

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH IN ROBOTICS & ARTIFICIAL INTELLIGENCE
EFFECTIVE FROM ACADEMIC YEAR 2022-23 ADMITTED BATCH
R22 COURSE STRUCTURE AND SYLLABUS

I Year I Semester

Course Code	Course Title	L	T	P	Credits
Professional Core – I	Fundamentals of Robotic Systems	3	0	0	3
Professional Core –II	Fundamentals of Artificial Intelligence	3	0	0	3
Professional Elective – I	1. Robot Sensing and Vision 2. Intelligent Systems and Interfaces 3. Knowledge Engineering and Expert System	3	0	0	3
Professional Elective – II	1. Machine Learning 2. Smart Manufacturing Systems 3. Digital Electronics & Microprocessors	3	0	0	3
	Research Methodology & IPR	2	0	0	2
Lab– I	Robotics Simulation Laboratory	0	0	4	2
Lab – II	Python Programming Laboratory	0	0	4	2
Audit–I	Audit Course-I	2	0	0	0
	Total	16	0	8	18

I Year II Semester

Course Code	Course Title	L	T	P	Credits
Professional Core– III	Kinematics and Dynamics of Robotic Systems	3	0	0	3
Professional Core – IV	Big Data Management	3	0	0	3
Professional Elective – III	1. Internet of Things 2. Autonomous Vehicles 3. Robotic Simulation and localization Mapping	3	0	0	3
Professional Elective–IV	1. Advanced Robotics Manufacturing 2. Intelligent Sensors & Actuators 3. Cyber security	3	0	0	3
	Mini Project with Seminar	0	0	4	2
Lab –III	Robotic Systems Laboratory	0	0	4	2
Lab –IV	Artificial Intelligence Programming Laboratory	0	0	4	2
Audit–II	Audit Course-II	2	0	0	0
	Total	14	0	12	18

II Year I Semester

Course Code	Course Title	L	T	P	Credits
Professional Elective–V	1. Deep Learning 2. Computer Integrated Manufacturing 3. Additive Manufacturing Technology	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review-II	0	0	12	6
	Total	6	0	12	12

II YEAR II SEMESTER

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review- III	0	0	12	6
Dissertation	Dissertation Viva-Voce	0	0	28	14
	Total	0	0	40	20

***For Dissertation Work Review - I, Please refer 7.10 in R22 Academic Regulations.**

Audit Course I & II:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

Open Electives:

1. Waste to Energy
2. Industrial Safety

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
FUNDAMENTALS OF ROBOTIC SYSTEMS

L	T	P	C
3	0	0	3

UNIT – I

Introduction: Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and Links-Robot classifications -Architecture of robotic Systems-Robot Drive systems- Hydraulic, Pneumatic and Electric system.

UNIT - II:

End Effectors and Robot Controls: Mechanical Grippers-Slider crank mechanism, Screw type, Rotary actuators, cam Type-Magnetic grippers -Vacuum grippers -Air operated Grippers-Gripper force Analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT - III:

Robot Transformations and Sensors: Robot Kinematics- Types – 2D & 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple Transformation-Simple problems. Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors – Robotic vision Sensor-Force sensor -Light sensors, Pressure sensors.

UNIT - IV:

Robot Cell Design and Micro/Nano Robotics System: Robot work cell design and Control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot. Micro/Nanorobotics system Overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication Techniques-Fabrication of micro/nano Grippers-Wall climbing micro robot working Principles-Biomimetic Robot-Swarm Robot-Nano robot in targeted drug delivery system.

UNIT - V:

Robot Programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, Functions-Wrist Mechanism-Interpolation-Interlock commands- Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

Robot Languages-Classifications, Structures- VAL- language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications. RAPID- language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move-master command language- Introduction, syntax, simple problems. VAL-II programming-basic commands, applications- Simple problem using conditional Statements-Simple Pick and Place applications.

TEXT BOOKS:

1. Mikell P Groover & Nicholas Godfrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology Programming and Applications, McGraw Hill, 2nd Edition.
2. J John Craig, "Introduction to Robotics, Pearson Education, 2018, 4th Edition.

