DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Two Year M.Tech Degree Program

Scheme of Instruction and Examination

(Effective from 2025-26)

M.Tech I SEMESTER Automation and Robotics (AR) Scheme-2025

S. No	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
I		**Theory**							
1	PC	Programmable Logic Controllers	3	-	-	3	60	40	100
2	PC	Introduction to Robotics	3	-	-	3	60	40	100
3	PC	Program Elective-I	3	-	-	3	60	40	100
4	PC	Program Elective-II	3	-	-	3	60	40	100
5	MC	Research Methodology and IPR	2	-	-	2	-	100	100
6	SEC	Skill Enhancement Course	2	1	-	2	60	40	100
7	AC	Audit Course-I	2	-	-	0	-	-	-
II		**Practical**							
8	PCL	Programmable Logic Controller Laboratory	-	-	4	2	60	40	100
9	PCL	Microcontrollers and Embedded Systems Laboratory	-	-	4	2	60	40	100
	Total		18	1	8	20	420	380	800

M.Tech II SEMESTER - Automation and Robotics (AR) Scheme-2025

S. No	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
I		**Theory**							
1	PC	Industrial Automation Systems	3	-	-	3	60	40	100
2	PC	Robotics and Control	3	-	-	3	60	40	100
3	PE	Program Elective-III	3	-	-	3	60	40	100
4	PE	Program Elective-IV	3	-	-	3	60	40	100
5	MC	Quantum Technologies and Applications	2	-	-	2	60	40	100
6	PC	Comprehensive Viva Voce		-	-	2	-	-	100
7	AC	Audit Course-II	2	-	-	0	-	-	-
II		**Practical**							
7	PCL	Industrial Automation Laboratory	-	-	4	2	60	40	100
8	PCL	Robotics Laboratory	-	-	4	2	60	40	100
	Total		16		8	20	420	280	800

M.Tech III SEMESTER - Automation and Robotics (AR) Scheme-2025

S. No	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
1	PE	Program Elective -V	3	-	-	3	60	40	100
2	OE	Open Elective-I	3	-	-	3	60	40	100
3	PR	Dissertation Phase – I	-	-	20	10	-	100	100
4	CAA	Co- Curricular Activities	-	-	-	1	-	100	100
5		Industry Internship	-	-	-	2	-	100	100
	Total		6		20	19	120	380	500

***Open Elective Course shall be done through MOOCs.**

S. No	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
1	PR	Dissertation Phase - II	-	-	16	8		100	100
2	PR	Project Viva Voce	-	-	-	8	100		100

List of Program Elective Courses

Category	Course Title
PE-I	(i) Microcontrollers and Embedded Systems
	(ii) Measurement Techniques, Transducers and Sensors
	(iii) Power Electronics and Drives
PE-II	(i) Advanced Control Systems
	(ii) Mobile and Autonomous Robotics
	(iii) Mechatronics
PE-III	(i) Process Control and Instrumentation
	(ii) Industry 4.0
	(iii) Digital Signal Processing
PE-IV	(i) Machine Learning
	(ii) Digital Control Systems
	(iii) Digital Image Processing
PE-V	(i) Neural Networks and Fuzzy Logic
	(ii) Internet of Things
	(iii) Industrial Automation and Robotics

Open Elective

OE	Open electives will be selected through MOOC's

List of Audit Course

Category	Course Title
Audit Course-I	English for Research Paper Writing
	Disaster Management
	Essence of Indian Traditional Knowledge
Audit Course-II	Stress Management by Yoga
	Pedagogy Studies
	Personality Development through Life Enlightenment Skills

PROGRAMMABLE LOGIC CONTROLLERS (PLC)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
EE801	Professional Core	3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the basics of PLC programming.

CO2: Understand the digital logic gates and ladder diagrams

CO3: Understand the registers and functions in PLC programming

CO4: Understand the data handling functions in PLC

CO5: Understand the Analog PLC operation and human machine interface systems

UNIT - I	
PLC Basics	PLC system, I/O modules and interfacing, CPU processor, programming Equipment, programming formats, construction of PLC ladder diagrams, Devices connected to I/O modules.
PLC Programming	Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.
UNIT - II	
PLC based digital logic gates and Ladder diagrams	Digital logic gates, programming in the Boolean algebra system, conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system.
UNIT - III	
PLC Registers and functions	Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers. Timer functions & Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions
UNIT - IV	
Data Handling functions	SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis Robots with PLC, Matrix functions.
UNIT - V	
Analog PLC operation	Analog modules& systems, Analog signal processing, Multi bit Data Processing, Analog output Application Examples, PID principles, position indicator with PID control, PID Modules, PID tuning, PID functions.
Human machine interface systems	Introduction to HMI and need for using HMI. Different features of HMI and its methods of configuration. Use of HMI to above mentioned applications.

