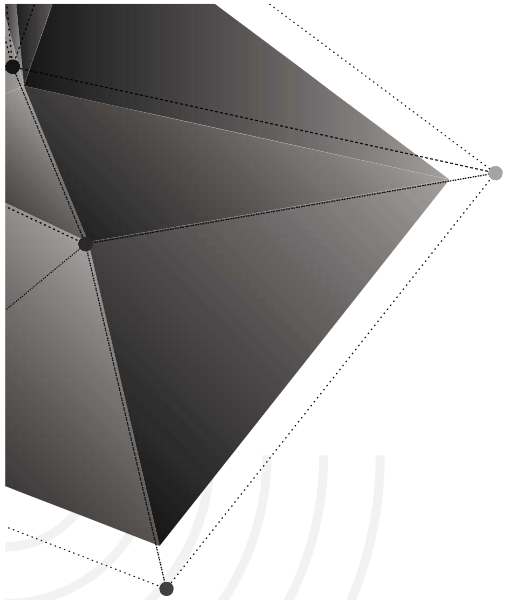
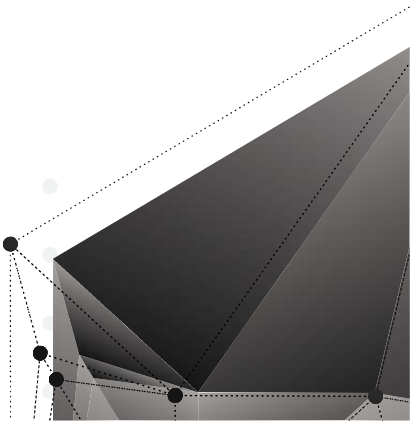


FOURTH SEMESTER

'AUTOMATION
&
ROBOTICS'



SUB SYSTEMS OF ROBOTS

Course Code:	464001
Course Title	Sub Systems of Robots
No. of Credits	4 (TH:4,T:0,P:0)

COURSE OUTCOMES : After completion of the course the Student will be able to:

1. Explain the various robotic actuating system and its application on hydraulic pneumatic and electrical drives.
2. Explain about various types of sensors and concepts on robot vision system.
3. Explain the concepts of robot control systems
4. Explain the various applications of robots

COURSE CONTENTS

Unit - 1 : Actuating Systems

1.1 Characteristics of Actuating Systems

1.2 Comparison of Actuating Systems

1.3 Parameters for Selection of Actuators

Unit - 2 : Hydraulic Actuators & Pneumatic Devices

2.1 Cylinders- Types & Construction, Applications

2.2 Hydraulic Cushioning, Hydraulic Motors

2.3 Compressor – Filters, Regulator, Lubricator, Muffler

2.4 Air Control Valves, Quick Exhaust Valves

Unit - 3 : GRIPPERS

3.1 Different Methods of Gripping

3.2 Mechanical Grippers-Slider Crank Mechanism, Screw Type, Cam Type Grippers

3.3 Magnetic Grippers, Vacuum Grippers, Air Operated Grippers.

Unit - 4 : Robotic Vision Systems

4.1 Human Vision Considerations

4.2 Machine Vision Approaches

4.3 Image Acquisition and Image Analysis

4.4 Applications and Available Systems

4.5 Ranging Techniques

Unit - 5 : Robotic Control Systems

5.1 Linear Control

5.2 Nonlinear and Force Control

Unit - 6 : Mobile Robots

6.1 Approaches to Mobility
6.2 Design Considerations
6.3 Locomotion
6.4 Steering
6.5 Power and Stability
6.6 Intelligence
6.7 Error Considerations
6.8 Current Applications

Unit - 7 : Robot Standards

7.1 RIA Standards Program
7.2 Testing Standards
7.3 Device Communication Standards
7.4 Network Standards
7.5 Other Standards Activity

References /Suggested Learning Resources:

