Course Curriculum

(3rd Semester)

Structure for 3rd semester courses offered through "Design Your Degree"

In Semester 3, students have the flexibility to choose two courses from either academic basket A or B. The subjects from General Basket are compulsory courses.

General Basket

Course Category	Course Title	Credits	Maximum Marks	Minimum Pass Marks
DYD-AEC-301	Fundamentals of Climate Change	02	50	20
DYD-SEC-302	Design Thinking	04	100	40
DYD-MD-303	Science, Technology & Society	04	100	40
DYD-PW-304	Project Work/ Capstone Project	04	100	40

Basket A

Course Category	Course Title	Credits	Maximum Marks	Minimum Pass Marks
DYD-MJ-305	Principles of Management	04	100	40
DYD-MJ-306	Basic Microeconomics	04	100	40
DYD-MJ-307	E-Commerce	04	100	40

Basket B

Course Category	Course Title	Credits	Maximum Marks	Minimum Pass Marks
DYD-MJ-308	Artificial Intelligence	04	100	40
DYD-MJ-309	Data Science	04	100	40
DYD-MJ-310	Hands-on Electronics: Concept, Circuits and Creativity	04	100	40

Course Code: DYD-AEC-301 **Course Title: Fundamentals of Climate Change**

Credits: 2

Course Objectives

1. To understand the fundamentals of Climate Change by studying the scientific basis of climate change, including the roles of greenhouse gases, natural cycles, and human activities.

2. To analyse the environmental and societal impacts of climate change.

3. To evaluate mitigation and adaptation strategies of climate change, such as renewable energy, policy frameworks, and community resilience efforts.

Learning Outcomes

- This course provides an in-depth examination of climate change, including its causes, consequences, and potential solutions. Students will explore the science behind climate change, its environmental, societal impacts, policy and mitigation strategies.

Course Content

Module-I

Concept of Climate Change and Global Warning. Climate Variability. Earth's climate system; Greenhouse gases and radiative forcing; Climate change indicators; Extreme weather events; Impacts of climate change on environment, Climate modelling.

Climate policy and international agreements: United Nations Framework Convention on Climate Change (UNFCCC); Kyoto protocol and Paris Agreement; Clean development mechanism (CDM); Grassroots activism and climate movements

Module-II

Concept of climate vulnerability and risk; Mitigation strategies for different sectors; Adaptation strategies for different sectors; Climate justice and equity. Climate change impact and Mitigation Strategies for Kashmir region, Sustainable Cevelopment Goals (SDGs) on Climate Action. National Action Plan on Climate Change (NAPCC), State Action Plan on Climate Change (SAPCC) of Jammu and Kashmir, National Disaster Act 2005.

Suggested Readings:

1. Mélières, Marie-Antoinette, and ChloéMaréchal. *Climate Change: Past, Present, and Future. John Wiley & Sons, 2015.*
2. Bulkeley, Harriet, and Peter Newell. *Governing climate change*. Routledge, 2010.
3. Noguer, Maria, et al. *Climate change 2001: the scientific basis*. Eds. John Theodore Houghton, Y. D. J. G. Ding, and David J. Griggs. Vol. 881. No. 9. Cambridge: Cambridge University Press, 2001.

4. Zhang, Zhihua, and Jianping Li. "*Big data mining for climate change.*" Elsevier (2019).

Online Resources:

1. Assessment of Climate Change Over the Indian Region. A Report of the Ministry of Earth Sciences (MoES), Government of India , 2020. Available free on Google Books: https://www.google.co.in/books/edition/Assessment_of_Climate_Change_over_the_In/oEzrDwAAQBAJ?hl=en&gbpv=1/
2. Climate Time Machine by NASA. Series of visualizations showing how some of Earth's key climate indicators are changing over time. https://climate.nasa.gov/interactives/climate-time-machine/?intent=021/

Course Code: DYD-SEC-302 **Course Title: Design Thinking**

Credits: 4

Course Objectives

1. To provide basic understanding of problem search, design process, design thinking and ability to convert an innovative product idea to a prototype.

