the students shall be able to:
1. Develop healthy mind in a healthy body thus improving social health 2. Improve efficiency

203200154 - Personality Development through Life Enlightenment Skills

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	The course provides details of personality development using study of Srimad Bhagavad Gita.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
-	2	-	0.00	-	-	-	40	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit 1** Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52,53,59 (donts) Verses- 71,73,75,78 (dos)	8	33
2	**Unit 2** Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	8	34
3	**Unit 3** Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 Verses 37,38,63	8	33
	Total	24	100

Reference Books	
1.	**Srimad Bhagavad Gita** Swarupananda, Swami; Advaita Ashrama
2.	**Bhartrihari's Three Satakam (Niti-sringar-vairagya)** P.Gopinath, Rashtriya Sanskrit Sansthanam; Rashtria Sanskrit Sansthan

Course Outcome

After Learning the Course the students shall be able to:
1. Develop his personality and achieve the highest goal in life with study of Shrimad-Bhagwad-Geeta. 2. Lead the nation and mankind to peace and prosperity after studying Geeta. 3. Develop versatile personality with the study of Neetishatakam.

203230101 - Fundamentals of Mechatronics Engineering

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Fundamentals of Mechatronics Engineering typically include a foundation in basic mathematics, physics, and electronics. Familiarity with mechanics, control systems, and programming languages.	
Course Objective	The rationale of pursuing an M.Tech in Robotics Engineering lies in addressing complex societal and industrial challenges through the integration of advanced robotics technologies for automation, efficiency, and innovation.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	Tutorial	Lab	Credit	T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Mechatronics** Definition of Mechatronics, Key elements of a mechatronic system, Electronics, Digital control, Information technology, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach	10	20
2	**Fundamentals of Electronics** Introduction, Number systems, Karnaugh maps and logic design, Combinational logic modules, Sequential logic components, Applications of digital systems, Amplifiers, the ideal operational amplifier model, the inverting and non-inverting amplifier, summing amplifier, difference amplifier, instrumentation amplifier, integrator amplifier, differentiator amplifier, comparator, sample and hold amplifier, filters.	12	25
3	**Electrical and Mechanical Actuator System** Introduction, moving-iron transducers, solenoids, relays, electric motors, direct current motors, dynamic model and control of d.c. motors, the servo motor, the stepper motor, mechanical elements, kinematic chains, cam mechanisms, gears, hydraulic and pneumatic actuators.	11	30
4	**Data Conversion Device** Sensors, micro sensors, transducers, signal processing devices, introduction to microprocessors, microcontrollers and PLC.	8	15
5	**Case Studies** A PC based computer numerically controlled drilling machine, A robotic arm	4	10
	Total	45	100

Reference Books

1.	**Mechatronics Principles and Applications** Godfrey Onwubolu, Professor of Engineering
2.	**Mechatronic Systems: Fundamentals** R. Iserman; Springer; 1st Edition, 2005
3.	**Computer automation in manufacturing - an Introduction** T.O. Boucher; Chapman and Hall, 1996
4.	**Machine design for mobile and industrial applications** G.W. Kurtz, J.K. Schueller, P.W. Claar. II; SAE, 1994

List of Practical

1.	**To study about Mechatronics Engineering**
2.	**To study and perform assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion**
3.	**To study and perform assembly language programming of 8051 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion**
4.	**To interface stepper motor**
5.	**To study and control speed of DC motor.**
6.	**To study of various types of transducers.**
7.	**To study of hydraulic, pneumatic and electro-pneumatic circuits.**
8.	**Modelling and analysis basic hydraulic, pneumatic and electrical circuits using software.**
9.	**To study and perform basic PLC programming and its applications**
10.	**To study of image processing**

Course Outcome

After Learning the Course the students shall be able to:

1. Gain knowledge of basic mechanical designing, electrical wiring, robotic sensors and actuators, PCB design and communication protocols.
2. Gain an understanding of the theoretical background necessary to understand advanced robotic technologies and their specific applications.
3. Demonstrate proficiency in design, construction, and operation of robotic systems.
4. Develop problem-solving skills by applying principles of robotics engineering to real-world problems.
5. Communicate effectively about robotics engineering technologies, their workings and potential applications.

203230102 - Manufacturing Automation

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Basic knowledge of Manufacturing.	
Course Objective	Manufacturing Automation course provides a link between engineering and automation techniques. Manufacturing Automation in general enables the effective and economical operation of both production equipment and processes.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**INTRODUCTION TO AUTOMATION** Automation production system, Mechanization and automation, Types of automation, Automation strategies, Mechanical, electrical, hydraulic and Pneumatic automation devices and controls, Economics of automation.	4	9
2	**AUTOMATION AND COMPUTER INTEGRATED MANUFACTURING (CIM)** Computers in Industrial manufacturing, Product cycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential and concurrent engineering, Computerized Manufacturing planning systems, shop floor control & automatic identification techniques. Computer Network for manufacturing and the future automated factor.	7	16
3	**COMPUTER AIDED QUALITY CONTROL (CAQC)** The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate measuring machine, Computer Aided testing, Integration of CAQC with CAD/CAM, Features of Computer controlled machine tools, NC, DNC, CNC, VNC, automatic tool changers, group technology, cell design and layout, Computer aided process planning (CAPP).	6	13
4	**FLEXIBLE MANUFACTURING SYSTEMS (FMS)** Major elements of FMS and their functioning: Tool handling system, Material handling system, Automated guided vehicles (AGV), Automated storage and retrieval system (AS/RS), FMS layout - concept, types and applications: Data required developing an FMS layout, Signal flow diagram and line balancing in FMS	6	13
5	**HIGH VOLUME MANUFACTURING AUTOMATION** Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multi model and mixed model production lines. **ASSEMBLY AUTOMATION:** Assembly systems, Automatic transfer, feeding and orienting devices, Flexible assembly systems, Performance evaluation and economics of assembly systems.	14	31
6	**Programmable controllers and Advanced Control Strategy in Automation**	8	18