REFERENCE BOOKS:

1. Klafter. R.D, Chmielewski. T.A. and Noggin"s., "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., 2009
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

UNIT - I:

Introduction – History, Definition of AI, Emulation of human cognitive process, Intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

UNIT - II:

Search Methods: Problem – Solving Agents: Problem Definitions, Formulating Problems, searching for solutions – Measuring Problem – Solving Performance with examples. Search Strategies: Uninformed search strategies – Breadth – first Search, Uniform – Cost Search, depth –first search, depth – limited search, Iterative deepening depth – first search, bidirectional search, comparing uninformed search strategies. Informed search strategies – Heuristic information, Hill climbing methods, best – first search, branch – and – bound search, optimal search and A* and Iterative Deepening A*.

UNIT - III:

Concepts of Machine Learning – I - Supervised Learning, Unsupervised and Reinforcement Learning, Linear, logistic & Hierarchical Cluster Analysis. Decision Tree – Procedure & Technique of Decision Tree, Support Vector Machine – Mathematical Approach.

UNIT - IV:

Concepts of Machine Learning – II- Clustering & Classification Analysis, Boosting & Bagging, Data Visualization, Random Forest Algorithm, KN Neighbour Algorithm, Naïve Bayes Algorithm, Solving Numerical methods.

UNIT - V:

Programming & Logics in Artificial Intelligence: LISP and other programming languages – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non- deductive inference methods.

TEXT BOOKS:

1. Stuart Russel, Peter Norvig, Artificial Intelligence – A Modern Approach. Third Edition, PHI, Pearson Education, 2010.
2. Tom Mitchell, Machine Learning, McGraw Hill Publishers, 2013

REFERENCE BOOKS:

1. Dan. W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, PHI Learning, 2009.
2. Donald. A. Waterman, “A guide to Expert Systems”, Pearson, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
ROBOT SENSING AND VISION

L	T	P	C
3	0	0	3

UNIT - I

Robotic vision sensors and their interfacing. Fundamentals of Computer Vision: Image acquisition and representation, image transformation, filtering, restoration, morphing, Camera Models, Calibration, Single view geometry, Multiple view geometry, Epipolar geometry, RANSAC.

UNIT - II

Robotic Machine vision: Imaging Devices, Lighting Techniques, Image Processing & Analysis, Analog to Digital Signal Conversion, Object recognition, Training the Vision System.

UNIT - III

Position and Orientation: Feature based alignment; Pose estimation; Time varying pose and trajectories, Structure from motion, dense Motion Estimation, Visual Odometry (Semi-direct VO, direct sparse odometry), Bundle Assignment.

UNIT - IV

Localization and Mapping: Initialization, Tracking, Mapping, geometric SLAM formulations (indirect vs. direct error formulation, geometry parameterization, sparse vs. dense model, optimization approach), Relocalization and map Optimization, Visual SLAM, Examples: Indirect (Feature based) methods (MonoSLAM, PTAM, ORB-SLAM), Direct methods (DTAM, LSD-SLAM), Sensor combinations (IMU, mono vs. Stereo, RGB-Depth), Analysis and parameter studies.

UNIT - V

Recognition and Interpretations: Concepts of machine learning and deep learning, sequence modeling, Learning for robotic vision: Active learning, incremental and class incremental learning identify unknowns, uncertainty estimation, Embodiment for robotic vision: active vision, spatial and temporal embodiment, reasoning for object, scene and scene semantics.

TEXT BOOKS:

1. H. R. Everett, Sensors for Mobile Robots: Theory and Application, A K Peters/CRC Press, 2019.
2. Dahiya, Ravinder S., Valle, Maurizio, Robotic Tactile Sensing, Springer, 2013.