1. Robotics: Fundamental concepts and analysis, By Ashitava Ghosal, Publisher-OUP India, 2006
2. Introduction to Robotics, By S K Saha, Publisher- Tata McGraw-Hill Education
3. Introduction To Robotics: Analysis, Control, Applications, 2nd Edition by Saeed Benjamin Niku 2011, Publisher: Wiley India Pvt. Limited
4. Fundamentals of Robotics Engineering, By Harry H. Poole, Publisher: Springer Science & Business Media, 2012

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SPECIAL MACHINES & CONTROLLERS

Course Code:	464002
Course Title	Special Machines & Controllers
No. of Credits	5 (TH:4,T:0,P:2)

COURSE OUTCOMES : After completion of the course the Student will be able to:

1. Understanding principles of operation, types and applications of stepper motors
2. Understanding principles of operation, types and applications of switched reluctance motors
3. Knowledge in evaluating the performance of dc motors
4. To evaluate the knowledge in permanent magnet synchronous motors.
5. Ability to understand the working and applications of linear motors and servo motors.

COURSE CONTENTS

Unit -1 : Stepper Motors

1.1 Types
1.2 Constructional features and Principle of operation
1.3 Variable reluctance motor-single & multi-stack configurations
1.4 Permanent Magnet Stepper motor
1.5 Hybrid stepper motor
1.6 Different modes of Excitation

Unit - 2 : Switched Reluctance Motors

2.1 Constructional features and principle of operation
2.2 Torque Equation - Power Converters for SR Motor
2.3 Rotor Sensing Mechanism & Logic Controller
2.4 Sensor less Control of SR motor
2.5 Applications.

Unit - 3 : Permanent Magnet Brushless D.C. Motors

3.1 Principle of operation
3.2 Types
3.3 EMF and torque equations
3.4 Power controllers
3.5 Motor characteristics and control
3.6 Applications.

Unit - 4 : Permanent Magnet Synchronous Motors

4.1 Principle of operation
4.2 EMF, power input and torque expressions
4.3 Torque speed characteristics
4.4 Applications.

Unit - 5 : Linear Motors

5.1 Linear Induction motor (LIM)

5.2 Classification, construction, Principle of operation

5.3 Linear Synchronous motor (LSM), Types, Applications

5.4 Servomotor Types, Constructional features, Principle of operation

5.5 Control applications of servo motors

PRACTICAL OUTCOMES : After undergoing the subject, the students will be able to:

1. Understand the torque-speed characteristic of permanent magnet brushless DC motors.
2. Analyze the EMF and torque equations of permanent magnet synchronous motors through experiments.
3. Demonstrate the starting procedure of synchronous motors and plot V-curves.
4. Determine the transfer functions of AC and DC servomotors through experimentation.

List of Practicals :

1. Draw the torque speed characteristic of permanent magnet brushless D.C Motor.
2. Perform an experiment for EMF and Torque equation for permanent magnet synchronous motor.
3. Starting of synchronous motor and plotting V-curves.
4. Determination of transfer function of AC servomotor.
5. To characterize a small permanent magnet stepper motor
6. To drive stepper motor with full, half and micro steps.
7. Perform an experiment for EMF and Torque equation for permanent magnet stepper motor.
8. Determination of transfer function of DC servomotor.
9. Speed control of Switched Reluctance Motor.

References / Suggested Learning Resources:

1. K. Venkataratnam," Special Electrical Machines", Universities Press (India) Private Limited, India,2009.
2. Kenjo, T and Naganori, S "Permanent Magnet and brushless DC motors", Clarendon Press, Oxford, 1989
3. Kenjo T, "Stepping Motors and their Microprocessor Controls", Clarendon Press London, 2003.
4. Miller T J E, "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
5. Naser A and BoldeaL," Linear Electric Motors: Theory Design and Practical Applications", Prentice Hall Inc., New Jersey 1987.
6. Floyd E Saner," Servo Motor Applications ", Pittman USA, 1993.
7. William H Yeadon, Alan W Yeadon, Handbook of Small Electric Motors, McGraw Hill, INC,2001

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FLUID POWER AUTOMATION

Course Code:	464003
Course Title	Fluid Power Automation
No. of Credits	5 (TH:4,T:0,P:2)

COURSE OUTCOMES: After completion of the course the Student will be able to:

1. Explain different types of control system.
2. Understand various parameters associated with fluid flow
3. Develop Hydraulic control circuit for industrial application.
4. Develop Pneumatic control circuit for industrial application.
5. Develop Electrical control circuit for industrial application.

