DJS-23 HONORS DEGREE COURSES

ACADEMIC YEAR: 2024-25

Honors Degree in Artificial Intelligence and Machine Learning

Sem	Subject Name	Credits
III	Mathematics for AIML	**3**
IV	Artificial Intelligence	**3**
V	Machine Learning	**4**
V	Machine Learning Laboratory	**1**
VI	Deep Learning	**3**
VI	Deep Learning Laboratory	**1**
VIII	Pattern Recognition and Application	**3**
	Total	**18**

Honors Degree in IoT & 5G technology

Sem	Subject Name	Credits
III	Sensors & Actuators for IoT	**3**
III	Sensors & Actuators for IoT Laboratory	**1**
IV	IoT System Design	**3**
IV	IoT System Design Laboratory	**1**
V	Intelligent IoT	**3**
VI	Industrial IoT	**3**
VI	IoT Applications Laboratory	**1**
VIII	5G Technology	**3**
	Total	**18**

Honors Degree in VLSI Design

Sem	Subject Name	Credits
III	Microelectronics	**3**
IV	Digital System Design using HDL	**3**
V	Digital System Design using HDL Laboratory	**1**
V	Digital VLSI	**3**
V	Digital VLSI Laboratory	**1**
VI	Analog VLSI	**3**
VI	Analog VLSI Laboratory	**1**
VIII	Low Power VLSI	**3**
	Total	**18**

Honors Degree in Robotics & Automation

Sem	Subject Name	Credits
III	Sensors and Instrumentation	**3**
IV	Control Systems	**3**
IV	Control Systems Laboratory	**1**
V	Robotics	**3**
V	Robotics Laboratory	**1**
VI	PLC and Applications	**3**
VI	PLC and Applications Laboratory	**1**
VIII	Industrial Automation Design	**3**
	Total	**18**

DJS-23 HONORS Syllabus

Semester III

ACADEMIC YEAR: 2024-25

B. Tech. Program (Electronics & Telecommunication Engineering) (DJS23 Scheme

HONORS Track: Artificial Intelligence and Machine Learning (Sem III)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester III																
1	DJS23ECH1301	Mathematics for AIML	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

HONORS Track: IoT & 5G Technology (Sem III)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester III																
1	DJS23ECH2301	Sensors & Actuators for IoT	3	-	-	3	40	-	40	60	-	-	-	60	100	4
	DJS23ELH2301	Sensors & Actuators for IoT Laboratory	-	2	-	1	-	25	25	-	25	-	-	25	50	
		Total	**3**	**2**	**-**	**4**	**40**	**-**	**65**	**60**	**25**	**-**	**-**	**85**	**150**	**4**

HONORS Track: VLSI Design (Sem III)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester III																
1	DJS23ECH3301	Microelectronics	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

HONORS Track: Robotics & Automation (Sem III)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester III																
1	DJS23ECH4301	Sensors & Instrumentation	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

Honors in Artificial Intelligence and Machine Learning		
Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: III**
Course: Mathematics for AIML (DJS23ECH1301)		

Pre-requisite: --

1. Mathematics - I (DJS23FCBS101)

Objectives:

1. To build an intuitive understanding of Mathematics and relating it to Artificial Intelligence, Machine Learning.
2. To provide a strong foundation for probabilistic and statistical analysis mostly used in varied applications in Engineering.

Outcomes: On completion of the course, the learner will be able to:

1. Recall the Basic Concepts of Linear Algebra Probability and Statistics
2. Understand linear algebra, probability, and statistical fundamentals.
3. Apply linear algebra, probability, and statistical concepts to solve problems.