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	PLC Architecture, Modes of operation, Programming methods, Instructions, Instruction addressing, latches, timers and counters, SCADA, DCS, Integration of PLC, SCADA and DCS with manufacturing systems, Man-machine interfaces, Introduction to PLM, Case studies.		
	Total	**45**	**100**

Reference Books

1.	**Automation, Production Systems & Computer Aided manufacturing,** M. P. Grover; Prentice Hall
2.	**Industrial Automation and Robotics** A.K Gupta, S.K. Arora; LaxmiPubilaction (P) Ltd
3.	**Principles of Automation & Automated Production Process** Malov and Ivanov; Mir Publication.
4.	**CAD/CAM/CIM** P. Radhakrishna; New Age International

List of Practical

1.	**Part Programming on CNC Milling Machine**
2.	**Problems on CNC Programming.**
3.	**Case study on FMS Layout.**
4.	**Case study on Assembly Automation.**
5.	**Automation using PLC such as bottle filling, elevator control.**
6.	**Process automation simulation using SCADA**
7.	**Interface HMI with PLC**

Course Outcome

After Learning the Course the students shall be able to:

1. To understand the importance of product development through CIM. Get knowledge of shop floor control.
2. Adopt appropriate material handling and storage in automated manufacturing environment techniques.
3. To incorporate methods of utilization of appropriate features in CAD application enhancing productivity in design.
4. To learn the different types of FMS layouts, material handling and retrieval systems.

203230131 - Optimization Techniques

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Basic knowledge of linear algebra, vector calculus and ordinary differential equations	
Course Objective	This course deals with optimization techniques used in engineering.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Optimization** Historical Development, Engineering applications of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems	4	9
2	**Classical Optimization Techniques** Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions	7	16
3	**Linear Programming** Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Dual simplex method	6	13
4	**Non-linear Programming: One-dimensional minimization method** Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods	6	13
5	**Non-linear Programming: Unconstrained Optimization Techniques** Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method, Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method	8	18
6	**Non-linear Programming: Constrained Optimization Techniques** Direct Methods: Random search method, Sequential linear programming, Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method	8	18
7	**Evolutionary Algorithms** An overview of evolutionary algorithms, Simulated annealing algorithm, Genetic algorithm, Particle swarm optimization	6	13
	Total	45	100

Reference Books

1.	**Engineering Optimization Theory and Practice** S.S.Rao; New Age International (P) Ltd, Publishers
2.	**Multi-objective optimization using evolutionary algorithms** Kalyanmoy Deb; John Wiley Publications
3.	**Introduction to Optimum Design** Jasbir S. Arora; McGraw Hill Publication
4.	**Optimization Techniques** Chandrashekhar Mohan & Kusumdeep; New Age Science Publications

List of Practical

1.	**Computer programme (using Matlab / Scilab) for Unrestricted Search methods**
2.	**Computer programme (using Matlab / Scilab) for Golden Section Method.**
3.	**Computer programme (using Matlab / Scilab) for Fibonacci Method.**
4.	**Computer programme (using Matlab / Scilab) for Newton Methods.**
5.	**Computer programme (using Matlab / Scilab) for Quasi Newton and Secant methods.**
6.	**Computer programme (using Matlab / Scilab) for Univariate methods.**
7.	**Computer programme (using Matlab / Scilab) for Indirect search methods.**

Course Outcome

After Learning the Course the students shall be able to:
1. Understand basic theoretical principles for formulation of optimization models and its solution. 2. Learn the unified and exact mathematical basis as well as the general principles of various soft computing. 3. To apply detailed theoretical and practical aspects of intelligent modeling, optimization and control of linear and non-linear systems. 4. Solve engineering design and manufacturing-related optimization problems using software tools.