COURSE CONTENTS

Unit 1 Introduction to Fluid Power Automation

1.1 Introduction Fluid Power System:

- 1.1.1 Definition, Types, Application and Advantages of Fluid Power
- 1.1.2 Basic concept of Pascal's Law
- 1.1.3 Comparison of Hydraulics and Pneumatics
- 1.1.4 Properties of fluids (Density, Specific Gravity, Specific Weight, Viscosity, Kinematic Viscosity, Bulk Modulus, Pour Point, Demulsibility, Oxidation Resistance)

1.2 Introduction to Automation –

- 1.2.1 Definition & Need for Automation
- 1.2.2 Block diagram of Automation System & Elements of an Automated System –
- 1.2.3 Functions of Automation, Levels of Automation
- 1.2.4 Types of Production System (Continuous flow process, Mass Manufacturing, Batch production, Job Shop Production)

1.3 Introduction to Industrial Control Systems (Continuous, Discrete, Sequential logic, Supervisory)

Unit 2 Hydraulic System

2.1 Hydraulic Pumps:

- 2.1.1 Classification of pumps
- 2.1.2 Principle of Positive displacement pumps –
- 2.1.3 Construction and Working of Gear pumps.

2.2 Actuators:

2.2.1 Classification of actuators

2.2.2 Linear actuator: Definition and Types

2.2.3 Single acting cylinder, Double acting cylinder

2.2.4 Rotary actuators: Definition and Types

2.2.5 Gear motor, Piston motor.

2.3 ISO symbols of hydraulic pumps and actuators.

2.4 Hydraulic Control Components.

2.5 Control Valves: Classification of valves, actuation method.

2.6 Basic idea of Hydraulic Circuit Design.

Unit - 3 : Pneumatic System

3.1 Basic principle and its structure

3.2 Compressor Types

3.3 Pneumatic single and double acting cylinder.

3.6 Basic idea of Pneumatic Circuits.

Unit - 4 : Electrical Control

4.1 Components and Circuits Switches

4.1.1 Push button, selector, drum, limit, pressure, temperature (Thermostat), float, zero speed and proximity switches.

4.2 Relays

4.2.1 DC relay, latching relay, over current relay, Solid state relay

4.2.2 Timer –Electronic timer.

4.2.3 Contactor (Air break contactor).

PRACTICAL OUTCOMES : After completion of the course the Student will be able to:

1. Understand the operation of single-acting and double-acting cylinders in pneumatic systems.
2. Demonstrate the operation of a double-acting cylinder with a quick exhaust valve.
3. Implement speed control of a double-acting cylinder.
4. Automate the operation of a double-acting cylinder in multi-cycles using limit switches and memory valves.
5. Control the speed of a hydraulic motor.

LIST OF PRACTICALS:

Part - A : Pneumatics Lab

1. Operation of single acting and double acting cylinder.
2. Operation of a Double Acting cylinder.
3. Speed control of Double Acting cylinder.
4. Automatic operation of Double Acting cylinder in multi cycles using limit switches and memory valves.

Part - B : Hydraulics Lab

5. Speed control Hydraulic Motor.
6. Operation of a Double Acting cylinder using solenoid operated Directional control valve.

Part - C : Electrical Control Lab

9. Construct and test simple ON and OFF control using single push button switch.
10. Indirect actuation of pneumatic cylinder using relay.