REFERENCE BOOKS:

1. S. R. Deb, Sankha Deb, Robotics Technology and Flexible Automation, 2nd edition, McGraw Hill Education, 2017.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Cengage, Third Edition (2013)
3. Abdessalan Bouzerdoum, George Mamic and M. Bennamoun, Object Recognition: Fundamentals & Case Studies, First Edition, Universities Press, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
INTELLIGENT SYSTEMS & INTERFACES

L	T	P	C
3	0	0	3

UNIT - I

Language Processing, Computational Phonology: Issues, Phonological Rules, Mapping Text to Phones, Prosody in TTS, Probabilistic Models of pronunciation and spelling, N-Grams. Syntax: Word Classes & POS Tagging, CFG for English, Lexicalized and Probabilistic Parsing.

UNIT - II

Semantic Representation: Semantic and Lexical Analysis and word sense disambiguation, IR. Pragmatics: Discourse, Dialogue Agents, Natural Language Generation and Machine Translation. Machine Learning: Data Mining, Association Rules, Clustering, Decision Trees, Text Mining.

UNIT - III

Synergetic Techniques: Synergetic Learning Systems, Concept, Architecture & Algorithm, Basics of Genetic Algorithms, Artificial Neural Network Techniques for machine learning.

UNIT - IV

Application to Bio Informatics, Intelligent Interfaces: Incorporating Intelligence: Requirements, design Issues. Applications: Development of Intelligent Interfaces for systems – Stand Alone systems like OS, Databases, Physical Machines including Robots.

UNIT - V

Web Based Application – Intelligent Tutoring Systems – Design and developmental methods, Methods of Web Mining, E-Shopping: E-commerce chat box, Augmented Reality.

TEXT BOOKS:

1. D Jurafsky and J H Martin, Speech and Language Processing, Pearson Education, 2000.
2. E Reiter and R Dale, Building Natural Language, Generation Systems, Cambridge University Press, 2000.

REFERENCE BOOKS:

1. T.M. Mitchell, Machine Learning, MGH 1997.
2. J. Han and M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2000.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
KNOWLEDGE ENGINEERING AND EXPERT SYSTEM

L	T	P	C
3	0	0	3

UNIT - I

An Introduction to Knowledge Engineering, the history of knowledge-based expert systems, Types of Knowledge based systems, Characteristics of current expert systems, Basic concepts for building expert systems.

UNIT - II

Knowledge Representation & Reasoning- Logic, Rules & representation, Developing Rules based system & Semantic Networks, Knowledge Acquisition, Knowledge representation schemes.

UNIT - III

Building the Expert System, architecture of expert systems, Constructing an expert system, methods of inference. Expert systems shells, Development of environments, Use of AI Language.

UNIT - IV

Conceptual data analysis; plausible reasoning techniques, Tools for building expert systems. Reasoning under uncertainty, Introduction to Clips, Pattern matching, Modular design and execution control.

UNIT - V

Production-rule programming, Issues and case studies. Comparing different Approaches. Language and Tools for Knowledge Engineering, Expert system design examples, A Case Study in Knowledge Engineering.

TEXT BOOKS:

1. Joseph C Giarratano, Gary D Riley, Expert Systems – Principles & Programming, Third Edition, Course Technology Publishers.
2. Simon Kendal & Malcolm Creen, An Introduction to Knowledge Engineering, Springer Publishers, 2007.

REFERENCE BOOKS:

1. Buchanan, B. B. & Shortliffe, E. H. Building Expert Systems with Production Rules: The Mycin Experiments. Addison-Wesley Publishing Company
2. Davis, R. & Lenat, D. B. Knowledge-Based Systems in Artificial Intelligence. McGraw-Hill International Book Company
3. Hayes-Roth, F., Waterman, D. A. & Lenat, D. B. (eds) Building Expert Systems. Addison-Wesley Publishing Company, Inc.
4. Torsun, I. S. Expert Systems: State of the Art, Addison-Wesley Publishing Company

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
MACHINE LEARNING

L	T	P	C
3	0	0	3

UNIT - I

Introduction to machine learning – Types of machine learning – supervised, unsupervised and reinforcement learning, Various packages used for machine learning, Data visualization, Splitting the data into training and validation.