Text Books :

1. John W. Webb & Ronald A. Reiss, “Programmable Logic Controllers- Principles and Applications” Fifth Edition, PHI

2. JR. Hackworth & F.D. Hackworth Jr. , “Programmable Logic Controllers- Programming Method and Applications”, Pearson. 2004

Reference Books :

1. Alireza H. Fassih "Programmable Logic Controllers", New Generation publication 2014

2. Madhuchhanda Mitra and Samarjit Sen Gupta, “PLC and Industrial Applications an Introduction”, Pernram International Pub. (India) Pvt.Ltd., 2011

3. Frank D. Petruzella, “Programmable Logic Controllers”, 5th Edition, McGraw- Hill, New York, 2016.
Web References:
https://www.electrical4u.com/programmable-logic-controllers
https://www.watelectrical.com/industrial-applications-of-programmable-logic-controller/
https://nptel.ac.in/content/storage2/courses/112103174/
Question Paper Pattern:
1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks. **2. End Examination:** The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

INTRODUCTION TO ROBOTICS (IR)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE802	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration :						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand the basics and need of robotics.
CO2:	Understand various end effectors and actuators.
CO3:	Understand various sensors for robotic applications.
CO4:	Understand different vision systems.
CO5:	Understand different applications of robot.

UNIT – I	
Introduction to Robotics	Robotics and Programmable Automation, Historical Background, Laws of Robotics, Robot Definitions, Robotics Systems and Robot Anatomy, Human Systems and Robotics, Specifications of Robots, Present Application Status, Machine Intelligence, Computer and Robotics—Future Trends, Flexible Automation Versus Robotics Technology, Safety Measures in Robotics.
UNIT - II	
End effectors	Definition, General Aspects, Types of End effectors, Classification, Electric, Hydraulic, Pneumatic grippers, Selection of Motors and Grippers.
Actuators	Introduction, fluid power-general aspects, hydraulic actuators, pneumatic actuators, electrical actuators.
UNIT – III	
Robotic Sensors	Characteristics, Types, Tactile sensor, Position and display sensor, Force sensor, proximity sensor, Range sensor, Selection of a sensor.
UNIT - IV	
Robot Vision	Introduction, Robot vision systems- functions-components- Advantages, lightning devices, A to D conversion, image storage, illumination, Feature extraction, object inspection, procedure of robot vision.
UNIT - V	
Applications of Robots	Introduction, robot in industry, robots in handling, machine loading and unloading, material transfer, palletizing, welding, arc welding, spot welding, compliance, assembly injection moulding.

Text Books

1. Saha S, "Introduction to Robotics", MGH, 2nd Ed.
2. R. K. Rajput, "Robotics And Industrial Automation", S. Chand, 2nd Ed.
3. S.R.Deb, Sankha Deb , "Robotics Technology and Flexible Automation", MGH, 2017.
4. Ramachandran nagarajan, "Introduction to industrial robotics", pearson India education services, 2016.

Reference Books

1. D. K. Pratihar, "Fundamentals of robotics", Narosa publishing house pvt Limited, 2017.
2. RK Mittal, IJ nagrath, "Robotics and control", McGraw Hill Education, 2003.

Web References:

1. Introduction to Robotics | Stanford Onlinehttps://online.stanford.edu
2. Learn Robotics with Online Courses, Classes, & Lessons | edX https://www.edx.org

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without

choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

RESEARCH METHODOLOGY AND IPR (RM&IPR)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
MC101	Mandatory Course	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	2	100	-	100
Sessional Exam Duration : 2Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand overview of research process, state the research problem and conduct a literature review of the concepts comprising the research questions

CO2: Study the data collection methods and process the data statistically.