Text & Reference Books :

1. Industrial Hydraulics –Third Edition John J. Pippenger Tyler, G. Hicks. McGraw-Hill Book Company.
2. Introduction to Fluid Power--James L. Johnson. -Delmar Thomson Learning Inc.
3. Control of Electrical Machines. S.K. Bhattacharya New Age International Publishers, New Delhi
4. Hydraulics and Pneumatics - (HB) Adrewparr –Jaico Publishing House.
5. Pneumatic and Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987
6. Industrial motor control. Stephen Herman 6th Edition, Cengage Learning

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SENSORS & INSTRUMENTATION

Course Code:	464004
Course Title	Sensors & Instrumentation
No. of Credits	5 (TH:4,T:0,P:2)

COURSE OUTCOMES: After completion of the course the Student will be able to:

1. Familiar with various calibration techniques and signal types for sensors.
2. Apply the various sensors in the Automotive and Robotics applications
3. Describe the working principle and characteristics of force, magnetic 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.

COURSE CONTENTS

Unit - I : Introduction

Basics of Measurement – Classification of errors, Error analysis, Static and dynamic characteristics of transducers, Classification of sensors.

Unit - II : Motion, Proximity & Ranging Sensors

Motion Sensors – Potentiometers, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT, Synchro, Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Laser Range Sensor (LIDAR).

Unit - III : Force, Magnetic Sensors

Strain Gage, Load Cell, and Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive, Hall Effect, Current sensor.

Unit - IV : Optical, Pressure & Temperature Sensors

Photo conductive cell, photo voltaic, Photo resistive, LDR; Fiber optic sensors, Pressure – Diaphragm, Bellows; Piezoelectric sensors; Temperature – IC, Thermistor, RTD, Thermocouple; Acoustic Sensors; flow and level measurement; Radiation Sensors; Smart Sensors; LASER sensors.

Unit - V : Signal Conditioning & DAQ Systems

Amplification, Filtering – Sample and Hold circuits, Data Acquisition techniques, Applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

PRACTICAL OUTCOMES: After completion of the course the Student will be able to:

1. Demonstrate the ability to measure displacement using different transducers such as potentiometers, LVDTs, and capacitive transducers.
2. Draw the resistance-temperature characteristics of RTDs (Resistance Temperature Detectors) and thermistors.
3. Understand and draw the temperature characteristics of thermocouples.
4. Perform measurement of flow using differential pressure flow meters.
5. Perform measurement of flow using magnetic flow meters.
6. Study various pressure elements and their applications in pressure, stress, and weight measurement.

List of Practicals:

1. Measurement of displacement using L.V.D.T.
2. To draw the resistance temperature characteristics of RTD.
3. To draw the temperature characteristics of Thermocouple
4. Measurement of flow by differential pressure flow meter
5. Measurement of stress / pressure / weight by strain gauge.
6. Velocity and speed measurement by suitable transducer
7. To draw the input/ output characteristics of Photo diode
8. To draw the input/ output characteristics of Photo conductive (LDR)

Refrences / Suggested Learning Resourses:

1. Ernest O Doebelin, "Measurement Systems– Applications and Design", Tata McGraw-Hill, 2009
2. Sawney A K & Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai& Co, New Delhi, 2013.
3. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001 4.
4. Hans Kurt Tönshoff (Editor), Ichiro, "Sensors in Manufacturing" Volume 1, Wiley-VCH April 2001.
5. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999. 6.Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011.
6. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press,2015

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STRENGTH OF MATERIALS

Course Code:	454001
Course Title	Strength of Materials
No. of Credits	5 (TH:4,T:0,P:2)

COURSE OUTCOMES: At the end of the course, the student will be able to:

1. Demonstrate an understanding of different types of forces, stress, and strain, and their nature on engineering materials.
2. Analyze and evaluate the mechanical properties of common engineering materials.
3. Apply the concepts of stress and strain to interpret stress-strain diagrams and determine the significance of various points on the diagrams.
4. Understand the concept of factor of safety and its importance in engineering design.
5. Establish the relationship between elastic constants and their significance in material behavior.
6. Calculate stress and strain values in bodies of uniform and composite sections under the influence of normal forces, and analyze thermal stresses.