Learning Outcomes

After studying the course, the student will be able to:

- Understand the innovation process
- Do product designing
- Empathy research.
- Designing brief and proof of concept.
- Prototyping. Product testing and validation

Course Content

Module-I

Design thinking and innovation in product or process designing. Identifying user needs. Human Centered Design.

Module-II

Innovation Opportunities. Problem space exploration. Ideation. Empathy Research.

Module-III

Novel product or process Opportunities. Solution space exploration. Design brief. Concept generation. User validation Converting ideas to product.

Module-IV

Developing Prototypes. Iterative improvement. Proof of concept - Product testing and validation. Disruptive design innovations – case studies.

Suggested Readings:

1. Creative Confidence: Unleashing the creative potential within us all by Tom Kelley & David Kelley, Crown Business (New York, 2013)

2. The Design of everyday things by Don Norman, Basic Books (2013)

3. Design Thinking: Understanding how designers think and work by Nigel Cross, Bloomsbury Visual Arts (2019)

Online Resources:

1. Stanford Design School Tools.
   https://dschool.stanford.edu/innovate/tools
2. IDEO U Design Thinking Resoruces, Activities and Exercises.
   https://www.ideou.com/pages/design-thinking-resources
3. Design Thinking Resources by Interaction Design Foundation.
   https://www.interaction-design.org/literature/topics/design-thinking

Course Code: DYD-MD-303 **Course Title: Science, Technology & Society**

Credits: 4

Course Objectives

1. To understand how techno-scientific and social phenomena interact and influence each other.
2. To analyze how technologies mediate our perception of reality.
3. To enquire how gender, race, and other social inequalities are reproduced or addressed by technologies.
4. To become well versed with the distribution of benefits and risks of Science and Technology.

Learning Outcomes

- Develop a critical understanding of the interplay between science, technology, and society.
- Engage with real-world case studies to analyze both the benefits, challenges and risks posed by scientific and technological advancements, including ethical dilemmas, environmental impacts, and policy debates.
- Gain insights into the historical and contemporary development of science and technology in India, examining how socioeconomic factors shape innovation and its societal consequences.

Course Content

Module - I

Basic Concepts and Perspectives on Science. Nature of Scientific Knowledge. Scientific Method. Concept of Technology, Concept of Development, Role of Technology in Development, Science and Technology Studies – An Overview.

Module - II

Theoretical Perspectives on: Paradigm Shift, Social Construction of Knowledge, Technological Determinism, and Social Construction of Technology (SCOT).

Module - III

Science and Technology in a Globalized World, Digital Society, Risk Society, Challenges and opportunities of emerging technologies like Information Technology, Bio-technology and AI, Ethics in engineering, Bioethics, Ethics and AI. Evolution of Science & Technology (S&T) Policy in India.

Module - IV

Science and Technology in a Knowledge Economy, Intellectual Property Rights, Patent Laws and Indigenous Knowledge. Open Science. Citizen Science.

Suggested Readings:

1. Bridgstock, Martin, David Burch, John Forge, John Laurent, and Ian Lowe. *Science, Technology and Society: An Introduction.* Cambridge: Cambridge University Press,1998.
2. Biagioli,Mario. *The Science Studies Reader.* Routledge (1999).
3. Ramamurthy, V S and Dinesh K Srivastava. *Science, Technology and Development: How Long is the Long Path for Developed India.* National Institute of Advanced Studies, India. http://eprints.nias.res.in/2562/1/NIAS_NSE_U_RR_11_2023.pdf
4. Visvanathan, S. (1997). *A Carnival for Science: Essays on Science, Technology, and Development*. Oxford University Press(1997).
5. Gobo, Giampietro, and Valentina Marcheselli. *Science, Technology and Society: An Introduction*. Springer Nature, 2023.
6. Waterstone, Marvin, ed. *Risk and Society: The Interaction of Science, Technology and Public Policy*. Vol. 6. Springer Science & Business Media, 2012.
7. Snow, Charles Percy. *Two Cultures*. Science 130, no. 3373(1959):419-419.
8. Chesbrough,Henry. *From Open Science to Open Innovation*. Institute for Innovation and Knowledge Management, ESADE (2015).