CO3: Apply multivariate analysis and experimental research methods for reliable data interpretation

CO4: Understand the principles , types and global framework of Intellectual property rights

CO5: Explain the patent process, filing procedures and legal aspects of intellectual property

UNIT – I

FUNDAMENTALS OF RESEARCH METHODOLOGY: Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences

UNIT - II

DATA COLLECTION AND SOURCES: Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection

UNIT – III

DATA ANALYSIS AND REPORTING: Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals

UNIT - IV

UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS: Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT - V

PATENTS : objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Text Books / Reference Books

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.
3. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education 11e (2012).
4. Ranjit Kumar , Research Methodology: A Step-by-Step Guide for Beginners. . David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.

5. Deborah E. Bouchoux , Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.
6. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024.
7. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
8. Peter Elbow, Writing With Power, Oxford University Press, 1998.

PROGRAMMABLE LOGIC CONTROLLERS LABORATORY (PLC(P))

I Semester : Automation and Robotics					Scheme : 2025		
Course Code	Hours/Week			Credits	Maximum Marks		
EE810	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	-	-	4	2	40	60	100
End Exam Duration: 3 Hrs							

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

CO1: Understand Programmable logic controller (PLC)

CO2: Verify logic gates, timer and counters using PLC

CO3: Apply ladder programming for traffic light, automatic water level control and bottle filling system

CO4: Apply ladder programming for temperature monitoring, colour mixture and colour creation control system

CO5: Apply ladder programming for fault detection, protection of induction motor and lift operation

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Study of Programmable Logic Controller (PLC)
2. Study and verification of logic gates using PLC
3. Study and verification of timer and counters using PLC
4. PLC based Traffic Light control system
5. PLC based Automatic water bottle filling system
6. PLC based Automatic water level control system of a tank
7. Automatic temperature monitoring and control system Using PLC
8. Colour mixture and colour creation control systems using PLC
9. Automatic fault detection and protection of induction motor using PLC
10. Control of lift using PLC

MICROCONTROLLERS AND EMBEDDED SYSTEMS LABORATORY (MES (P))

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE811	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	40	60	100
						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Apply embedded C programming method for MSP 430 microcontroller using Code Composer Studio.

CO2: Understand configuration of GPIO, serial ports, ADC and DAC for MSP430 microcontroller.

CO3: Understand interfacing of sensors, actuators with ESP32, NodeMCU and Raspberry PI.

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Configure GPIO ports of MSP430 to drive a DC Motor.
2. Configure GPIO ports of MSP430 to drive a stepper Motor.
3. Configure GPIO ports of MSP430 to generate variable duty cycle PWM. (Without and with timer)
4. On/Off control of DC Motor using temperature and humidity sensor and ESP32.
5. Display the PIR sensor values on serial monitor using ESP32.
6. On/Off control of DC Motor using IR sensor and NODEMCU. ultrasonic sensor
7. Interface 16X2 LCD to NodeMCU and display the given input string.
8. Display the PIR sensor values on serial monitor using NODEMCU.
9. On/Off control of DC Motor using ultrasonic sensor and Rasberry pi.
10. Object detection system by using a PIR sensor, buzzer and Rasberry PI.

List of Program Elective Courses

Description	Subject Title
PE-I	(i) Microcontrollers and Embedded Systems
	(ii) Measurement Techniques, Transducers and Sensors
	(iii) Power Electronics and Drives
PE-II	(i) Advanced Control Systems
	(ii) Mobile and Autonomous Robotics
	(iii) Mechatronics
PE-III	(i) Process Control and Instrumentation
	(ii) Industry 4.0
	(iii) Digital Signal Processing
PE-IV	(i) Machine Learning
	(ii) Digital Control Systems
	(iii) Digital Image Processing
PE-V	(i) Neural Networks and Fuzzy Logic
	(ii) Internet of Things
	(iii) Industrial Automation and Robotics

MICROCONTROLLERS AND EMBEDDED SYSTEMS (MC&ES)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
EE803	Program Elective-I	3	0	0	3	40	60	100
Sessional Exam Duration :						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the architectural features and I/O functions of MSP430.

CO2: Understand the data types, control structure, arrays and pointers for programming of MSP430.

CO3: Understand the pin configuration and I/O functions of Node MCU,ESP32

CO4: Understand the architectural features and I/O functions of Raspberry Pi**.**

CO5: Understand fundamentals of python for programming Raspberry Pi.