COURSE CONTENTS

Unit 1 - Simple Stresses and Strains

1.1 Types of forces; Stress, Strain and their nature;

1.2 Mechanical properties of common engineering materials;

1.3 Significance of various points on stress – strain diagram for M.S. and C.I. specimens;

1.4 Significance of factor of safety;

1.5 Relation between elastic constants;

1.6 Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces;

1.7 Thermal stresses in bodies of uniform section and composite sections

1.8 Related numerical problems on the above topics

Unit 2 - Shear Force & Bending Moment Diagrams

2.1 Types of beam;

2.2 Types of Load;

2.3 SFD and BM Diagram for various types of beam;

2.4 Analytical method for SF & BM of Simply supported beam;

2.5 Over hanging beam with point loads;

2.6 Combination of point and UDL for the above; Related numerical problems

Unit : 3 - Theory of Simple Bending & Deflection of Beams

3.1 Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature (Definition only);

3.2 Problems involving calculations of bending stress, modulus of section and moment of resistance;

3.3 Calculation of safe loads and safe span and dimensions of cross- section;

3.4 Definition and explanation of deflection as applied to beams (Standard cases only);

3.5 Related numerical problems.

Unit 4 - Torsion in Shafts and Springs

4.1 Definition and function of shaft;

4.2 Calculation of polar M.I. for solid and hollow shafts;

4.3 Assumptions in simple torsion;

4.4 Problems on design of shaft based on strength & rigidity;

4.5 Numerical Problems related to comparison of strength and weight of solid and hollow shafts

4.6 Classification of springs;

4.7 Deflection formula for closed coil helical spring (without derivation);

4.8 Stiffness of spring;

4.9 Related numerical problems.

Unit 5 - Thin Cylindrical Shells

5.1 Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell;

5.2 Related numerical Problems for safe thickness and safe working pressure.

PRACTICAL OUTCOMES: - At the end of the course, students will be able to:

1. Develop the ability to determine Rockwell's Hardness Number for various materials such as mild steel, high carbon steel, brass, copper, and aluminum, providing insights into their hardness properties.
2. Gain proficiency in conducting Izod impact tests to evaluate the resistance of materials to impact loads, enabling the assessment of their toughness.
3. Gain proficiency in conducting Charpy impact tests to evaluate the resistance of materials to impact loads, providing insights into their toughness properties.
4. Acquire the skills to perform torsion tests on mild steel, establishing the relationship between torque and angle of twist, and determining shear modulus and shear stress, contributing to the understanding of material behavior under torsional forces.
5. Develop the ability to determine Young's Modulus of Elasticity, yield points, percentage elongation, and percentage reduction in area by conducting tests on mild steel, enabling the characterization of its mechanical properties through stress-strain analysis.
6. Acquire the skills to determine the modulus of rigidity, strain energy, shear stress, and stiffness using the load deflection method, specifically in open and closed coil spring setups, contributing to the understanding of material behavior under bending and shear forces.

List of Practicals:

1. Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
2. Finding the resistance of materials to impact loads by Izod test.
3. Finding the resistance of materials to impact loads by Charpy test.
4. Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.
5. Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage
6. reduction in area, stress strain diagram plotting, tests on mild steel.
7. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
8. Single or double Shear test on M.S. bar to finding the resistance of material to shear load.
9. To determine tensile test using UTM.
10. To determine bending, shear and compression test using UTM.

Text & Reference Books:

.1. Measurement system (Application and Design) – Ernest O Doebelin.

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017.
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013.
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi.
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi.
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi.

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ELECTRICAL CIRCUITS & POWER SUPPLIES

Course Code:	464005
Course Title	Electrical Circuits & Power Supplies
No. of Credits	5 (TH:4,T:0,P:2)

COURSE OUTCOME:- After completion of the course the Student will be able to:

1. Understand and classify electrical components based on their properties, such as active/passive, linear/nonlinear, unilateral/bilateral, and lumped/distributed.
2. Calculate equivalent resistance for series and parallel resistances, and perform delta to star and star to delta conversions for resistive networks.
3. Simplify electrical networks using the concepts of equivalent resistances and conversion techniques.
4. Analyze electrical circuits using Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL) through nodal analysis and mesh analysis.
5. Apply Cramer's rule for mesh and nodal analysis in solving electrical circuits.
6. Apply network theorems to analyze and solve electrical circuits.