UNIT - II

Supervised learning-I : Linear Regression technique, logistic regression technique and Hierarchical cluster analysis, Significance of using Decision tree, types of decision trees, theory on hyperplane and kernels, Strategies to implement transformations such as Translation, Scaling, Rotation, Mirror Reflection, shearing for simple geometries.

UNIT - III

Supervised learning - II: Bayesian classification, Perceptrons, Multi-layer perceptron, RBF Networks, Regression Model, Support Vector Machines, Convolutional Neural Networks, Recurrent Neural Networks, Random Forest – mathematical concepts, Naïve Bayes Theorem, Limitation of Naïve Bayes theorem, K Nearest Neighbors Algorithm.

UNIT - IV

Unsupervised learning: K-Means clustering, DBSCAN, Non-parametric Estimation, Mean-shift clustering, Classification Performance Analysis, Ensemble methods- Boosting and Bagging.

UNIT -V

Reinforcement learning – Introduction, Learning Task, Q learning, temporal difference learning, relationship to dynamic programming, generalizing from examples. Introduction to Deep Learning, Applications: Structure Mapping, Case Studies in Robotics.

TEXT BOOKS:

1. Tom Mitchell, Machine Learning, McGraw Hill Publishers, 1997.
2. Alpaydin, Introduction to Machine Learning, 3rd Edition, Prentice Hall (India) 2015.

REFERENCE BOOKS:

1. S. O. Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Education (India), 2016
2. I Good Fellow, Y Benjio, A Courville, Deep Learning, MIT Press, 2017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
SMART MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

UNIT - I:

Computer Integrated Manufacturing Systems Structure and functional areas of CIM system – CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

UNIT - II:

Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT - III:

Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks – Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT - IV:

Automated Process Planning – Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES) – Manufacturing system design. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT - V:

Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation – Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology – Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBST) — Data Base, Knowledge Base, Clustering Algorithm.

TEXT BOOKS:

1. Andrew Kusiak, Intelligent Manufacturing Systems, Prentice Hall.
2. Yagna Narayana, Artificial Neural Networks, PHI, 2006

REFERENCE BOOKS:

1. Groover M.P, Automation, Production Systems and CIM, PHI, 2007
2. Simon Haykin, Neural networks: A comprehensive foundation, PHI.
3. Li Min Fu, Neural networks in Computer intelligence, TMH, 2003

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
DIGITAL ELECTRONICS & MICROPROCESSORS

L	T	P	C
3	0	0	3

UNIT – I

Number Systems & Code conversion, Boolean Algebra & Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions, SOP and POS methods –Simplification of Boolean functions using K-maps, Signed and Unsigned Binary Numbers.

UNIT - II

Combinational Logic Circuits: Adders &Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Logic Devices. Sequential Logic Circuits: RS, Clocked RS, D, JK, Master Slave JK, T Flip-Flops, Shift Registers, Types of Shift Registers, Counters, Ripple Counter, Synchronous Counters, Asynchronous Counters, Up-Down Counter.

UNIT - III

Microprocessors -I - 8085 microprocessor Review (brief details only), 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.

UNIT - IV

Microprocessors -II -Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic, logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation Instructions. Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, addressing modes and instruction set of 8051(Brief details only), Simple Programs.

UNIT - V

Interfaces - Peripheral Interfacing Parallel versus serial transmission, synchronous and asynchronous serial data transmission. Interfacing of hexadecimal keyboard and display UNIT, interfacing of cassette recorders and parallel, serial interface standards. Study of Peripheral Devices 8255, 8253,8257, 8251, 8259. Module V: Microprocessor applications to Power Engineering Protective Relaying: over-current, impedance, MHO, reactance, bi-directional relays.

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5thEdition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.

REFERENCE BOOKS:

1. Thomas L. Floyd, Digital Fundamentals –A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth. J. Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
RESEARCH METHODOLOGY & IPR

L	T	P	C
2	0	0	2

Prerequisite: None

Course Objectives:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- 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.