UNIT – I	
Introduction to MSP430 Microcontroller	MSP430 CPU Architecture-General layout-Central Processing Unit - I/O Subsystem Organization - Oscillators and Clocks, Pin layout of MSP430 and Configuring of GPIO Ports.
UNIT - II	
MSP430 Programming with Embedded C	Memory management- Embedded C Data Types-Arithmetic and Logic Operations-Control Structures-Arrays and Pointers.
UNIT – III	
NODEMCU Controller	Board Description - Pin layout of NODEMCU Development Board.
ESP32 Controller	Board Description - Pin layout of ESP32 Development Board.
UNIT - IV	
Introduction to Raspberry Pi	Raspberry Pi board and its processor, General purpose IO Pins - Communication facilities on Raspberry Pi (I2C, SPI, UART).
UNIT - V	
Basics of Python Programming for Raspberry Pi	Python on Raspberry Pi- Control statements, Functions, Module, basic programs.

Text Books

1. John H Davies, "MSP430 Microcontroller Basics", Newnes Publications, Elsevier, 2008.
2. S. Monk, "Programming the Raspberry Pi" McGraw-Hill Education, 2013.
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", Orient Blackswan Private Limited - New Delhi; First edition.

Reference Books

1. Chris Nagy, "Embedded Systems Design using TI MSP430 Series", Newnes Publications, Elsevier, 2003.
2. Cem Unsalan, H.Deniz Gurham, "Programmable Microcontrollers with Applications: MSP430 LaunchPad with CCS and Grace" McGraw-Hill Education, 2014.
3. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, JohnWiley & Sons.

Web References:

1. https://www.ti.com/
2. https://www.raspberrypi.org/learn/

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without

choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

MEASUREMENT TECHNIQUES, TRANSDUCERS AND SENSORS (MTTS)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE804	Professional Elective - I	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the basic concepts of measuring electrical parameters

CO2: Understand the measurement techniques of resistance, inductance and capacitance

CO3: Understand the operation of inductive , capacitive, optical sensors and limit switches

CO4: Understand the operation of Laser, Ultrasonic, Radar type Sensors for distance and level measurement

CO5: Understand the operation of various feedback sensors

UNIT – I	
Measurement of electrical parameters	Method of measuring voltage using PTs, Method of measuring current using CTs, Interposing CTs, Shunt and Hall effect sensor. Advantages/Disadvantages of CTs over shunts. True RMS voltmeter, simple methods of measurement of power in DC and AC systems. Method of electrical isolation. Voltage and current transducers. Operation and comparison of moving coil, moving iron meters, dynamometer, induction type & rectifier type ; Extension of range and calibration of voltmeter and ammeter. Measurement of Non-Electrical Quantities : Metrology, Strain, Pressure, Temperature etc.
UNIT – II	
Measurement of Resistance, Inductance and capacitance	Wheatstone bridge-sensitivity analysis, limitations, kelvin's double bridge, Maxwells bridge, schering Bridge, source and detectors, minimization of AC bridge errors, problems.
UNIT – III	
Inductive, capacitive, optical Sensors and limit switches	Inductive proximity sensors and its working principle. Different types like flush, non flush, ring type. Various industry applications (like end travel sensing, metal sensing). Capacitive type proximity sensors and its working principle, various industry applications (like rice mill etc.,) Limit switches and its industry applications (like dead stop). Photo sensors (diffused beam, through beam, slotted sensor) working principle and industry application.
UNIT – IV	
Laser, Ultrasonic, Radar type Sensors for distance and level measurement	Ultrasonic sensor for distance and level measurement (ON/OFF type, Analog type). Laser and Radar sensor for distance and level measurement with its industrial use application. Advantage and disadvantages. Conventional conductive sensor used in water tanks for level measurement. Light curtains for industrial safety. Touch and color sensors and its working principles and industrial applications.
UNIT – V	
Feedback Transducers	Introduction, feedback fundamentals, inverse transducers, temperature balance systems, self balancing potentiometers and bridges, heat flow and beam balance systems, Servo operated manometer and electromagnetic flow meter, feedback pneumatic load cell and accelerometer systems, Automatic measurement of dew point, non contact position measurement, bimorph position control system and integrating servo.