Online Resources:

1. Online Resources for Science, Technology and Society by North Carolina State Universityhttps://ids.chass.ncsu.edu/majors-and-minors/science-technology-and-society/science-technology-and-society-specializations-and-resources/
2. INTERSECT : An international Science, Technology, and Society research journal run by undergraduate students at Stanford University. https://sts.stanford.edu/news-publications/sts-intersect-journal
3. Do You think Science https://semiconductorfilms.com/art/do-you-think-science/
4. Open Science 101 by NASA https://science.nasa.gov/open- science/os101/
5. Project2061 for Science Literacy by the American Association for Advancement of Science https://www.aaas.org/programs/project-2061/
6. https://aeon.co/essays/science-needs-the-freedom-to-constantly-change-its-mind/

Course Code: DYD-MD-304 **Course Title: Project Work/ Capstone Project**

Credits: 4

Capstone Project Outline: Addressing Climate Change through Design Thinking and Science, Technology and Society

1. Project Overview

- **Objective**: Develop a solution to a specific climate change challenge using Design Thinking principles, integrating scientific and technological approaches while considering societal impacts and stakeholder needs.
- **Focus Areas**:
  - Climate Change: Mitigating or adapting to environmental challenges (e.g., carbon emissions, extreme weather, resource scarcity).
  - Design Thinking: Applying empathetic, iterative, and human-centered problem-solving.
  - Science, Technology, and Society (STS): Analyzing how technology shapes and is shaped by societal values, ethics, and equity.
- **Deliverables**: A prototype or actionable solution, a final report, and a presentation.

2. Project Phases (Aligned with Design Thinking)

Phase 1: Empathize

- **Objective**: Understand the climate change issue and its impact on stakeholders.
- **Activities**:
  - Identify a specific climate change problem (e.g., urban heat islands, agricultural resilience).
  - Conduct stakeholder interviews (e.g., local communities, policymakers, scientists, businesses).
  - Research societal impacts, including vulnerable populations and equity considerations.
  - Analyze how technology influences or is influenced by the problem (STS lens).
- **Outputs**:
  - Stakeholder personas and empathy maps.
  - Problem statement grounded in climate science and societal context.

Phase 2: Define

- **Objective**: Refine the problem based on insights from the Empathize phase.
- **Activities**:
  - Synthesize findings to articulate a clear, human-centered problem statement.
  - Identify key climate science principles relevant to the issue (e.g., greenhouse gas dynamics, ecosystem resilience).
  - Explore technological constraints and opportunities (e.g., renewable energy, IoT sensors, AI modeling).

- Consider societal factors (e.g., policy barriers, cultural attitudes, economic implications).

- **Outputs**:
  - Refined problem statement.
  - Research summary linking climate science, technology, and societal dynamics.

Phase 3: Ideate

- **Objective**: Generate innovative, feasible solutions.
- **Activities**:
  - Brainstorm solutions that integrate climate science and technology (e.g., low-cost carbon capture, community-based adaptation tools).
  - Use Design Thinking tools like mind mapping to explore ideas.
  - Evaluate ideas through an STS lens: How do they impact equity, ethics or social structures?
  - Prioritize ideas based on feasibility, impact and scalability.
- **Outputs**:
  - Shortlist of 3–5 solution concepts.
  - Initial assessment of technological and societal implications.

Phase 4: Prototype

- **Objective**: Build tangible representations of the selected solution(s).
- **Activities**:
  - Develop low-fidelity prototypes (e.g., physical models, digital mock-ups, or process diagrams).
  - Incorporate appropriate technologies (e.g., sensors for monitoring, renewable energy systems, or data visualization tools).
  - Ensure prototypes address climate goals (e.g., reducing emissions, enhancing resilience).
  - Consider societal accessibility (e.g., affordability, cultural relevance).
- **Outputs**:
  - Functional prototype or detailed simulation.
  - Documentation of design choices and technology integration.