UNIT - I:

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

UNIT - II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT - III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT - IV:

Nature of Intellectual Property: Patents, Designs, Trade 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.

UNIT - V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. 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.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".

REFERENCE BOOKS:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
ROBOTICS SIMULATION LABORATORY

L	T	P	C
0	0	4	2

List of Experiments:

1. Dynamic model development and simulation of simple mechanical systems using Matlab and Mathematica.
2. Numerical simulation of simple mechanical systems.
3. Stability analysis of simple mechanical systems using linear system theory namely root locus and Bodeplot.
4. State space model development and dynamic simulation using Simulink.
5. Simscape Multibody using Matlab:
 - i. Spring-Mass System Modeling,
 - ii. Crankshaft Modeling
 - iii. Custom Hydraulic Components Modeling
 - iv. Hydraulically Actuated System Modeling
 - v. Robot Manipulator Simulation
6. Mobile robot control using Matlab/Simulink.
7. Acquiring Data from Sensors and Instruments Using MATLAB.
8. Developing Kinematics (Forward and Inverse of popular configurations using using simulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

List of Experiments

1. Write a program to create, concatenate and print a string and accessing sub-string from given string
2. Write a program to perform basic arithmetic operations using function evaluation, root of equations and nonlinear solution methods.
3. Write a program to find the solutions of various numerical methods.
4. Write a python program that defines a matrix and perform matrix operations like addition, multiplication etc.
5. Use a python program to solve a Systems of Linear Algebraic Equations
6. Write a python program to define a module to find Fibonacci numbers and import the module to another program
7. Write a program to implement transformations such as Translation, Scaling, Rotation, Mirror Reflection and Shearing for simple geometries like line, triangle, rectangle and other
8. Write a program to implement curve generation using python for cubic spline, B-spline and Bezier curves.
9. Write a python program to compute Central Tendency Measures and Measure of Dispersion: Variance, Standard Deviation
10. Write a Python program to implement Simple Linear Regression
11. Use of Scikit-learn tools for classification, regression, clustering and dimensionality reduction.
12. Use of SciKit-learn tools to implement Naïve bayes, Random Forest Algorithm.
13. Use of SciKit Learn tools to implement Decision Tree, Logistic Regression, KNN Algorithms.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT - I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT - II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT - III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT - IV:

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,

UNIT - V:

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

UNIT - VI:

useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
DISASTER MANAGEMENT (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- 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

UNIT - I:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

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 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 - IV:

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.

UNIT - V:

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 - VI:

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.

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT - I:

Alphabets in Sanskrit,

UNIT - II:

Past/Present/Future Tense, Simple Sentences

UNIT - III:

Order, Introduction of roots,

UNIT - IV:

Technical information about Sanskrit Literature

UNIT - V:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
VALUE EDUCATION (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT - I:

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT - II:

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

UNIT - III:

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT - IV:

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

UNIT - V:

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

TEXT BOOKS/ REFERENCES:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
CONSTITUTION OF INDIA (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT - I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

UNIT - II:

Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT - III:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT - IV:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions

UNIT - V:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT - VI:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the

welfare of SC/ST/OBC and women.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
PEDAGOGY STUDIES (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT - I:

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.

UNIT - II:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT - III:

Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho 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.

UNIT - IV:

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

UNIT - V:

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeamong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272–282.
5. Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.
6. Chavan M (2003) *Read India: A mass scale, rapid, 'learning to read' campaign*.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)**

STRESS MANAGEMENT BY YOGA (Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT - I:

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II:

Yam and Niyam.

UNIT - III:

Do's and Don't's in life.

- Ahinsa, satya, astheya, bramhacharya and aparigraha
- Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - IV:

Asan and Pranayam

UNIT - V:

- Various yog poses and their benefits for mind & body
- Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Training-Part-I': Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (ROBOTICS & ARTIFICIAL INTELLIGENCE)
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

L	T	P	C
2	0	0	0

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT - I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT - II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT - III:

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.

UNIT - IV:

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:

UNIT - V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.