Text Books :

1. E.W.Golding and F.C.Widdis, "Electrical Measurements and measuring Instruments", Wheeler

Publishers
2. A.K.Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co. Publishers
3. J. B. Gupta: “A Course in Electrical and Electronic Measurements and Instrumentation”, S.K. Kataria & Sons
4. DVS Murthy, Transducers and Instrumentation PHI publications
Reference Books :
1. Buckingham and Price, “Electrical Measurements”, Prentice – Hall
2. Reissland, M.U, “Electrical Measurements: Fundamentals, Concepts, Applications”, New Age International (P) Limited Publishers
3. H.S.Kalsi, “Electronic Instrumentation”, Tata MCGraw-Hill Edition
Web References:
1 https://archive.nptel.ac.in/courses/108/108/108108147/
2.https://www.researchgate.net/publication/329682377_Measurement_techniques_Sensors_and_transducers
3. https://gmw.com/transducers/
Question Paper Pattern:
1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks. **2. End Examination:** The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

POWER ELECTRONICS AND DRIVES (PED)

I Semester : Automation and Robotics					Scheme : 2025			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
EE805	**Professional Elective - I**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the working and characteristics of power semi conductor devices like diode, SCR, TRIAC, MOSFET and IGBT.

CO2: Understand the principle of operation of AC to DC converters

CO3: Understand the principle of operation of DC to AC converters

CO4: Understand the principle of operation of AC to AC and DC to DC converters

CO5: Understand the performance of converter controlled DC motors and AC motors

CO6 : Understand the performance of converter controlled special machines

	UNIT – I
Basics of Power Electronics	Concept of power electronics, Power Semiconductor Switches (Diodes, SCR, TRIAC, BJT, MOSFET and IGBT), types of power converters, Realisation of semi conductor devices as switches. 1-phase and 3-phase AC to DC converters.
	UNIT – II
Converters-I	DC to AC converters, 1-phase and 3-phase VSI, 1-phase CSI, PWM techniques for inverters, UPS.
	UNIT – III
Converters-II	DC to DC to converters (step up and step down converters), AC to AC converters, Switch Mode power supply.
	UNIT – IV
Conventional Drives	Converter controlled separately excited DC Motor Drives, Converter controlled induction motor drives. Self controlled synchronous motor drives.
	UNIT – V
Special machine Drives	Principle, operation, converters and control techniques for BLDC, stepper, Switched Reluctance and servo motor drives. Scalar and vector control of induction motor, Direct torque and flux control of induction motor.

Text Books :

1. M.H. Rasheed, “Power Electronics Circuits Devices and Applications”, 3rd Edition, PHI publishers. 2004
2. P.S. Bimbhra , “Power Electronics”, 4th Edition, Khanna publishers. 2010
3. G.K. Dubey, “Fundamentals of Electrical drives” 2 nd Edition, Narosa Publishers. 2001.

Reference Books :

1. Ashfaq Ahmed, “Power Electronics for Technology” First Indian Reprint, Pearson Education
2. M.D. Singh and K.B. Khanchandani, “Power Electronics”, 2nd Edition, Tata McGraw Hill Publishers. 2002.

Web References:

1. https://nptel.ac.in/downloads/108105066/
2. https://nptel.ac.in/courses/108101126/
3. https://www.youtube.com/watch?v=Coy-WRCfems

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of

EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

ADVANCED CONTROL SYSTEMS (ACS)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE806	Program Elective-II	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1:	Design of compensators with root locus and frequency response approach.
CO2:	Understand behaviour of non-linear systems.
CO3:	Analyze stability of open loop and closed loop systems.
CO4:	Design of control systems in state space.
CO5:	Understand the optimal control systems.

UNIT – I	
Linear system Design	Introduction to design using compensators, Root locus approach to control system Design, Frequency response approach to control system Design, Lag compensator, Lead compensator, Lag –Lead compensators, PI,PD,PID controllers, Feedback compensation.
UNIT - II	
Nonlinear Systems	Behaviour of non-linear systems, Jump resonance, sub-harmonic oscillation, limit cycles, common physical non linearities, singular points, phase plane method.
UNIT – III	
Stability	Liapunov's stability criteria, Theorems. The direct method of Liapunov for linear systems. Methods of constructing Liapunov function Krasovski's method, variable gradient method.
UNIT - IV	
Analysis and design of control system in state space	Eigen values and Eigen Vectors, Similarity Transformation, Cayley-Hamilton theorem, Transformation of state model, Concept of controllability and observability, Controllable phase variable form of state model, Control system design via pole placement by state feedback, Observable phase variable form of state model, State observers.
UNIT - V	
Optimal Control	Concept of optimal control, Performance Indices ,Minimum time problem, Minimum energy problem, Minimum terminal error problem, State regulator problem, output regulator problem, Tracking, Relation between Quadratic performance index and Lyapunov function, State regulator design using Lyapunov equation, riccati equation.