Phase 5: Test

- **Objective**: Validate the solution with stakeholders and refine based on feedback.
- **Activities**:
  - Conduct usability testing with stakeholders (e.g., community members, local governments).
  - Assess environmental impact using climate science metrics (e.g., carbon footprint reduction).
  - Evaluate societal outcomes (e.g., inclusivity, economic viability, ethical implications).
  - Iterate on the prototype based on feedback and testing results.
- **Outputs**:
  - Refined prototype.
  - Testing report with stakeholder feedback and lessons learned.

3. Integration of Science, Technology, and Society (STS)

- **Scientific Foundation**: Ground the project in climate science (e.g., understanding carbon cycles, climate modelling, or ecosystem dynamics).
- **Technological Innovation**: Leverage appropriate technologies (e.g., renewable energy, IoT, AI, or biodegradable materials) to address the problem.
- **Societal Impact**:
  - Analyze how the solution affects communities, particularly marginalized groups.
  - Consider ethical implications (e.g., data privacy in tech solutions, equitable access).
  - Explore policy and governance implications (e.g., how regulations shape adoption).

4. Project Timeline

- **Week 1–2**: Empathize (stakeholder research, problem identification).
- **Week 3–4**: Define (problem refinement, literature review).
- **Week 5–6**: Ideate (brainstorming, solution prioritization).
- **Week 7–9**: Prototype (design and development).
- **Week 10–12**: Test (validation, iteration, final refinements).
- **Week 13**: Finalize deliverables (report, prototype, presentation).

5. Deliverables

- **Prototype**: A tangible or digital solution addressing the climate change challenge.
- **Final Report**:
  - Problem statement and stakeholder analysis.
  - Climate science and technological basis for the solution.
  - STS analysis (societal impacts, ethical considerations).
  - Prototype documentation and testing results.
- **Presentation**: A 10–15 minute pitch to stakeholders, summarizing the project and its impact.

6. Evaluation Criteria

- **Design Thinking Application**: Effective use of empathize, define, ideate, prototype, and test phases.
- **Climate Change Impact**: Clear connection to climate science and measurable environmental benefits.
- **Technological Feasibility**: Practical and innovative use of technology.
- **Societal Relevance**: Consideration of equity, ethics and societal implications.
- **Clarity and Professionalism**: Quality of deliverables and presentation.

7. Resources and Tools

- **Climate Science**: IPCC reports, NOAA climate data, local environmental studies.
- **Technology**: Open-source platforms (e.g., Raspberry Pi), data visualization tools (e.g., Tableau, Python).
- **Design Thinking**: IDEO Design Thinking toolkit, Stanford school resources.
- **STS Frameworks**: Ethical impact assessment tools, case studies on technology adoption.

Course Code: DYD-MJ-305 **Course Title: Principles of Management**

Credits: 4

Course Objectives

1. The purpose of this course is to introduce students to the roles and responsibilities of managers in organizations.
2. The course will emphasis experiential learning and self-inquiry to explore the job of a manager, including the managerial environment, the five functions of management(planning, organizing, directing, staffing and controlling), decision-making and evaluation.

Learning Outcomes

- Examine the functions of planning, organising, leading, staffing and controlling.
- Evaluate and anticipate the potential effectiveness of various management styles, communications, and decisions for a given situation.

Course Content

Module- I

Nature, Meaning, and Significance of Management, Managerial functions, Principles of Management, Evolution of Management Thoughts–Classical, Behavioural, Modern Approaches; Contemporary management practices.

Module- II

Nature and Elements of Planning, Planning Types and Models, Planning in learning organizations. Organizing -Nature of Organizing, Basic issues in organizing. Organization Design: Organization Structureand types, interdependence and its mechanism, Departmentalization, centralization vs decentralization.

Module- III

Directing- concept, features & its significance. Implications of motivation as a directing tool in organizational perspective. Staffing- concept, functions & its objectives. Controlling- concept, significance, process & its limitations. Types of controlling and implications of effective control in organizations.Quantitative and Qualitative measures of Control, Feedback Management

Module- IV

Decision-making styles; Process of decision making, locus of decision making. Management by Objectives (MBO), SWOT Analysis. Nature of Evaluation, Design and Problems – Appraising Techniques– Developing Compensation Plans.