Mathematics for AIML (DJS23ECH1301)		
Unit	**Description**	**Duration**
1	**Matrices and Vector Spaces** • The geometry of linear equations • Elimination with matrices • Multiplication, Transpose and Inverse of Matrices • Factorization into A = LU form • Vectors, Lengths and distances, angles • Inner Product, Vector Spaces and Subspaces • Solving Ax = 0; pivot variables • solving Ax = b; Rank and nullity of a matrix, • Row reduced form R • Linear Independence, Basis, Dimension, Span, Norm.	**06**
2	**Orthogonality & Projections onto Subspaces** • Orthogonal vectors and subspaces • Orthogonal and orthonormal Basis. • Projection onto 1-D subspaces, • Projection onto 2-D subspaces, • Projection matrices and least squares, • Orthogonal matrices and • Gram-Schmidt procedure.	**06**
3	**Eigen Values, Eigen Vectors & Positive Definite Matrices**	**07**

	• Concepts of Eigen values and Eigen vectors; • Diagonalization of a matrix, • Eigen decomposition. • Symmetric matrices and positive definiteness, • Positive definite matrices, Similar matrices, • Singular Value Decomposition, • Linear Transformation of matrices.	
4	**Probability & Probability distribution** • Probability definition, • Conditional Probability, • The Chain Rule of Conditional Probabilities, • Independence and Conditional Independence. • Binary variables, Bernoulli distribution, • Binomial Distribution, • Normal Distribution, • Student's *t* distribution, • Chi squared distribution, • Sample and sampling, • Sampling distribution and Central Limit Theorem.	**05**
5	**Statistics, Statistical Inference & Bayesian Statistics** • Mean, Variance and Covariance, • Covariance matrix, • Covariance and Correlation. • Mean of a dataset, • Variance of one-dimensional datasets, • Variance of higher-dimensional datasets. • Linear Transformation of datasets: Effect on the mean, Effect on the (co)variance. • Estimation, • Hypothesis Testing, • Confidence Interval • Bayesian concept learning: Likelihood, Prior, Posterior, • Posterior Predictive distribution, MAP estimation	**08**
6	**Continuous Optimization & Markov Process** • Continuous Optimization • Optimization Using Gradient Descent, • Stochastic Gradient Descent, • Convex Optimization. • Definition of Markov Process, • Discrete Markov chains, • The n–step transition probabilities, • Steady state probabilities, • Chapman-Kolmogorov Theorem.	**07**
	Total	**39**

Books Recommended:

Text Books:

1. Gilbert Strang, *Linear Algebra and its Applications*, 4th edn, Cengage India Private Limited,2005.
2. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, *Mathematics for Machine Learning*, Cambridge University Press,2020.

Reference Books:

1. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.

2. Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar. *Foundations of Machine Learning*, MIT Press, 2018.

3. Kuldeep Singh, "*Linear Algebra Step by Step*" , Oxford Publications

Prepared by Checked by Head of the Department Principal

Program: Electronics and Telecommunication Engineering	**S.Y. B. Tech.**	**Semester: III**
Course: Sensors & Actuators for IoT **(**DJS23ECH2301**)**		
Course: Sensors & Actuators for IoT Laboratory **(**DJS23ELH2301**)**		

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics
2. Electronic Devices and Circuits.
3. Digital System Designs

Objectives:

1. To provide an understanding of the physical parameters and sensing techniques of various sensors.
2. To provide an understanding of the signal conditioning principle.
3. To familiarize with MEMS sensors and actuators.

Outcomes: On completion of the course, the learner will be able to:

1. Describe applications in areas of IoT using sensors and actuators.
2. To understand the transduction principle of various sensors and actuators.
3. Apply knowledge of data acquisition and signal conditioning for interfacing of sensors.
4. Identify signal conditioning methods for applications.

Sensors & Actuators for IoT (DJS23ECH2301)		
Unit	**Description**	**Duration**
1	**Introduction to Sensors and Internet of Things:** Introduction to Internet of Things (IoT), brief review of applications of IoT, Sensors, transducers, classification of sensors--analog, digital, electrical, mechanical, characteristics of sensors, specifications, selection of sensors, basic interfacing and block diagram of instrumentation system.	08
2	**Sensors:** Temperature – Resistance Temperature Detectors Pt100/1000, Semiconductor PN junction sensors-LM35, Pressure – Concept of Pressure, Semiconductor Pressure Sensor (BMP380) Ultrasonic Sensors (HC-SR04), Proximity Sensors, Humidity Sensors, Pyroelectric sensors. Photoelectric Sensors, Coupled Charge Devices.	08
3	**Actuators:** Mechanical Actuation Systems, Electrical Actuation Systems. Motors- Servo, DC continuous and stepper, BLDC, Relay- SPDT, DPDT, Solenoid.	10
4	**Data Acquisition and Signal Conditioning:** Data Acquisition: Signal conditioning, input characteristics, Amplifiers, ADC—basic concepts, successive approximation ADC (ADC 0808), Integration type ADC, Sigma delta ADC(16 bit/24-bit) (ADS1115), DAC: R-2-R	06
5	**Current Trends in Sensors and Technology Smart Sensors:** Automation Sensor Technologies: Introduction to Semiconductor IC Technology, Standard Methods, Nano-sensors (MPU 9250), Microelectromechanical Systems. Sensors Applications: Automobile Sensors (Automotive Sensors), Medical Diagnostic Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring. Self-learning Topics: Energy Harvesting, Self-powered Wireless Sensing in-ground, Ground penetrating sensors	07
	Total	**39**