COURSE CONTENTS

Unit - 1: Basic of Network

1.1 Electrical components: Active & Passive, Linear & Nonlinear.

1.2 Equivalent resistance of series & parallel resistances.

1.3 Delta to Star and Star to Delta conversion.

1.4 Examples of network simplifications using above methods.

1.5 Voltage source & current source (ideal & practical), source conversion.

Unit - 2 : KIRCHOFF'S LAW

Analysis of electrical circuits (D.C.) using following laws

2.1 Node, junction, branch, loop and Mesh

2.2 Kirchhoff's voltage law (KVL), Kirchhoff's current law (KCL), nodal analysis.

2.3 Cramer's rule for mesh analysis & nodal analysis.

Unit - 3 : Network Theorems

Analysis of electrical circuits (D.C.) using:

3.1 Superposition Theorem

3.2 Thevenin Theorem

3.3 Norton Theorem

3.4 Maximum Power transfer theorem

3.5 Reciprocity Theorem

UNIT - 4 : D.C. Supplies

4.1 Unregulated D.C. supplies using half wave rectifier, full wave rectifier and different types of filters.

4.2 Regulated D.C. supply using Zener diode.

4.3 Overload & short circuit protection of regulated D.C. supplies.

4.4 Construction & working of 78XX and 79XX based 3 pin fix voltage regulators.

4.5 Construction & working of LM 317 based 3 pin variable voltage regulator.

4.6 Basic block diagram of switch mode power supply (SMPS).

4.7 Merits & Demerits of SMPS.

PRACTICAL OUTCOMES:- After completion of the course the Student will be able to:

1. perform the conversion of electrical sources (ammeter to volt meter and vice-a-versa).
2. Apply mesh analysis to determine the current through a specific branch of an electric network using voltmeters & ammeters.
3. Apply node analysis to determine the current through a specific branch of an electric network using voltmeters & ammeters.
4. Apply the various network theorems to determine the current through a branch and voltage across an element of a circuit using voltmeters and ammeters.
5. Understand the use of voltage regulator ICs in different practical applications.

List of Practicals:

1. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying mesh analysis.
2. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.
3. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
4. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem
5. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem
6. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.
7. Design a power supply of 5V on Bread Board.

References /Suggested Learning Resources:

1. Networks and Systems Ashfaq Husain Khanna Publishing House
2. Network Analysis M. E. Van Valkenburg Prentice Hall of India
3. Engineering Circuit Analysis W. H. Hayt, J. E. Kemmerly and S. M. Durbin McGraw Hill
4. Electrical Circuits Joseph Edminister Schaum's Outline, Tata McGraw Hill
5. Basic Circuit Theory Lawrence P. Huelsma Prentice Hall of India
6. Network & Systems D. Roy Choudhury Wiley Eastern Ltd
7. Linear Circuit Analysis De Carlo and Lin Oxford Press
8. Op-Amps and linear integrated circuits by Ramakant A. Gaykwad, Pearson.

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‘Elective 1-1’
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code:	454007
Course Title	Artificial Intelligence & Machine Learning
No. of Credits	4 (TH:4,T:0,P:0)

COURSE OUTCOMES: At the end of this course, the student will be able to:

1. Understand the history and foundations of artificial intelligence, including its origins and key milestones in its development.
2. Gain knowledge and proficiency in problem-solving techniques in AI.
3. Develop an understanding of adversarial search in decision support systems and technologies.
4. Acquire knowledge of representation, reasoning, expert systems, and the basics of planning in AI.
5. Learn the basics tools and techniques used in machine learning.