Suggested Readings:

1. Robbins, Stephen P., and Mary Coulter. "Management."13th ed., Pearson, 2019.
2. Daft, Richard L. "Management." 12th ed., Cengage Learning, 2021.
3. Bateman, Thomas S., and Scott Snell. "Management: Leading and Collaborating in a Competitive World." 13th ed., McGraw-Hill Education, 2022.
4. Mintzberg, Henry. "Managing."1st ed., Beret-Koehler Publishers, 2009.
5. Koontz, Harold, and Heinz Weihrich. "Essentials of Management: An InternationalPerspective." 10th ed., Tata McGraw-Hill, 2015.
6. Griffin, Ricky W. "Management." 13th ed., Cengage Learning, 2020.

Online Resources:

1. MIT Human Resources. The Basics of Managing as a Leader.https://hr.mit.edu/learning-topics/leading/articles/basics
2. MIT Human Resources. Leading and Managing Others. https://hr.mit.edu/learning-topics/leading
3. Management Fundamentals | Online Resources by SAGE Publications.https://edge.sagepub.com/lussier6e

Course Code: DYD-MJ-306 **Course Title: Basic Microeconomics**

Credits: 4

Course Objectives

1. To expose the students to the basic principles of microeconomic theory.
2. To understand the essence of subject, followed by law of demand and supply along with concepts like market equilibrium, utility, budget line and consumer's equilibrium.
3. To explore basic concepts associated with producer's equilibrium.

Learning Outcomes

- Develop a basic understanding of theoretical concepts in microeconomics.
- Exhibit a broad understanding of the theory of demand and be in a position to calculate demand elasticity under different circumstances.
- Demonstrate an understanding of utility theory and analyze changes in budget and its impact on consumer's equilibrium.
- Inculcate the skills to calculate revenue and cost functions of a firm.

Course Content

Module- I

Microeconomics and Macroeconomics distinction; central problems of an economy; scarcity and choice; concept of opportunity cost; production possibility curve.

Module- II

Demand – concept and types, demand schedule & demand curve; determinants of demand; law of demand & its exceptions; movement vs. shift in demand. Supply-concept, types and determinants; law of supply. Elasticity of demand & supply.

Module- III

Consumer Preference's, Utility- concept and approaches, total utility and marginal utility and the relationship between the two; law of diminishing marginal utility and law of equi-marginal utility; utility function; indifference curve and its types.

Module- IV

Production function, law of variable proportions, economies and diseconomies of scale, returns to scale. Isoquants, iso-cost line, producer's equilibrium - cost minimizing approach. Cost: short run and long run cost curves. Revenue: total, average and marginal revenue and their relationship.

Suggested Readings:

1. Mankiw, N. (2020). Economics: Principles and applications, 9th ed. Cengage Learning.
2. Snyder, C., Nicholson, W. (2010). Theory and Application of Intermediate Microeconomics, 10th Edition
3. Samuelson, P., & Nordhaus, W. (2010). Principles of Economics. McGraw-Hill, New York, 10th edition.
4. Karl E. Case, Ray C. Fair, Sharon E. Oster (2017), Principles of Microeconomics, Pearson.
5. Bernheim, B. Douglas, and Michael Dennis Whinston. 2014. Microeconomics. New York, NY:McGrawHill/Irwin.
6. Varian, H. (2010). Intermediate microeconomics: A modern approach, 8th ed. W. W. Norton.
7. Bergstrom, T., Varian, H. (2014). Workouts in intermediate microeconomics. W. W. Norton.

Online Resources:

1. MIT OpenCourse Ware, Principles of Microeconomics by Prof.Jonathan Gruber Warehttps://ocw.mit.edu/courses/14-01sc-principles-of-microeconomics-fall-2011/
2. Microeconomics for Free by Dr. Bella Valle https://microeconomicsforfree.com/

Course Code: DYD-MJ-307 **Course Title: E- COMMERCE**

Credits: 4

Course Objectives

1. To understand the concept of E-Commerce and Know the Characteristics of E-Commerce
2. To explain the functions of E-Commerce and to define the scope of E-Commerce
3. To recognize the benefits and limitations of e-commerce
4. To Identify E-Commerce opportunities and challenges

Learning Outcomes

- Comprehend E-Commerce Fundamentals and evaluate E-Commerce Opportunities and Challenges:
- Understand E-Commerce Business Models and analyze E-Marketing Dynamics:
- Develop E-Marketing Strategies and understand E-Payment Systems:

Course Content

Module- I

E – Commerce: Meaning, definition, features, functions of E-Commerce, Scope, Benefits and Limitations of E-Commerce, The Internet and India, E-commerce opportunities and challenges for Industries.