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Sensors & Actuators for IoT Laboratory (DJS23ELH2301)	
Exp.	**Suggested experiments**
1	To study Performance Characteristics of temperature/pressure/proximity sensors
2	To study Arduino architecture and basic programming.
3	Interfacing with Arduino to Evaluate the characteristics of temperature sensors - semiconductor, RTD, thermistor etc. (e.g. LM35, Pt – 100/1000, MLX 90614, DHT22/DHT11)
4	Interfacing with Arduino to Evaluate the characteristics of 9 DOF (accelerometer + gyro + magnetometer) (e.g. BMP180).
5	Interfacing to Arduino based platform for IR based sensor for obstacle detection
6	Interfacing to Arduino for Piezo sensor.
7	Arduino programming for home automation systems based on motion detection.
8	Measure the distance using an Ultrasonic sensor and display it on an LCD module.
9	To study ESP32 and detect available Wi-Fi networks.
10	Upload sensor data on Thing speak using ESP32
11	To Study and implement interfacing of actuators based on data collected using IoT sensors.
12	Interface the Camera module with Arduino/ESP32.
13	Interface the motor drivers with Arduino/ESP32
14	Implementation of Data transfer using wireless devices.

Batch wise laboratory work of a minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt. Batch wise tutorial sessions are to be conducted on topics which would help the learner to identify/analyze the problem and to apply problem solving techniques learnt.

Books Recommended:

Text books:
1. D. Patranabis, *Sensor and Actuators*, 2nd Edition, Prentice Hall of India.
2. A. K. Sawhney, *A course in Electronic Measurements and Instrumentation*,19th Edition, Dhanpat Rai & Co.
3. H. S. Kalsi, *Electronic Instrumentation and Measurements*,4th Edition, McGraw-Hill.
4. Nathan Ida, *Sensors, Actuators and their Interfaces*, SciTech Publishing,2013.

Reference Books:

1. Jacob Fraden, *Handbook of Modern Sensors: Physics, Designs, and Applications,* Fourth Edition, Springer, 2010.
2. Clarence. W. de Silva, *Sensors and Actuators: Engineering System Instrumentation*, 2nd Edition, CRC Press, 2015.
2. Ernest. O. Doebelin, *Measurement Systems, Application and design*, Tata McGraw- Hill, Publishing Company Ltd., 5thEdition, 2004.
3. D. A. Bradley, D. Dawson, N. C. Burd, A. J. Loader, *Mechatronics*, Thomson Press India Ltd., 2004.
4. S. Renganathan, *Transducer Engineering*, Allied Publishers (P) Ltd., 2003.
5. W. Bolton, *Mechatronics*, 4th Edition, Pearson Education, 2011.

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Honors in VLSI Design	
Program: Electronics and Telecommunication Engineering	**Semester: III**
Course: Microelectronics (DJS23ECH3301)	

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics (DJS22FECBE).