COURSE CONTENTS

Unit - I : Introduction

History & foundations of AI, Problem solving: Uninformed and informed Search.

Unit - II : Adversarial Search

Two players games, games with uncertainty; Decision support systems and technologies; Knowledge representation, Reasoning.

Unit - III : Machine Learning Basics

Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation, Neural networks, Visualization.

Unit - IV :

Basic idea of Linear regression, concept of SSE; gradient descent; closed form; normal equations; features.

Unit - V :

Classification problems; Decision boundaries; Probability and classification, Bayes optimal decisions.

References:

1. Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/Prentice Hall.
2. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, New Delhi (2018)
3. V.K. Jain, Machine Learning, Khanna Publishing House, New Delhi (2018)
4. Ethem Alpaydin, Introduction to Machine Learning, Second Edition,
5. http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012.

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‘Elective 1-2’
SOFT COMPUTING

Course Code:	454008
Course Title	Soft Computing
No. of Credits	4 (TH:4,T:0,P:0)

COURSE OUTCOMES : At the end of the course, the student will be able to:

1. Classify and differentiate problem solving methods and tools.
2. Apply A*, AO*, Branch and Bound search techniques for problem solving.
3. Formulate an optimization problem to solve using evolutionary computing methods.
4. Design and implement GA, PSO and ACO algorithms for optimization problems in Mechanical Engineering.
5. Apply soft computing techniques for design, control and optimization of Manufacturing systems.

COURSE CONTENTS

Unit - I : Introduction

Soft Computing, Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

Unit - II : Neural Networks

Introduction to Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Neural Network.

Unit - III : Fuzzy Systems

Fuzzy Control Systems, Fuzzy Classification.

Unit - IV : Genetic Algorithm

History of Genetic Algorithms (GA), Working Principle, Various Encoding methods.

Unit - V : Hybrid Systems

Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems.

Text & Reference Books:

1. Tettamanzi Andrea, Tomassini and Marco, Soft Computing Integrating Evolutionary, Neural and Fuzzy Systems, Springer, 2001.
2. Elaine Rich, Artificial Intelligence, McGraw Hill, 2/e, 1990.
3. Kalyanmoy Deb, Multi-objective Optimization using Evolutionary Algorithms, John Wiley and Sons, 2001.

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'Audit Course'
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Code	AS401
Course Title	Essence of Indian Traditional Knowledge
No. of Credits	0 (TH:2,T:0,P:0)

COURSE OUTCOMES: After completion of this course, student will be able to:

1. Develop a comprehensive understanding of the essence of Indian knowledge and tradition.
2. Explore the rich philosophical systems of ancient India and their relevance today.
3. Gain familiarity with the Vedic literature and scriptures, and appreciate their wisdom.
4. Analyze Indian epics and mythology to understand their cultural and spiritual significance.
5. Learn and apply principles of yoga, meditation, and mindfulness for personal well-being.
6. Discover the principles and practices of Ayurveda and natural healing for holistic health.

COURSE CONTENTS

1. Introduction to Indian Knowledge and Tradition
2. Ancient Indian Philosophical Systems
3. Vedic Literature and Scriptures
4. Indian Epics and Mythology
5. Yoga, Meditation, and Mindfulness Practices
6. Ayurveda and Natural Healing Systems
7. Indian Classical Arts and Music
8. Indian Architecture and Sculpture
9. Indian Festivals and Rituals
10. Ethical and Moral Values in Indian Culture

References /Suggested Learning Resources:

1. "Indian Philosophy: A Very Short Introduction" by Sue Hamilton
2. "The Vedas: An Introduction to Hinduism's Sacred Texts" by Roshen Dalal
3. "The Ramayana: A Shortened Modern Prose Version of the Indian Epic" by R.K. Narayan
4. "The Upanishads" translated by Eknath Easwaran
5. "Autobiography of a Yogi" by Paramahansa Yogananda
6. "Ayurveda: The Science of Self-Healing" by Dr. Vasant Lad.