203230132 - Advanced Electrical Drives

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Power Electronics, Machines, Basic Electronics	
Course Objective	To equip students with a deep understanding of both fundamental and cutting-edge concepts, enabling them to design, analyze, and optimize high-performance electric drive systems for various applications.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Electrical Drives** Electrical Drives, Parts of Electrical Drives, Dynamics of Electrical Drives, Components of Load Torques, Classification of Load Torques, Time and Energy-Loss in Transient Operations, Steady State Stability, Load Equalization.	2	15
2	**Control of Electrical Drives** Modes of Operation, Speed Control and Drive Classifications, Closed-Loop Control of Drives, Current-limit control, Closed-loop torque control, Closed-loop speed control, Closed-loop speed control of multi-motor drives, Speed sensing, Current sensing, Phase-locked-loop (PLL) control, Closed loop position control.	4	20
3	**DC Motor Drives** DC Motors and Their Performance, dc servo motors, Starting & Braking, Regenerative braking, Dynamic braking, Plugging, Transient Analysis, Speed Control, Transformer and Uncontrolled Rectifier Control, Controlled Rectifier Fed dc Drives, Single-phase fully-controlled and half-controlled, Three-phase fully-controlled and half-controlled rectifier control of dc motor, Dual-converter control of dc motor.	8	25
4	**Induction Motor Drives** Three-Phase Induction Motors, Analysis and performance, Starting, Soft start using saturable reactor starter, Braking, Transient Analysis, Starting and plugging, Speed Control, Rotor Resistance Control, Static rotor resistance control, Slip Power Recovery, Static Scherbius drive, Static Kramer drive, Variable Speed Constant Frequency Generation, Squirrel-cage induction machine and Cycloconverter scheme, Wound-rotor induction motor and Cycloconverter scheme, Single-Phase Induction Motors: Starting, Breaking, Speed Control, Linear Induction Motor and it's Control, PWM voltage source inverter (VSI) induction motor drives, Load commutated inverter fed synchronous motor drives, CSI squirrel-cage induction motor drive, PWM VSI squirrel--cage induction motor drive, Load commutated inverter (LCI) fed Induction motor drive.	12	25
5	**Synchronous Motor** Synchronous Motors, Starting, Braking, Synchronous Motor Variable Speed Drives, Variable frequency control, Modes of variable frequency control, Variable frequency control of multiple synchronous motors, Self-controlled synchronous motor drive employing load commutated thyristor inverter, Self-controlled synchronous motor drive employing a Cycloconverter, Starting Large Synchronous Machines.	7	15
6	**Brushless dc Motor, Stepper Motor & Switched Reluctance Motor Drives**	7	

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Brushless dc Motors Unipolar brushless dc motor, Bipolar brushless dc motor, Speed control of brushless dc motors, Important features and applications, Stepper (or Stepping) Motors, Variable reluctance, Permanent magnet important features of stepper motors, Torque versus stepping rate characteristics, Drive circuits for stepper motors, Switched Reluctance Motor.		
	Total	**40**	**100**

Reference Books

1.	**Power Electronics : - Converters, Applications, And Design** Ned Mohan; Wiley India Pvt Ltd
2.	**Power Electronics** P C Sen; Tata McGrow Hill
3.	**Electric Motors and Drives: Fundamentals, Types and Applications** Austin Hughes and Bill Drury; Elsevier; 5th, 2019
4.	**Electrical Drives: Principles, Planning, Applications, Solutions** Dieter Gerling; Springer, 2015

List of Practical

1.	**Design and simulate a power electronic converter for an electric drive system.**
2.	**Implement a vector control algorithm for an AC motor drive.**
3.	**Explore and implement sensor less control techniques for motor drives.**
4.	**Design, simulate, and analyze the performance of a multilevel inverter for an electric drive system.**
5.	**Develop a simulation model for an entire electric drive system, including the motor, power electronic converter, and control algorithms.**
6.	**Integrate wireless power transfer technology into an electric drive system.**
7.	**Explore energy harvesting techniques, such as regenerative braking or piezoelectric energy harvesting.**
8.	**Implement a real-time control system for an electric drive using hardware-in-the-loop (HIL) simulation.**
9.	**Introduce faults in the electric drive system, such as motor winding faults or converter failures. Implement fault diagnosis algorithms and explore methods for fault tolerance to ensure system reliability.**
10.	**Optimize the performance of an electric drive system by adjusting various parameters such as control gains, switching frequencies, and modulation techniques.**

Course Outcome

After Learning the Course the students shall be able to:
1. Remember and understand the fundamental concepts of drives. 2. Apply the knowledge in designing the power electronic converters. 3. Analyze and evaluate vector control of machines. 4. Create innovative solutions by integrating emerging technologies. 5. Apply modeling and simulation tools to analyze electric drive systems.

203230133 - Digital Signal Processing

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Higher Engineering Mathematics, Different Transforms (Fourier, Laplace, Z-transforms), Signals and systems	
Course Objective	The purpose of this course is to provide an understanding of Digital Signal Processing. Topics include: Introduction to digital signal processing and application, discrete time signals and systems; Analysis of LTI systems; Structures of discrete time systems; Filter designing techniques; DFT and FFT; Architecture of DSP Processors, and Multi-rate Signal Processing and applications.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	Tutorial	Lab	Credit	T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to DSP** Overview: Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples	4	3
2	**Discrete-Fourier Transform & Fast Fourier Transform** Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix2 Decimation-in-Time Decimationin-Frequency FFT Algorithms	12	9
3	**Discrete-Time Signals and Systems (Frequency Domain analysis)** Z-transform & Inverse z-transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems	6	5
4	**Analysis of Linear Time Invariant System** Analysis of LTI systems in time domain and stability considerations. Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase.	9	6
5	**Structures for Discrete Time Systems** Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, lattice and lattice-ladder structures, Transposed forms, Direct and cascade form Structures for FIR Systems, Linear Phase FIR structure, Effects of Co-efficient quantization.	12	8
6	**Filter Design Techniques**	7	6