Objectives: `

1. To provide understanding of fundamental semiconductor physics.
2. To provide Understanding about IC Fabrication.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the principles of semiconductor Physics
2. Analyze the mathematical models of semiconductor junctions
3. Apply the mathematical models of MOS transistors for circuits and systems
4. Analyze various processing steps in IC fabrication

Microelectronics (DJS23ECH3301)		
Unit	**Description**	**Duration**
1	**Introduction to Semiconductor Physics:** Energy Band and Charge Carriers: Energy bands in semiconductors, Types of semiconductors, Charge carriers, Intrinsic and extrinsic materials. Carrier concentration: Fermi Level, Electron and hole concentration equilibrium, Temperature dependence of carrier concentration, Conductivity and mobility, Drift Velocity, Effect of temperature, Doping and high electric field, Drift & Diffusion Current, Hall-Effect.	06
2	**Generation and recombination of carriers:** p-n junction and contact potential, Fermi levels, Space charge, Reverse and Forward bias, Zener and Avalanche breakdown. Capacitance of p-n junction, Schottky barriers; Schottky barrier height, C-V characteristics, current flow across Schottky barrier: thermionic emission, Rectifying contact and Ohmic contact., Zener diode, Schottky diode, LED.	06
3	**P-N Junctions:** Bipolar Junction Transistor (BJT), I-V characteristics of BJT, Structure and Operation of MOS transistor, MOS capacitor, C-V characteristics, , I-V characteristics of MOSFET, Short Channel Effects: Limitation of long channel analysis, short-channel effects: velocity saturation, device degradation, channel length modulation, body bias effect, threshold adjustment, mobility degradation, hot carrier effects, MOSFET scaling and short channel behaviour.	10

4	**Integrated circuit fabrication process:** Clean room and Wafer Cleaning, Growth of single crystal Si, Wafer Preparation, oxidation, diffusion, ion implantation, photolithography, etching, metallization, chemical vapour deposition, sputtering, Testing and Packaging.	07
5	**IC Technology:** Integrated circuit fabrication; monolithic integrated circuit technology; planar process, monolithic diodes, bipolar transistor, fabrication of resistors and capacitors, fabrication of MOFET- nMOS and pMOS, CMOS technology.	10
	Total	**39**

Books Recommended:

Text books:

1. Sedra Smith, *Microelectronic Circuits*, 5th edition. Oxford university press (2011)
2. Sze and May, *Fundamental of Semiconductor Fabrication*, 2nd Edition, Wiley India, 2009
3. Sung Mo Kang, Yusuf Leblebici, *CMOS Digital Integrated Circuits*, Tata Mcgraw Hill, 2003

Reference Books:

1. Mishra, Umesh K. and Singh, Jaspreet, *Semiconductor Device Physics and Design*, Springer, 2008.
2. S K Gandhi, *Silicon Process Technology*, 2nd Edition, Wiley India, 2009
3. D. Neamen, D. Biswas, *Semiconductor Physics and Devices*, McGraw-Hill Education, 2003

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Honors in Robotics & Automation		
Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: III**
Course: Sensors and Instrumentation (DJS23ECH4301)		

Pre-requisite:

1. Basic Electrical & Electronics Engineering

Objectives:

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

Outcomes: On completion of the course, the learner will be able to:

1. Familiar with various calibration techniques and signal types for sensors.
2. Apply the various sensors in the Automotive and Mechatronics applications
3. Describe the working principle and characteristics of force, magnetic and heading sensors.
4. Understand the basic principles of various pressure and temperature, smart sensors.
5. Ability to implement the DAQ systems with different sensors for real time applications.

Sensors and Instrumentation (DJS23ECH4301)		
Unit	**Description**	**Duration**
1	**Introduction** • Basics of Measurement – Classification of errors • Error analysis – Static and dynamic characteristics of transducers • Performance measures of sensors • Classification of sensors • Sensor calibration techniques • Sensor Output Signal Types	08
2	**Motion, Proximity and Ranging Sensors** • Introduction, classifications • calibration and performance measurements. • Motion sensor, Optical encoder. • magnetic, Inductive, capacitive. • Accerometer, Range sensors (RF Beacon), Ultrasonic and Laser Range Sensor (LIDAR).	08
3	**Force, Magnetic and Heading Sensors** • Strain guage, Load cell Magnetic sensor • Types, principle, requirement and advantage • Magneto, resistive-hall effect, current sensor • Heading sensors, gyroscope, inclinometers	08

4	**Optical Pressure and Temperature sensors** • Photo conductive cell, fiber optic sensors. • Pressure-Diaphragm, Piezoelectric-tactile sensor. • RTD, Thermocouple. • Acoustic sensors – flow and level measurement. • Radiation sensors, smart sensors, LASER sensor.	06
5	**Signal Conditioning and DAQ Systems** • Amplification – Filtering – Sample and Hold circuits • Data Acquisition: Single channel and multichannel data acquisition • Data logging • Applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring	09
	Total	**39**

Books Recommended:

Text Books:

1. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
2. .Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013
3. Hans Kurt Tönshoff (Editor), Ichiro , "Sensors in Manufacturing" Volume 1, Wiley-VCH April 2001.