Case studies on E-commerce ventures in Kashmir.

Module- II

Business Models for E-commerce: The Birth of Portals, E-Business Models, Business-to Consumer (B2C), Business-to-Business (B2B), Consumer-to Consumer (C2C), Consumer To-Business (C2B), Brokerage Model, Value Chain Model, Advertising Model.

Module- III

E-marketing, Traditional Marketing Vs E-Marketing, Impact of E-commerce on markets. Marketing issues in E-Marketing, Online Marketing, E-advertising, Internet Marketing Trends, E-Branding, Marketing Strategies.

Case studies on E-marketing.

Module- IV

E-payment Systems: Digital payment Requirements, Digital Token-based E-payment systems, Benefits to Buyers, Benefits to Sellers, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E- Cash.

Case studies on Google Pay and Paytm.

Suggested Readings:

1. Joseph P. T., E - Commerce – An Indian Perspective
2. Jaiswal S., E-Commerce Mohammad Mahmoudi Maymand
3. E-Commerce Murthy C.S.V., E-Commerce - Concepts, Models and Strategies

Course Code: DYD-MJ-308 **Course Title: Artificial Intelligence**

Credits: 4

Course Objectives

1. To develop an understanding of artificial intelligence's basic principles and history.
2. To apply reasoning methods for decision-making and problem-solving
3. To implement and apply algorithms to solve complex problems

Learning Outcomes

- Identify and discuss various applications of AI across different domains and their impacts.
- Develop and implement knowledge-based systems and expert systems for decision-making and problem-solving.
- Implement and evaluate informed and uninformed search algorithms to solve problem-solving tasks.

Course Content

Module- I

Foundational concepts of AI : What is Intelligence? Decision Making. How do you make decisions? (Make your choices!), what is Artificial Intelligence and what is not? Understand the concept of Artificial Intelligence (AI) and its domains, Applications of AI – A look at Real-life AI implementations. AI Ethics: Learn about the ethical concerns involved in AI development, such as AI bias, data privacy and how they can be addressed. Moral Machine Activity: a platform for gathering a human perspective on moral decisions made by machine intelligence, such as self-driving cars. http://moralmachine.mit.edu/

Module- II

Evolution of AI, Types of AI, Domains of AI, AI Terminologies, Benefits and limitations of AI. AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, Turing Test, Future of Artificial Intelligence agents.

Module- III

Problem Solving Using Uninformed Search: Formulating search in state space; Evaluation of search algorithm; Uninformed Search: Breadth-First Search (BFS), Advantages and disadvantages of BFS, DepthFirst Search (DFS), Advantages and disadvantages of DFS, Comparison of BFS and DFS; Iterative Deepening Depth-First Search (IDDFS), Advantages and disadvantages of IDDFS; Bidirectional Search; Comparison of Uninformed Search Strategies;

Module- IV

Problem Solving Using Informed Search & First order logic: Informed (Heuristic) Search: Strategies for providing heuristic information, Formulation of heuristic search as state space, Best-First Search, Greedy Best-First Search; A* Algorithm: Working, Advantages and disadvantages, Admissibility properties, Properties of heuristic algorithm, AO* Algorithm, Advantages of AO* Algorithm; First order logic. Inference in first order logic, propositional vs. first order inference, unification, forward chaining, backward chaining, conflict resolution, knowledge representation.