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques		
7	**Advance DSP Techniques and Application** Multirate Signal Processing: Decimation, Interpolation, Sampling rate conversion by rational factor Adaptive filters: Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.	**10**	**8**
	Total	**60**	**45**

Reference Books

1.	**"Digital Signal Processing: Principles, Algorithms, & Applications",** Proakis, J.G., & Manolakis, D.G.,; Prentice Hall of India.
2.	**Discrete Time Signal Processing** Oppenheim, Schafer, Buck; Pearson education publication; 2nd Edition
3.	**Digital Signal Processing Fundamentals and Applications** Li Tan; Elsevier, Academic Press
4.	**Digital Signal Processing – A computer-based Approach** S.K.Mitra; Tata McGraw Hill; 3rd edition, 2006
5.	**Fundamentals of digital Signal Processing** Lonnie Ludeman; Wiley

List of Practical

1.	**Write a program for Direct form – I, II form realization of the given IIR system function.**
2.	**Write a program to plot pole-zero of a given FIR filter.**
3.	**(A)Create Blackman Harris, Hamming and Gaussian window and plot them in the same filter design tool. (B) Design an FIR filter with side lobe attenuation of 40 dB using Kaiser Window of 200 points.**
4.	**(A) Design low pass butter worth digital filter with given specification using impulse invariance method. (B) Design a high pass elliptical filter with given specification using impulse invariance method. (C) Design a band pass chebychev-2 filter with given specification using impulse invariance method.**
5.	**Design a second-order digital band pass Butterworth filter with the following specifications: fu= 2.6 kHz,fL = 2.4 kHz , fs = 8000 Hz. Plot the magnitude and phase response.**
6.	**Write a program to demonstrate the time shifting and frequency shifting property of DTFT.**
7.	**Write a program to perform circular convolution of two sequences using DFT.**
8.	**Write a program to up sample the sinusoidal sequence by an integer factor.**
9.	**Write a program to down sample the sinusoidal sequence by an integer factor.**
10.	**Write a program to convert the sampling by non-integer factor of a sinusoidal sequence.**

Course Outcome
After Learning the Course the students shall be able to:
1. Formulate engineering problems in terms of DSP tasks 2. Analyze digital and analog signals and systems 3. Algorithms for efficiently computing the DFT are called Fast Fourier Transform (FFT) methods 4. Analyze discrete time signals in frequency domain 5. Change sampling rate of the signal

203230134 - Micro Electro-Mechanical Systems

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Gain knowledge of micro system and fabrication process	
Course Objective	This subject deals with fundamentals of Micro-electromechanical Systems and its applications, which are useful for Mechatronics engineers.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to MEMS and Micro Systems** Microsystems and Microelectronics – Miniaturization – Micro sensors: Chemical Sensors- Optical Sensors- Pressure Sensors- Thermal Sensors – Micro actuators and Micro motors.	10	20
2	**Microsystem Materials** Molecular Theory and Intermolecular Forces – Silicon Piezo Resistors– Electrochemistry – Substrates and Wafers – Silicon Compounds – Polymers – Packaging Materials	12	25
3	**Microsystem Fabrication Process** Photolithography – Ion Implantation – Diffusion –Oxidation – Chemical Vapor Deposition – Etching – Applications of MEMS in Automatic-Telecom and Other Industries.	11	30
4	**Introductory concepts in modeling** Theory of elasticity, Solution Procedures in linear theory of elasticity, Theory of laminated composites, Micromechanical analysis of a laminae, wave propagation in structures	15	8
5	**Modeling of Smart sensors and Actuators** Introduction, Constitutive modeling, Finite Element modeling, Modeling of magnetostrictive sensors and actuators, Modeling of Micro Electro Mechanical systems, Active Control Techniques	4	10
	Total	52	93

Reference Books

1.	**MEMS & Microsystems Design & Manufacture** Tai, Ran Hsu,; Tata Mc Graw Hill, 2002
2.	**Smart Materials Systems and MEMS: Design and Development Methodologies** Vijay K Varadan, K.J.Vinoy and S. Gopalakrishnan; John Wiley and sons
3.	**The MEMS Hand book** Mohamed Gad-el-Hak; CRC Press, New York, London

List of Practical

1.	**To Perform Static Analysis of a Corner Bracket.**
2.	**To Perform Interference Fit and Pin Pull-Out Contact Analysis.**
3.	**To Perform Modal Analysis of a Model Airplane Wing**
4.	**To Perform Multiphysics Analysis of a Thermal Actuator -I.**
5.	**To Perform Multiphysics Analysis of a Thermal Actuator -II.**
6.	**Tutorial – 6 Introduction to MEMS & Microsystems.**
7.	**Tutorial – 7 Mechanics of MEMS.**
8.	**Tutorial – 8 Dynamics of MEMS.**
9.	**Tutorial – 9 Fabrications processes for MEMS.**
10.	**Design and Analysis of MEMS Pressure Sensor-I**

Course Outcome

After Learning the Course the students shall be able to:

1. Attain a broad range of the knowledge required to flourish in the rapidly developing field of MEMS and Nanotechnology.
2. Facilitate the application of basic physical laws, chemical laws, dynamic behavior as well as steady state performance to design and synthesize MEMS and Microsystems.
3. Acquaint him / her with applications of mems fabrication techniques to solve the problems encountered at a macro level.
4. Gain Proficiency in modeling, simulating and evaluating MEMS and Microsystems.