Text Books

1.A.Nagoor Kani, "Advaced control Theory", RBA Publications, 2nd edition, 1999

2.KR Varmah, "Modern Control Theory",CBS Publishers& Distributors Pvt Ltd 1st Edition 2017

3.Gopal M (1993), "Modern Control System Theory", New Age International Publishers.

Reference Books

1.Nagrath I.J and Gopal M. (1982), "Control System Engineering", Wiley Eastern Publishers

2.K. Ogata, "Modern Control Engineering", Prentice Hall, 5th edition, 2010

Web References:

1. https://www.javatpoint.com/control-system-compensators
2. https://tutorial.math.lamar.edu/classes/alg/nonlinearsystems.aspx
3. https://web.stanford.edu/class/ee363/lectures/lyap.pdf
4. https://www.tutorialspoint.com/control_systems/control_systems_state_space_analysis.htm

5. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.701.8402&rep=rep1&type=pdf

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

MOBILE AND AUTONOMOUS ROBOTICS (MAR)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
EE807	Program Elective-II	3	0	0	3	40	60	100
Sessional Exam Duration :						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1:	Understand basics of mobile robots.
CO2:	Understand the kinematics and its models in mobile robots
CO3:	Understand architecture, learning and perception.
CO4:	Understand localization, planning and navigation of robots.
CO5:	Understand functionality of camera systems and image processing.

UNIT – I	
Introduction of Mobile Robotics	Mechanics and Locomotion: A brief history of mobile robotics, applications and market. Recent advances in the mobile robotics for RISE (Risky Intervention and Surveillance Environment) applications, Locomotion, Key issues in locomotion, legged, wheeled and aerial mobile robots.
UNIT - II	
Mobile Robot Kinematics	Introduction, kinematic models and constrains, mobile robot workspace, beyond basic kinematics, motion control (kinematic control).
UNIT – III	
Perception, robotics architectures and Robot Learning	Sensors Classification, sensor characterization, wheel/motor encoders, heading/orientation sensors, ground based beacons, active ranging, motion/speed sensors, vision based sensors. Low level control, Control architectures, software frameworks, Robot Learning, case studies of learning robots.
UNIT - IV	
Mobile Robot Localization	Introduction, the challenge of localization: Noise and aliasing, to localize or not to localize: localization based navigation versus programmed solutions, map representation, probabilistic map, map based localization, autonomous map building.
Planning and navigation	Planning and reaction, obstacle avoidance, D* algorithm, Navigation Architecture, case studies.
UNIT - V	
Introduction to image processing	Introduction to computer vision, Image processing: Point operators, Linear Filters, More neighbourhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.
Camera Systems in Machine	Camera Technology, History in Brief, Machine Vision versus closed Circuit Television (CCTV), Sensor Technologies, spatial Differentiation: 1D and 2D, CCD Technology, Full Frame Principle, Frame Transfer Principle, Interline Transfer, Interlaced Scan Interline Transfer, Frame Readout.

Text Books

1. Roland Siegwart & Illah R. Nourbakhsh, “Introduction to autonomous mobile robots”, Prentice Hall of India, 2004.
2. George A. Bekey “Autonomous Robots” MIT Press.
3. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavrakiand Sebastian Thrun, "Principles of Robot motion: Theory, Algorithm and Implementations", MIT Press.

Reference Books

1. Richard Szeliski: “Computer Vision: Algorithms and Applications”, 2010 Springer.
2. Alexander Hornberg: “Handbook of Machine Vision”, Wiley-VCH.
Web References:
1. Stanford Onlinehttps://online.stanford.edu
2. Learn Robotics with Online Courses, Classes, & Lessons | edX https://www.edx.org
Question Paper Pattern:
1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks. **2. End Examination:** The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE808	Program Elective-II	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration :						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the Mechatronics systems and Process used for industrial automation.

CO2: Understand the concept of electronic devices used for industrial automation.

CO3: Understand the concept of electrical drive used for industrial automation.