Reference Books:

1. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
2. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
3. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011.

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DJS-23 HONORS Syllabus

Semester IV

ACADEMIC YEAR: 2024-25

B. Tech. Program (Electronics & Telecommunication Engineering) (DJS23 Scheme)

HONORS Track: Artificial Intelligence and Machine Learning (Sem IV)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester IV																
1	DJS23ECH1401	Artificial Intelligence	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

HONORS Track: IoT & 5G Technology (Sem IV)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester IV																
1	DJS23ECH2401	IoT System & Design	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

HONORS Track: VLSI Design (Sem IV)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester IV																
1	DJS23ECH3401	Digital System Design Using HDL	3	-	-	3	40	-	40	60	-	-	-	60	100	4
	DJS23ELH3401	Digital System Design Using HDL Laboratory	-	2	-	1	-	25	25	-	25	-	-	25	50	
		Total	**3**	**2**	**-**	**4**	**40**	**-**	**65**	**60**	**25**	**-**	**-**	**85**	**150**	**4**

HONORS Track: Robotics & Automation (Sem IV)

Sr. No	Course code	Course	Teaching Scheme (hrs.)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					(A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O&P	Total SEA(B)		
Semester IV																
1	DJS23ECH4401	Control Systems	3	-	-	3	40	-	40	60	-	-	-	60	100	3
		Total	**3**	**-**	**-**	**3**	**40**	**-**	**40**	**60**	**-**	**-**	**-**	**60**	**100**	**3**

Honors in Artificial Intelligence and Machine Learning		
Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: IV**
Course: Artificial Intelligence (DJS23ECH1401)		

Pre-requisite:

1. Mathematics for AIML (DJS23ECH1301)

Objectives: `

1. To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2. To make students understand advanced representation formalism and search techniques.

Outcomes: On completion of the course, the learner will be able to:

1. Understand basic building blocks of AI present in intelligent agents.
2. Design appropriate problem-solving method for an agent to find a sequence of actions to reach goal state.
3. Analyze various AI approaches to knowledge– intensive problem solving, reasoning, and planning.
4. Understand applications of AI in different fields.

Artificial Intelligence (DJS23ECH1401)		
Unit	**Description**	**Duration**
1	**Intelligent Agents:** Introduction, AI Intelligent Agents; Structure of Intelligent Agents; Agents and Environments, Types of Agents.	03
2	**Introduction to AI Problems:** Introduction; Turing Test; Problems in AI	02
3	**Solving Problems in AI (Searching Algorithms as Applied in AI):** **Uninformed search** BFS, DFS, Depth First with Iterative Deepening, Generate and Test Search Algorithms. **Informed/Heuristic search** Hill Climbing, Steepest Ascent Hill Climbing, Problems in Hill Climbing, Greedy Nearest Neighbor, Best First Search, Greedy Best First Search, Beam Search, A* search, AO* search algorithms. **Constraint satisfaction Search** Crypto Arithmetic, Back Tracking: N Queens Problem. **Problem Reduction Search** AND/OR Graphs, Game Trees. **Adversarial search in Games** The Min-Max Algorithm, Alpha Beta Pruning.	 3 5 4 4 4
4	**Knowledge Representation and Reasoning:** **Logical Agents** Knowledge Based Agents, Wumpus World Knowledge Base **Propositional Logic** Syntax, Semantics, Inference, Resolution, Problems in Propositional Logic **First Order Logic** Syntax and Semantic of FOL, Using FOL **Inference in FOL** Propositional vs. First-Order Inference, Unification, Resolution.	9
5	**Application of AI:** Natural Language Processing and Understanding, Ecommerce, E-tourism, Industry, Healthcare, vision, and Robotics.	05
	Total	**39**

Books Recommended:

Text books:

1. Stuart J. Russell and Peter Norvig, "*Artificial Intelligence: A Modern Approach*", 4th Edition" Pearson Education, 2020.
2. Ben Coppin, "*Artificial Intelligence Illuminated*", Narosa Publishing House.