203230135 - Embedded Systems

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Microprocessor, Microcontroller and Programming C	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**INTRODUCTION TO EMBEDDED SYSTEMS** Introduction to Embedded system, embedded system examples, Parts of Embedded System Typical Processor architecture, Power supply, clock, memory interface, interrupt, I/O ports, Buffers, Programmable Devices etc. Simple interfacing examples. Memory Technologies – EPROM, Flash, OTP, SRAM, DRAM	9	15
2	**TYPICAL EMBEDDED SYSTEM** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces. Memory selection for Embedded Systems.	9	20
3	**DESIGN AND DEVELOPMENT OF EMBEDDED SYSTEMS** Embedded System product Development Life cycle (EDLC), Definition and objectives of EDLC, Different Phases of EDLC, and EDLC Approaches (Modelling the EDLC). Schematic Design, PCB layout, fabrication and assembly Disassembler / Decompiler, Simulators.	10	25
4	**RTOS BASED EMBEDDED SYSTEM DESIGN** Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Task scheduling. Preemptive and non-preemptive scheduling.	9	25
5	**Washing Machine** Application Specific Embedded System, Automotive: Domain Specific Example for Embedded System; Programming in Embedded 'C'. Smart card System Application.	8	15
	Total	45	100

Reference Books

1.	**Introduction to Embedded Systems** Shibu. K.V.; Tata Mcgraw Hill, 2009
2.	**Embedded System-Architecture, Programming, Design** Rajkamal; McGraw Hill, 2013
3.	**Embedded system Design** Peckol; John Wiley & Sons, 2010
4.	**Embedded system Design Using C 8051** Han-Way Huang; Cengage Learning, 2009

List of Practical

1.	**MCU-DAC interfacing and generation of ramp wave.**
2.	**Interfacing of ADC and data transfer by software polling.**
3.	**DC triggering through timer (On Chip Timer).**
4.	**Interrupt driven data transfer from ADC.**
5.	**LCD-MCU interfacing and displaying a string.**
6.	**Keyboard-MCU interfacing. Take a input from keypad and display on LCD.**
7.	**Stepper Motor Control Using ATMEGA-16 Microcontroller.**
8.	**Implementation of Hopfield network in C to recognize a simple ASCII character.**
9.	**Serial Communication between micro controller and PC.**
10.	**Temperature control using ATmega16.**

Course Outcome

After Learning the Course the students shall be able to:

1. Understand the basic build process of embedded systems, structural units in embedded processor, power supply, interrupts, buffers, I/O ports and memory technologies.
2. Understand selection of processor and memory devices depending upon the applications.
3. Classify the types of I/O device ports and buses and interfaces for data transfer.
4. Modelling of the Embedded Product Development Life Cycle (EDLC) by using different techniques like state machine model and sequential program model.
5. Analyze the basic concept of RTOS and scheduling of different task Systems.
6. Apply the knowledge of programming concepts of Embedded Systems for various applications.

203230151 - Smart Materials and Micro-Systems

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	NA	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Smart Materials** Overview of Smart Materials: Definition and characteristics of smart materials, Historical development and applications, Types of Smart Materials: Piezoelectric materials, Shape memory alloys, Magnetostrictive materials, Electroactive polymers, Smart fluids (magnetorheological and electrorheological fluids), Properties and Behavior: Material properties (mechanical, electrical, thermal, etc.) Phase transformations and hysteresis, Applications in Mechatronics: Use cases in sensors, actuators, and transducers	8	20
2	**Design and Selection of Smart Materials** Material Selection Criteria: Mechanical, electrical, and thermal properties, Environmental considerations, Cost and availability, Design Considerations: Design methodologies for incorporating smart materials (to the mechanism as sensor / actuator), Integration with traditional materials, Case studies of smart material integration, Simulation and Modeling: Finite element analysis (FEA), Computational tools for material behavior prediction and control.	8	20
3	**Control of Smart Material Systems** Control Principles: Basics of control theory relevant to smart materials, Feedback and feedforward control systems, Actuation Mechanisms: Control of piezoelectric actuators, Shape memory alloy actuation, Magnetostrictive and electroactive polymer control, Sensors and Feedback: Integration of smart sensors, Real-time monitoring and control, Signal processing techniques, Control Algorithms: PID control, Adaptive control, Intelligent control strategies (fuzzy logic, neural networks)	10	20
4	**Application of Smart Materials in Mechatronics** Automotive Applications: Adaptive suspension systems, Vibration control and noise reduction, Aerospace Applications: Morphing wings and control surfaces, Health monitoring systems, Biomedical Applications: Smart prosthetics and orthotics, Biomedical sensors and actuators, Robotics and Automation: Soft robotics, Adaptive grippers and manipulators	10	20
5	**Future trends and advancement in smart material application** Emerging Smart Materials: Nano-smart materials, Bio-inspired smart materials, Advanced Fabrication Techniques: 3D printing of smart materials, Nanofabrication methods, Integration with IoT and AI: Smart materials in IoT systems, AI-driven smart material systems, Challenges and Opportunities: Technical and economic challenges, Future research directions	9	20
	Total	45	100