CO4: Understand the concept of hydraulics and Pneumatics system used for industrial automation.

CO5: Understand the concept of PID control, CNC machines and Part programming.

UNIT – I	
Introduction to Mechatronics	Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.
UNIT - II	
Electronics and Controllers	Review of fundamentals of electronics. Data conversion devices, sensors, microsensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.
UNIT – III	
Electrical and Mechanical Drives	Stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.
UNIT - IV	
Hydraulic systems	Flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits.
Pneumatics	Production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.
UNIT - V	
CNC and Part Programming	Description of PID controllers. CNC machines and part programming. Industrial Robotics.

Text Books

1. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988.
2. G.W. Kurtz, J.K. Schueller, P.W. Claar . II, "Machine design for mobile and industrial applications", SAE, 1994.

Reference Books

1. R. Iserman, "Mechatronic Systems: Fundamentals", Springer, 1st Edition, 2005
2. Musa Jouaneh, "Fundamentals of Mechatronics", 1st Edition, Cengage Learning, 2012.

Web References:

1. https://www.edx.org/course/mechatronics
2. https://www.udemy.com/course/robotics-and-mechatronics-a-basic-guide-to-begin-with/

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.

List of Audit Course

Audit Courses-I	English for Research Paper Writing
	Disaster Management
	Essence of Indian Traditional Knowledge

ENGLISH FOR RESEARCH PAPER WRITING (ERPW)

I Semester : Automation and Robotics					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC101	Audit Course-I	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	-	-	-	-
Sessional Exam Duration : 2Hr					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Recall the key language aspects and structural elements of academic writing in research papers.

CO2: Explain the importance of clarity, precision, and objectivity in research writing.

CO3: Apply critical reading strategies and advanced grammar skills to analyze and write research papers.

CO4: Analyze research articles, papers and identify the strengths and limitations of different methodologies.

CO5: Apply critical reading strategies and advanced grammar skills to analyze and write research papers.

CO6: Apply critical reading strategies and advanced grammar skills to analyze and write research papers.

UNIT – I

Fundamentals of Academic English : Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings

UNIT - II

Reading Skills for Researchers: Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT – III

Grammar Refinement for Research Writing: Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences

UNIT - IV

Mastery in Refining Written Content/Editing Skills: Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing

UNIT - V

Technology and Language for Research: Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

Text Books:

1. Bailey. S. Academic Writing: A Handbook for International Students. London and New York: Routledge,2015.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

References Books:

1. Craswell, G. Writing for Academic Success, Sage Publications, 2004.
2. Peter Elbow, Writing With Power, E-book, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. Writing Academic English, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
5. Goldbort R.Writing for Science, Yale University Press (available on Google Books), 2006
6. Day R.How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

DISASTER MANAGEMENT (DM)

I Semester : Automation and Robotics						Scheme : 2025		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC102	Audit Course-I	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	-	-	-	-
Sessional Exam Duration : 2Hr						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.

CO2: Assess the economic, social, and ecological repercussions of major natural and manmade disasters.

CO3: Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.

CO4: Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.

CO5: Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

UNIT – I	
Introduction	Disaster:Definition,FactorsandSignificance;DifferenceBetweenHazardandDisaster;Naturaland Manmade Disasters: Difference, Nature, Types and Magnitude
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
UNIT - II	
Repercussions of Disasters and Hazards	Economic Damage, Loss of Human 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
UNIT – III	
Disaster Preparedness and Management	Preparedness: Monitoring of Phenomena Triggering A Disasteror Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness
UNIT - IV	
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
UNIT - V	
Disaster Mitigation	Meaning,ConceptandStrategiesofDisasterMitigation,EmergingTrendsInMitigation.Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India

Text Books:

1. Gupta, H. K. Disaster Management. Universities Press, 2003
2. Singh, R. B. Natural Hazards and Disaster Management. Rawat Publications, 2006.

References Books:

1. Coppola, D. P. (2020). Introduction to International Disaster Management (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). Science and Technology in Disaster Risk Reduction in Asia. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). Handbook of Hazards and Disaster Risk Reduction and Management (2nd ed.). Routledge.
4. Saini, V. K. (2021). Disaster Management in India: Policy, Issues and Perspectives. Sage India.
5. Kelman, I. Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford

University Press, 2022
6. Sahni, P. & Dhameja, A. Disaster Mitigation: Experiences and Reflections. Prentice Hall of India, 2004.