Reference Books:

1. Lavika Goel, "*Artificial Intelligence: Concepts and Applications*," Wiley 2021.
2. Saroj Kaushik," Artificial *Intelligence*" 2nd Edition, Cengage Publication
3. Elaine Rich, Kevin Knight, Shivshankar B Nair, "*Artificial Intelligence*", 3rd Edition, Mc Graw Hill publication.

Video Links:

1. https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/video_galleries/lecture-videos/
2. 'Artificial Intelligence' Video Lectures from IIT Madras by Prof. Deepak Khemani - Computer Science and Engineering NPTEL Video Lectures (nptelvideos.com)

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Honors in IoT & 5G Technology		
Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: IV**
Course: IoT System Design (DJS23ECH2401)		
Course: IoT System Design Laboratory (DJS23ELH2401)		

Pre-requisite:

1. Sensor and Actuator for IoT (DJS23ECH2301)
2. Basic Electrical Engineering & Digital Electronics (DJS23FCES103)
3. Electrical Networks (DJS23FCPC2EC)

Objectives: `

1. To provide understanding of enabling technologies.
2. To provide Understanding about IoT sensors and their interfacing.
3. To familiarize about protocols for IoT, Application building with IoT.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the enabling technologies.
2. Select sensors suitable for required application.
3. Analyze protocols for IoT
4. Visualize the power of data from the IoT
5. Build the application with IoT

IoT System Design **(**DJS23ECH2401)		
Unit	**Description**	**Duration**
1	Introduction to Internet of Things Introduction and Definition of Internet of Things , IoT Growth- A statistical View, Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, IoT Enabling Technologies, IoT Challenges, IoT Levels, Cyber Physical system versus IoT, Wireless sensor Network versus IoT, Interfacing with any sensor, Microcontrollers : A Quick walkthrough, Advanced RISC Machine : A Quick Overview.	08
2	Protocols for IoT Messaging and Transport: Messaging Protocols: Message Queuing Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Data Distribution Service (DDS), Transport Protocols: Bluetooth Low Energy, Light Fidelity(Li-Fi), Addressing and Identification: A Quick OverviewIPv4,IPv6,IPv5, Uniform Resource Identifier (URI)	10
3	**Cloud for IoT** IoT with Cloud- Challenges, Selection of cloud service provider, Introduction to Fog Computing, Cloud computing : security aspects, Architectural Design of	06

	Compute and Storage Clouds AWS and AZURE	
4	**Data Analytics- Visualizing the power of data from IoT** Data Analysis, Machine Learning, Types of Machine learning Models, Model building process, Modelling algorithms, Model Performance, Big data Platform, Big Data Pipeline, Real Life Projects, Recommendation in IoT Gadgets	08
5	**Application Building with IoT** Introduction, Smart Perishable Tracking with IoT and sensors, Smart Healthcare, Smart Inflight lavatory maintenance with IoT, IoT – Based Application to monitor water quality, Smart warehouse Monitoring, Smart Retail, Integrated Vehicle Health management	07
	Total	**39**

IoT System Design Laboratory **(**DJS23ELH2401)	
Exp.	**Suggested Experiment List**
1	GPIO toggle, Interrupts and ISR
2	Half and Full duplex communications
3	UDP client server model – local host
4	UDP client server model – local network
5	TCP client server model – local host
6	TCP client server model – local network
7	IoT sensors data into data base management system
8	Transmission of sensor data to DB application running on server side
9	Interfacing the camera module and data transmission to server
10	Case study based on current trends and advancements on IoT
	Any other experiment may be included, which would help the learner to understand the topic/concept

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, *Internet of Things*, 2nd Edn, Wiley, 2020.
2. Dac-Nhuong Le, Chintan Bhatt, Mani Madhukar, *Security Designs for the Cloud, IoT, and Social Networking*, John Wiley & Sons, 2019.
3. Marco Schwatrz, *Internet of Things with Arduino Cookbook*, Packt Publications, 2016.
4. Rajkumar Buyya, Christian Vecchiola. S. Thamarai Selvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013.