Course Outcome
After Learning the Course the students shall be able to:
1. Explore different smart materials and their applications in mechatronics systems. 2. Apply criteria for selecting appropriate smart materials for specific applications. 3. Design and implement control algorithms for smart actuators with sensor integration for real-time feedback. 4. Design prototypes incorporating smart materials for specific applications and evaluate the performance in real-world applications. 5. Identify future trends and challenges in smart material systems.

203230152 - Industrial Process Automation

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Industrial Automation** Automation in Production System - Principles, strategies of Automation - Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Flow lines Different level of Flow lines - Production economics: Cost in manufacturing - Break even analysis, unit cost of production - Lead time and work in process - Production concepts and Mathematical models - Types of plant layouts - Case Study	9	20
2	**Material Handling and Storage** Overview of Material Handling Systems, Principles of Material Handling Systems - Design Consideration of Material Handling Systems - Material Transport Systems, Introduction of Storage Systems - Different types of storage system - Automatic storage and Retrieval system - Work in process storage - Storage system performance - Material Identification Methods	9	20
3	**Automated Manufacturing Systems** Overview of Manufacturing Systems - Classification of Manufacturing Systems - Introduction of Manufacturing Cells - Introduction of GT, Cellular Manufacturing - Case studies - Overview and classification of FMS, FMS and its Planning and Implementation - Lean and Agile manufacturing system - Design for automated assembly, types of automated assembly system - Parts feeding devices - Analysis of single station and multi-station assembly machine	9	20
4	**Control technologies in Automation** Industrial Control Systems - Process Industries and Discrete-Manufacturing Industries - Continuous Versus Discrete Control - Computer Process control - Case study Sequence Control: Programmable Logic Controllers, Relay Ladder Logic, Programming - Supervisory Controllers: Functionally of Supervisory Control Level - Process Optimization - Recipe Management Material. Tracking - Man-machine interfaces - Case Study	9	20
5	**Computer based Industrial Control**	9	20

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Automatic Process Control - Building Blocks of Automation Systems: LAN - Analog Digital I/O Modules , Digital I/O Modules - SCADA Systems and RTU - Case study Distributed Control System - Functional Requirements - Configurations and some popular Distributed Control Systems - Industrial Communication Systems: Characteristic features of industrial networks - Low level networks and their features, Field bus architecture - Performance aspects of Industrial Automation Systems - Case Study – Internet of Things based industrial control - Case Study		
	Total	**45**	**100**

Reference Books

1.	**Automation production systems and computer – integrated manufacturing** Mikell P.Groover; Prentice Hall of India
2.	**Programmable Logic Controllers by** John w. Webb and Ronald A. Reis; PHI Learning
3.	**Programmable Logic Controllers** Frank D. Petruzella; McGraw-Hill Book Company
4.	**Modern control systems** Richard C. Dorf, Robert H Bishop; Pearson Education International, Twelfth edition.

Course Outcome

After Learning the Course the students shall be able to:

1. Identify potential areas for automation in modern industries.
2. Analysis different material handling and storage systems used in Modern Industries.
3. Critically decide upon different manufacturing systems.
4. Analyze and suggest modern control technologies for industries.
5. Understand about application computers in industries.

203230153 - Seminar & Mini Project

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
0	0	4	2.00	-	-	50	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

203230181 - Wireless Sensor Networks

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	Basic knowledge of wireless communication and Data Communication and Networking is necessary.	
Course Objective	A wireless sensor network is an emerging area that employs a network of sensor nodes that are tiny in size and battery operated. They are required to be used very power efficiently so that network lifetime is optimized and provide reliable communication to the base station. By learning this subject, the students will gain the recent trends of wireless sensor networks, their design limitations and challenges.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Outcome

After Learning the Course the students shall be able to:

1. Understand the basis of Sensors with its applications.
2. Learn the architecture and placement strategies of Sensors.
3. Understand the state-of-the-art techniques and protocols in medium access control, routing algorithms in wireless sensor networks.
4. Design, develop, and carry out performance analysis of sensors on specific applications.
5. Explore and implement solutions to real world problems using sensor devices, enumerating its principles of working.