Online Resources :

1. National Disaster Management Authority (NDMA), India: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
2. United Nations Office for Disaster Risk Reduction (UNDRR): https://www.undrr.org – Sendai Framework, global risk reduction strategies.
3. Global Disaster Alert and Coordination System (GDACS): https://www.gdacs.org – real-time disaster alerts.
4. World Health Organization (WHO) – https://www.who.int/emergencies – disaster related health guidelines.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (EITK)

I Semester : Automation and Robotics					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
AC103	Audit Course-I	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	-	-	-	-
Sessional Exam Duration : 2Hr					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change

CO2: Understand the need for protecting traditional knowledge and its significance in the global economy

CO3: Understand the legal framework and policies related to traditional knowledge protection

CO4: Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

CO5: Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture and biotechnology

UNIT – I

Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge

UNIT - II

Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK

UNIT – III

Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

UNIT - IV

Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT - V

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Reference Books

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt.Ltd. Delhi, 2022.
2. Basanta Kumar Mohanta and Vipin Kumar Singh,Traditional Knowledge System and Technology in India, PratibhaPrakashan 2012.
3. 1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
4. 2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
5. Subbarayappa, B.V. and Sarma, K.V. Indian Astronomy: A Source Book, Nehru Centre, Mumbai, 1985.

E-Resources:

1.https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

List of Skill Enhancement Course

Skill Enhancement Course	AI Techniques in Electrical Engineering

I Semester : Automation and Robotics					Scheme : 2025			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
EE809	SEC	2	0	0	2	40	60	100
Sessional Exam Duration :					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand feed forward neural networks, feedback neural networks and learning techniques

CO2: Apply selected basic AI techniques; judge applicability of more advanced techniques

CO3: Analyze &Develop fuzzy logic control for applications in electrical engineering

CO4: Develop genetic algorithm for applications in electrical engineering

UNIT – I	
Artificial Neural Networks	Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks – Learning process – Error correction learning – Hebbian learning – Competitive learning – Boltzmann learning – Supervised learning –Unsupervised learning – Reinforcement learning -learning tasks.
UNIT - II	
Ann Paradigms	Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network–Functional link network– Hopfield Network.
UNIT – III	
Fuzzy logic	Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations –Properties of Fuzzy sets – Fuzzy Cartesian Product – Operations on Fuzzy relations – Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference- Fuzzy Rule based system– Defuzzification methods.
UNIT - IV	
Genetic Algorithms	Introduction-Encoding– Fitness Function-Reproduction operators–Genetic Modeling – Genetic operators- Crossover- Single–site crossover –Two-point crossover–Multi point crossover-Uniform crossover–Matrix crossover-Crossover Rate-Inversion & Deletion– Mutation operator–Mutation–Mutation Rate-Bit-wise operators-Generational cycle-convergence of Genetic Algorithm.
UNIT - V	
Applications of AI Techniques	Load forecasting – Load flow studies – Economic load dispatch –Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability)- Reactive power control – speed control of DC and AC Motors.

Text Books

1. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms" PHI,New Delhi, 2nd edition,2017.
2. Sudarshan K. Valluru and T. Nageswara Rao, "introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms", Jaico Publishing House, 1st edition, 2010.

Reference Books

1. P.D.Wasserman, VanNostrand Reinhold,"NeuralComputingTheory&Practice",NewYork,1st . Eddition ,1989
2. Bart Kosko,"Neural Network & Fuzzy System", Prentice Hall,1992.
3. G.J.Klir and T.A.Folger, "Fuzzy sets, Uncertainty and Information", Pearson, 1st edition, 2015.
4. D.E.Goldberg, "Genetic Algorithms", Pearson Education India, 1st edition, 2008.

Web References:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview
2. https://onlinecourses.nptel.ac.in/noc23_ge36/preview
3. https://onlinecourses.nptel.ac.in/noc22_hs59/preview

Question Paper Pattern:

1. Sessional Examination: The sessional examination question paper shall be for 30 marks. The question paper shall consist of three questions, and students must answer all three questions (without choice). Each question carries 10 marks.

2. End Examination: The end-examination question paper shall be for 60 marks. Two questions of EITHER/OR type shall be framed from each unit. Each question may contain sub-questions. Students shall answer any one question from each unit, i.e., a total of five questions, with each question carrying 12 marks.