Reference Books:

1. Agus Kurniawan, *Learning AWS IoT Packt* Publishing, 2018.
2. Nick Antonopoulos and Lee Gillam, *Cloud Computing: Principles, Systems and Applications*, 2nd Edn, Springer, 2017.

Prepared by Checked by Head of the Department Principal

Honors in VLSI Design	**Semester: IV**
Program: Electronics and Telecommunication Engineering	
Course: Digital System Design using HDL (DJS23ECH3401)	
Course: Digital System Design using HDL Laboratory (DJS23ELH3401)	

Pre-requisite:

1. Digital System Design (DJS22EC303)

Objectives:

1. Describe Verilog HDL and develop digital circuits using gate level and data flow modelling.
2. Develop Verilog HDL code for digital circuits using switch level and behavioral modelling.
3. Design and develop digital circuits using Finite State Machines(FSM).
4. Perform functional verification of the above designs using Test Benches.
5. Implementation of experiments on FPGA/CPLD boards.

Outcomes: On completion of the course, the learner will be able to:

1. Model Combinational circuits using Verilog descriptions.
2. Model sequential circuits using Verilog descriptions.
3. Perform functional verification of digital designs using Test Benches.
4. Implement digital circuit using FPGA/CPLD board.

Digital System Design using HDL (DJS23ECH3401)		
Unit	**Description**	**Duration**
1	**Introduction to Verilog:** Overview of digital design with Verilog HDL, Typical design flow, Verilog Operators and Modules, Verilog Ports, Data types and Assignments, Styles of Description.	**05**
2	**Switch level modeling:** Modeling of CMOS gates and Boolean functions, Modeling using transmission gates. **Gate level modeling:** Gate types, Gate delays, Gate level modelling of Adder, Comparator, Decoder, Encoder, Multiplexer, De-multiplexer, Verilog modeling of flip-flops.	**09**
3	**Dataflow modeling:** Basics of dataflow modeling, Continuous assignments, delays, Expression, Operators and Operands, Synthesis of combinational logic using Verilog, Synthesis of sequential logic using Verilog.	**09**
4	**Behavioral modeling:** Basics of behavioral modeling, Structured procedures: initial and always, Procedural Assignments: Blocking and Non- blocking assignments, Conditional statements, Multiway Branching, case statement, Casex and Casez Statements, Loops, Sequential and Parallel blocks, Verilog modeling of combinational circuits, counters, shift registers, sequence detector.	**09**

5	**Overview of FPGA and CPLD Architectures and Technologies**: FPGA Architecture (Xilinx XC4000), coarse vs fine grained, Antifuse, SRAM and EPROM based FPGAs, FPGA logic cells, interconnection network and I/O Pad, architecture of CPLD, Xilinx XC 9500 CPLD.	**07**
	Total	**39**

Digital System Design using HDL Laboratory (DJS23ELH3401)	
Exp.	**Suggested Experiment List**
1	To simplify the given Boolean expressions and realize using Verilog program.
2	To realize half adder and full adder circuits using Verilog data flow description.
3	To realize 4-bit ripple carry adder using data flow Verilog program.
4	To realize half-subtractor and full-subtractor circuits using data flow Verilog program.
5	To realize 4-bit CLA adder using data flow Verilog program.
6	To realize 4-bit comparator using data flow Verilog program.
7	To realize the following Code converters using Verilog Behavioral description: Gray to binary and vice versa.
8	To realize the following Code converters using Verilog Behavioral description: Binary to excess3 and vice versa.
9	To realize using Verilog Behavioral description: 8:1 multiplexer.
10	To realize 8:3 encoder, Priority encoder using Verilog Behavioral description.
11	To realize using Verilog Behavioral description: 1:8 De-multiplexer
12	To realize 3:8 decoder using Verilog Behavioral description.
13	To realize 2-bit comparator using Verilog Behavioral description.
14	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D type
15	To realize Counters - up/down using Verilog Behavioral description.
16	Write a VHDL/Verilog code to realize the inverter. Simulate & synthesize the same on FPGA/CPLD Board.
17	Write a VHDL/Verilog code to realize the Transmission Gate. Simulate & synthesize the same on FPGA/CPLD Board.
18	Write a VHDL/Verilog code to realize the universal gates Simulate & synthesize the same on FPGA/CPLD Board.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. John F. Wakerly, *Digital Design Principles and Practices*, Pearson Education, 5th Edition, 2021.