203230183 - Digital Manufacturing and Smart Factories

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Digital Manufacturing** Introduction and concepts of digital manufacturing-digital networked manufacturing-new generation intelligent manufacturing- virtual environment for digital manufacturing- Application of virtual environme digital manufacturing system	8	20
2	**Modeling and Intelligent Control in Digital Manufacturing** Manufacturing computational model-Modeling theory of digital manufacturing-Introduction to reverse engineering-Methodologies and techniques for reverse engineering-Applications-Intelligent controlconcept of intelligent multi information sensing and fusion-Multi agent manufacturing system	8	20
3	**Industrial Internet of Things** Introduction to internet of things (IoT)-IoT vs IIoT-M2M architecture-IoT Architecture-Sensing and actuation-wireless sensor networks-Basics of networking protocols-Transmission control protocol (TCP)- User datagram protocol (UDP)-Message Queueing Telemetry Transport (MQTT)	9	20
4	**Big Data Analytics and AR, VR for Industrial Application** Introduction to big data analytics-Data visualization methods- Types of digital data-big data analytics-History of Hadoop-design of HDFS-Hadoop file system interface- Data flow- Hadoop I/O tools. Introduction to immersive technologies-Design and implementation of an immersive user experience case study for AR and VR in industrial applications	10	20
5	**Cloud Manufacturing and Smart Factory Architecture** Introduction to cloud computing and manufacturing-cloud models-cloud service-architecture-cyber physical manufacturing-data security and cyber security-advanced automation and robotics: cobotsrobotics in flexible manufacturing systems-integration of digital twin with IoT platform- edge computing -fog computing.	9	20
	Total	44	100

Course Outcome

After Learning the Course the students shall be able to:
1. Understand the concepts of digital manufacturing. 2. Familiar in interfacing and intelligent control in digital manufacturing. 3. Illustrate the fundamentals of IoT architecture, communication, and networking. 4. Understand methods for data preparation and processing for big data analytics. 5. Explore challenges and industrial applications of cloud computing in manufacturing.

203230184 - Digital Image Processing & Machine Vision

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

203230186 - Mobile and Autonomous Robots

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	-	
Course Objective	-	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

203232136 - Robotics Engineering

Course	Master of Technology (MTech)	**Semester - 1**
Type of Course	-	
Prerequisite	Have Knowledge of kinematics, dynamics, motion planning, perception, and robot learning.	
Course Objective	Robotics engineering integrates multiple disciplines to create efficient manipulator.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	-	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Basic of Robotics** Definition of Robots, History of Robots, Classification of Robots, Robotic Joints and Links, Robot Workspaces, CNC Vs Robots, Present Research in Robotics, 3H of Robotics, Laws of Robotics.	12	25
2	**General considerations of Robotic Manipulator** Robot anatomy: Links, Joint and joint notations scheme, Degrees of freedom; Arm and wrist configurations, End effectors; Coordinate frames, Mapping between: Rotated frames, Translated frames, rotated and translated frames; Description of robotic pose in a space; Homogeneous transformation and inverting a homogeneous transformation; Orientation with RPY and Euler angles.	11	20
3	**Differential Motion and Statics** Linear and Angular Velocity of a rigid body; Relation between transformation matrix and angular velocity; Mapping velocity vectors; Linear and Angular velocity of a link; Manipulator Jacobian; Jacobian Singularities; Static analysis of robots.	10	25
4	**Robotics Sensors, Actuators, Grippers** Acoustic, Optic, Pneumatic, Force/ Torque sensors; Properties of Sensors, Robotics actuators, Robotic grippers and their design criteria.	8	20
5	**Robot Applications** Case studies on various robotic applications in Industrial, Material Handling, Processing, Assembly, Compliance, Inspection, Surgical, Space and Military applications.	4	10
	Total	45	100

Reference Books

1.	**Introduction to Robotics** S. K. Saha; Tata McGraw Hill Education Pvt. Ltd., New Delhi
2.	**Robotics and Control** R K Mittal, I. J. Nagrath; Tata Mc Graw-Hill
3.	**Introduction to Robotics – Mechanics and Control** J. J. Graig; Pearson Education, Inc; 2nd edition
4.	**ROBOTICS – Control, Sensing, Vision, and Intelligence** K. S. Fu, R. C. Gonzalez, and C. S. G. Lee; McGraw-Hill Book Company

List of Practical

1.	**To study different remote triggered actuators (electric, hydraulic and pneumatic types)and sensors used in developing robots**
2.	**To study online trajectory planning by remotely triggering stationary base robot**
3.	**To study the remotely triggered feedback control of robot for pick and place operation**
4.	**To study the remotely triggered trajectory planning of mobile robot without obstacles**
5.	**To study the remotely triggered trajectory planning of mobile robot with obstacles**
6.	**Open Ended Case studies in robotics applications**
7.	**Open Ended Case studies in robotics applications**

Course Outcome

After Learning the Course the students shall be able to:

1. Gain knowledge of basic mechanical designing, electrical wiring, robotic sensors and actuators, PCB design and communication protocols.
2. Gain an understanding of the theoretical background necessary to understand advanced robotic technologies and their specific applications.
3. Demonstrate proficiency in design, construction, and operation of robotic systems.
4. Develop problem-solving skills by applying principles of robotics engineering to real-world problems.
5. Communicate effectively about robotics engineering technologies, their workings and potential applications.