Lab manual (covers Modules-II to IV):

1. Write a program to implement Breadth-First Search (BFS) on a given graph or state space.
2. Write a program to implement Depth-First Search (DFS) and demonstrate its working on a sample tree.
3. Implement Iterative Deepening Depth-First Search (IDDFS) and show how it combines the benefits of BFS and DFS.
4. Write a program to implement Bidirectional Search and demonstrate its efficiency over BFS and DFS.
5. Implement a Best-First Search algorithm using a user-defined heuristic function.
6. Write a program to implement Greedy Best-First Search and demonstrate its behaviour on a sample graph.
7. Implement the A* Search algorithm with an admissible heuristic?
8. Implement Forward Chaining for inference using First-Order Logic rules.
9. Implement Backward Chaining for a goal-driven reasoning task using a knowledge base.
10. Write a program to perform Unification of two given FOL expressions.

Suggested Readings:

1. *Artificial Intelligence: A Guide to Intelligent Systems,* by Michael Negnevitsky, Latest Edition 2020.
2. *Artificial Intelligence: A Modern Approach*, by Stuart Russell and Peter Norvig, 4th Edition, 2020.
3. *Artificial Intelligence: A Guide for Thinking Humans*, by Melanie Mitchell, Latest Edition , 2019.
4. *Artificial Intelligence*, by Elaine Rich, Kevin Knight, and Shivashankar B. Nair, 4th Edition, 2021.
5. *Artificial Intelligence: Foundations of Computational Agents*, by Michael Wooldridge, 1st Edition, 2021.

Online Resources:

1. How AI Works by code.org, https://code.org/curriculum/how-ai-works
2. Animated Math by @3Blue1Brown on Youtubehttps://www.youtube.com/c/3blue1brown
3. Educational material in Machine Learning and Mathematics by Luis Serrano (website: https://serrano.academy/ , https://www.youtube.com/@SerranoAcademy).
4. byhand.ai
5. http://moralmachine.mit.edu/

Course Code: DYD-MJ-309 **Course Title: Data Science**

Credits: 4

Course Objectives

1. Ability to understand the fundamental concepts and techniques of data science.
2. Ability to identify, analyze and design solutions for handling large data.
3. Explore the various machine learning algorithms used in data science.
4. Acquire the skills in handling data science visualisation tools for domain-specific problems.

Learning Outcomes

- Collect, clean and pre-process data from various sources.
- Conduct exploratory data analysis using statistical methods and data visualization techniques.
- Build and evaluate basic predictive models using machine learning algorithms.
- Communicate data insights effectively through written reports and visualizations.

Course Content

Module- I

Concept of Data Science (DS) , applications of DS, Understand the basic concepts of data acquisition, visualization, and exploration, Workflow of Data Science, Tools and Programming Languages, Data Sources and Formats. Data Science Process, Data Collection methods- Data Cleaning and pre-processing, Data exploration

Module- II

Data modelling, Various types of databases and datasets such as structured, unstructured, graph, etc., Data related challenges today: Multimedia data, social media data, biological data, sensor data, etc. Exploratory Data Analysis, Data distribution analysis. Basic tools (plots, graphs and summary statistics) of Exploratory Data Analysis, Dimension- Reduction Methods, Understand the basic concepts of statistics, such as mean, median, mode, and standard deviation, and apply them to analyze data using various Python packages. Use Python libraries such as NumPy, Pandas, and Matplotlib for data analysis and visualization.

Module- III

Introduction to Big Data, Steps in Big Data, Feature Engineering, General techniques for handling large data, missing data. Machine Learning: Types of Machine Learning: Supervised Learning, Understanding Correlation, Regression, Finding the line, Linear Regression algorithm, Classification – How it works, Types, k – Nearest Neighbour algorithm, Unsupervised Learning, Clustering – How it works, Types, k -means Clustering algorithm

Module- IV

Model Evaluation: what is Evaluation? Different types of Evaluation techniques- Under fit, Perfect Fit, Over Fit, Learn various Model Evaluation Terminologies, Scenario - Prediction, Reality, True Positive, True Negative, False Positive, False Negative, Confusion Matrix. Different types of evaluation techniques in AI, such as Accuracy, Precision, Recall and F1 Score, and their significance. Which Metric is Important? - Precision or Recall?