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MINOR PROJECT WORK

Course Code:	AS402
Course Title	Minor Project Work
No. of Credits	2 (TH:0,T:0,P:4)

OBJECTIVE:

The Minor Project work is an integral part of the Engineering Diploma program, designed to provide students with an opportunity to apply theoretical knowledge gained throughout their studies to real-world engineering challenges. This module aims to foster creativity, problem-solving abilities, and practical skills essential for successful engineering professionals.

PRACTICAL OUTCOMES: After undergoing the minor project work, the student will be able to:

1. Understand the practical applications of engineering concepts in real-world scenarios.
2. Develop hands-on experience in designing, implementing, and testing engineering projects.
3. Enhance problem-solving and critical thinking skills through project execution.
4. Improve documentation and presentation skills for effective project communication.

GENERAL GUIDELINES:

1. Introduction to Minor Projects

- Overview of the module's purpose and objectives
- Importance of practical application in engineering
- Understanding the project life cycle and its stages

2. **Project Ideation and Proposal Development**
- Identifying engineering problems and project ideas
- Formulating clear project objectives and scope
- Developing a comprehensive project proposal

3. **Project Planning and Management**
- Creating a project plan with defined milestones and timelines
- Resource allocation and budgeting for the project
- Risk assessment and mitigation strategies

4. **Engineering Design and Analysis**
- Principles of engineering design and problem-solving
- Conducting feasibility studies and simulations (if applicable)
- Engineering analysis techniques and tools

5. **Prototyping and Implementation**
- Hands-on development of project prototypes
- Conducting experiments and data collection
- Troubleshooting and problem-solving during implementation

6. **Project Documentation and Reporting**
- Techniques for effective project documentation
- Writing comprehensive project reports and design documentation
- Organizing and presenting project data

7. Project Presentation and Communication

- Principles of effective communication in engineering
- Preparing engaging & informative project presentations
- Addressing questions & feedback during the presentation

8. Project Evaluation and Assessment

- Criteria for evaluating project success and achievement of objectives
- Conducting fair and unbiased project assessments
- Peer evaluations and constructive feedback.

ACTIVITIES AND EXECUTION GUIDELINES

1. Project Proposal Submission:

Students will submit their project proposals to the assigned mentors. The proposals should be well-structured, indicating the project's significance, expected outcomes, resources required, and a preliminary plan of action.

2. Project Execution:

During this period, students will work on their projects under the guidance of their mentors. They are encouraged to employ innovative techniques and apply engineering principles to achieve project objectives successfully.

3. Project Documentation:

Students will submit their final project reports and related documentation. The documentation should encompass all project phases, methodologies, experimental data, analysis, and outcomes.

4. Project Presentation:

Each student will deliver a comprehensive presentation to a panel of evaluators, showcasing their project's key aspects, results, and conclusions.

ASSESSMENT CRITERION

1. Project Proposal and Objective (10%)

Students are required to submit a comprehensive project proposal outlining the problem statement, objectives, scope, and methodology of the project. This component will account for 10% of the total marks.

2. Project Implementation (60%)

The core of the assessment will be based on the successful implementation of the project. Students will be evaluated on their ability to execute the project plan, adhere to timelines, and demonstrate practical engineering skills. This segment will carry 60% of the total marks.

3. Documentation (15%)

Proper documentation is vital to effective project management and communication. Students will be evaluated on the clarity, completeness, and organization of their project reports, design diagrams, code (if applicable), and any other relevant material. This component will contribute 15% of the total marks.

4. Project Presentation (15%)

Communication and presentation skills are crucial for engineers to articulate their ideas effectively. Students will be assessed based on their ability to present their project's

objectives, methodology, results, and conclusions in a clear and concise manner. This segment will be worth 15% of the total marks.

The Minor Project module is a pivotal component of the Engineering Diploma program that provides students with hands-on experience, encourages critical thinking, and prepares them for real-world engineering challenges. By adhering to the module guidelines and distribution of marks, students can excel in their projects and demonstrate their engineering prowess effectively.

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