2. Samir Palnitkar, *Verilog HDL A guide to Digital Design and Synthesis*, SunSoft Press, 2nd Edition, 2003.

Reference Books:

1. Michael D. Ciletti, *Advanced Digital Design with Verilog HDL*, PHI, 2005.
2. T. R. Padmanabhan and B. Bala Tripura Sundari, *Design through Verilog HDL*, IEEE Press, 2004.
3. Peter Ashenden, *Digital Design: An Embedded Systems Approach using Verilog*, Elsevier, 2008.
4. Stephen Brown & Zvonko Vranesic, *Digital Logic Design with Verilog HDL*, Tata McGraw Hill Ltd, 2nd Edition 2007.
5. W. Wolf, *FPGA based system design*, Pearson, 1st Edition, 2004.

Prepared by Checked by Head of the Department Principal

Honors in Robotics & Automation		
Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: IV**
Course: Control Systems (DJS23ECH4401)		

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics (DJS22FECBE)
2. Engineering Mathematics –I (DJS22FEC11)
3. Engineering Mathematics - II (DJS22FEC21)

Objectives:

1. To provide fundamental concept of control systems.
2. To introduce mathematical modelling, time domain analysis & frequency domain analysis.
3. To develop concepts of stability and its assessment criteria of the system.
4. To study basic concepts of controllers.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the basic concepts of control system.
2. Derive the mathematical model of different type of the systems.
3. Analysis of systems in time and frequency domain.
4. Understand & Find stability of given system using appropriate criteria.
5. Apply the control theory to design the conventional controllers widely used in the industries.

Basics of Control Systems (DJS23ECH4401)		
Unit	**Description**	**Duration**
1	**Introduction to Control Systems** • Open loop, closed loop systems, feed forward control, & adaptive control systems, Examples of control systems. • Modeling: Types of models, impulse response model, transfer function model. • Dynamic Response: Standard test signals, transient and steady state behavior control systems, • Steady state errors in feedback control systems and their types.	08
2	**Mathematical Modeling of Systems** • Conversion of block diagram to signal Flow Graph and Vice-versa. • Transfer Function models of various Electrical systems. • Block diagram reduction for single inputs single outputs(SISO) and multiple inputs multiple outputs(MIMO) systems. • signal flow graph, Mason's gain rule.	10

3	**State Variable Models** • Basic concepts, state variable and state models for electrical systems. • General state space representation, conversion between state space and transfer function, • Concept of state transition matrix, properties of state transition matrix. controllability and observability. • Analysis of LTI systems, with Examples.	07
4	**Stability Analysis** • Concept of stability, Routh stability criterion, • Root-locus, general rules for constructing root-locus, • Magnitude and phase plot; • Method of plotting Bode plot; Stability margins on the Bode plots, • Nyquist stability criterions gain and phase margins. • Case study on stability of Control System in Thermal Power Plant.	09
5	**Controllers & Compensators** • Introduction of PI, PD, and PID Controllers. • Lead and Lag compensators. • Case study on a model-driven PID control system.	05
	Total	**39**

Books Recommended:

Text books*:*

1. I. J. Nagrath, Madan.Gopal, "Control System Engineering", New Age InternationalPublication, Seventh Edition, 2021.
2. K.Ogata, "Modern Control Engineering", Pearson Education", Fifth Edition, 2015.

Reference Books:

1. Madan Gopal, "Control Systems Principles and Design", Tata McGraw hill, SeventhEdition, 2012.
2. Ajit K.Mandal, "Introduction to Control Engineering: Modeling, Analysis and Design",New Age International Publication, Second Edition, 2010.
3. S.Hasan Saeed, "Automatic Control System", S.K. Kataria & Sons, Ninth Edition, 2017.
4. Normon S. Nise, "Control System Engineering", John Wiley & sons, Eighth Edition,2020.