203232182 - Intelligent Sensors and Actuators

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	Basic electronics, Measurements and Instruments	
Course Objective	The syllabus aims to equip students with a holistic understanding of sensors and actuators, fostering their ability to design, integrate, and troubleshoot in real-world applications.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	T	T	P	P	Total Marks
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Sensors** Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.	9	10
2	**Inductive & capacitive transducer** Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor	12	30
3	**Actuators** Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.	12	35
4	**Micro sensors and micro actuators** **Micro Sensors:** Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. **Micro Actuators:** Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.	12	25
5	**Sensor materials and processing techniques**		

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process		
	Total	**45**	**100**

Reference Books

1.	**Sensors and Transducers** Ronald K. Jurgen; SAE

Course Outcome

After Learning the Course the students shall be able to:

1. Understand the principles of various sensors and actuators and their applications.
2. Design and integrate sensors and actuators into control systems for automation and feedback.
3. Evaluate the performance parameters of sensors and actuators, considering factors like sensitivity and response time.
4. Apply knowledge to real-world engineering challenges, developing solutions in areas such as robotics and industrial automation.

203232185 - Artificial Intelligence and Machine Learning

Course	Master of Technology (MTech)	**Semester - 2**
Type of Course	-	
Prerequisite	Basic Programming Skills	
Course Objective	To provide students with a deep understanding of artificial intelligence (AI) and machine learning (ML) techniques, optimization methods, and their applications. The course equips students with the skills to design, implement, and evaluate AI/ML models to solve complex real world problems.	
Effective From A.Y.	-	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	Tutorial	Lab	Credit	T	T	P	P	
3	0	2	4.00	60	20	30	20	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Fundamentals of Artificial Intelligence** • Introduction to AI: Definitions, history, and applications • Intelligent agents: Types, structure, and environment • Problem solving using search algorithms: BFS, DFS, Algorithms • Constraint satisfaction problems • Knowledge representation and reasoning: Propositional and predicate logic	8	20
2	**Machine Learning Basics** • Introduction to ML: Definitions and types (supervised, unsupervised, reinforcement learning) • Linear regression and logistic regression • Decision trees, random forests, and support vector machines • Overfitting, underfitting, and model evaluation metrics	9	20
3	**Optimization Techniques** • Optimization fundamentals: Objective functions, constraints, and solution spaces • Genetic algorithms: Encoding, fitness function, selection, crossover, and mutation • Particle Swarm Optimization (PSO): Principles, inertia weights, and velocity updates • Applications of GA and PSO: Solving Matyas and Rosenbrock functions • Hybrid optimization techniques	9	20
4	**Deep Learning** • Introduction to neural networks and perceptrons • Multilayer perceptrons and backpropagation • Convolutional Neural Networks (CNNs) and applications • Recurrent Neural Networks (RNNs) and sequence modeling • Handson implementation using TensorFlow/PyTorch	10	20
5	**AI and ML Applications and Research Directions** • AI applications in healthcare, finance, and autonomous systems • Natural Language Processing (NLP): Text classification, sentiment analysis, and chatbots • Current trends in AI and ML research • Capstone project: Developing an AI/MLbased solution for a selected domain	9	20
	Total	45	100

Reference Books	
1.	**"Artificial Intelligence: A Modern Approach" Author: Stuart Russell and Peter Norvig |Publisher: Pearson**
2.	**Deep Learning** Goodfellow, Bengio, and Courville.
3.	**Neural Networks** Simon Haykins; Prentice Hall; 1 ,January, 1994
4.	**Optimization for Engineering Design** Kalyanmoy Deb; Prentice Hall of India, New Delhi

List of Practical

1.	**Linear and Logistic Regression Models** • **Objective**: Build regression models for real-world datasets and evaluate their performance using metrics like MSE and accuracy.
2.	**Decision Trees and Random Forests** • **Objective**: Implement decision tree and random forest classifiers for a classification task and compare their performance.
3.	**Support Vector Machines (SVM)** • **Objective**: Implement an SVM classifier for binary and multi-class classification tasks.
4.	**Neural Network Implementation** • **Objective**: Design and train a simple feedforward neural network using TensorFlow/PyTorch on a regression or classification task.
5.	**Image Classification Using Convolutional Neural Networks (CNNs)** • **Objective**: Implement CNNs for an image classification task using datasets like MNIST or CIFAR-10.
6.	**Text Classification Using Recurrent Neural Networks (RNNs)** • **Objective**: Implement RNNs or LSTMs for tasks like sentiment analysis or text classification using datasets like IMDB reviews.
7.	**Optimization Using Genetic Algorithms (GAs)** • **Objective**: Solve optimization problems such as the Traveling Salesman Problem (TSP) or Rosenbrock function using GAs.
8.	**Particle Swarm Optimization (PSO)** • **Objective**: Use PSO to optimize functions like Matyas and Rosenbrock, and analyze its performance.
9.	**Mini-Project-I** • **Objective**: Design an AI/ML-based solution integrating optimization techniques (e.g., stock price prediction, energy optimization, or sentiment analysis).
10.	**Mini-Project-II** • **Objective**: Design an AI/ML-based solution integrating optimization techniques (e.g., stock price prediction, energy optimization, or sentiment analysis).

Course Outcome
After Learning the Course the students shall be able to:
1. Explain foundational AI concepts and their applications. 2. Apply search algorithms to solve decision making problems. 3. Differentiate between various machine learning techniques and use cases. 4. Explain and apply optimization methods like GA and PSO. 5. Build and train deep learning models using neural networks. 6. Analyze the role of AI and ML in various industrial domains.