Lab manual (covers Modules -II to IV):

1. Write a python program to calculate mean, median, mode, standard deviation and variance
2. Using Numpy.
3. Write a program to display line chart from (2,5) to (9,10).
4. Write a program to display a scatter chart for the following points (2,5), (9,10), (8,3), (5,7), (6,18).
5. Read CSV file saved in your system and display 10 rows.
6. Read CSV file saved in your system and display its information
7. Python programs to demonstrate the use of mean, median, mode, standard deviation and variance
8. Python programs to visualise the line graph, bar graph, histogram, scatter graph and pie chart using matplotlib
9. Python programs using operators, data types, control statements
10. Python programs on Numpy, Pandas, Scikit-learn
11. Python programs to visualise the line graph, bar graph, histogram, scatter graph and pie chart using matplotlib.
12. Calculation of Pearson correlation coefficient in MS – Excel.
13. Demonstration of Linear regression in MS – Excel / using python program.
14. Demonstration of k – Nearest Neighbour using python program.
15. Demonstration of k – means clustering using python program.

Suggested Readings:

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali. "Introducing Data Science." Manning Publications Co., 1st Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. "An Introduction to Statistical Learning: with Applications in R." Springer, 1st edition, 2013. –
3. DJ Patil, Hillary Mason, Mike Loukides. "Ethics and Data Science." O'Reilly, 1st Edition, 2018.
4. Ian Goodfellow, YoshuaBengio, Aaron Courville. "Deep Learning." MIT Press, 1st Edition, 2016.
5. Cathy O'Neil, Rachel Schutt. "Doing Data Science: Straight Talk from the Frontline." O'Reilly, 1st Edition, 2013.

Online Resources:

1. Animated Math byhttps://www.youtube.com/c/3blue1brown @3Blue1Brown on Youtube.
2. Educational material in Machine Learning and Mathematics by Luis Serrano (website : https://serrano.academy/ , https://www.youtube.com/@SerranoAcademy).
3. deeplearning.ai
4. statlearning.com
5. datacamp.com

Course Code: DYD-MJ-310

Course Title: Hands-on Electronics: Concept, Circuits and Creativity

Credits: 4

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate understanding of basic electrical and electronic components and principles.
2. Construct and analyze simple analog and digital circuits through hands-on experimentation.
3. Apply electronics knowledge to solve practical problems through mini-projects.
4. Use electronic tools (e.g. multimeter, breadboard, soldering iron) proficiently.
5. Document experimental procedures, observations, and reflect on learning through logs and reports.

Learning Outcomes

- Grasp fundamental electronic concepts such as current, voltage, resistance, and power.
- Learn the function and application of passive and active components.
- Understand and implement transistor-based circuits for control and amplification.
- Explore and build basic digital circuits using logic gates and timers.
- Develop experiential problem-solving abilities by building real-world mini-projects.

Course Content

Module-I

Theoretical Concepts: Charge, current, voltage, resistance, Ohm's Law, power formulas, Series and parallel circuits, Kirchhoff's Voltage and Current Laws (KVL & KCL), Introduction to circuit symbols and breadboard usage.

Experimental Activities: Measuring voltage and current in series/parallel configurations, Verifying Ohm's Law using resistive circuits, assembling voltage divider circuits and analyzing outputs, observing power consumption in real-time using multimeters.

Mini Project: LED Torch – Design and construct a battery-powered LED torch using series resistors and switch.

Module-II

Theoretical Concepts: Passive components: Resistors, capacitors, inductors, Diodes: PN junction, LED, Zener, Breadboarding, soldering, PCB basics, Safety and handling of electronic components.

Experimental Activities: Diode testing and IV characteristic plotting, constructing an RC timing circuit, soldering basic circuits on a general-purpose PCB, Using a multimeter for component identification.

Mini Project: **Flasher** Circuit – Build an LED flasher using an RC circuit and test frequency variation.

Module-III

Theoretical Concepts: Semiconductor fundamentals, Bipolar Junction Transistors (BJTs): NPN, PNP, BJT as switch and amplifier, Sensor integration (LDR, thermistor).

Experimental Activities: BJT switch to control LED/motor, build a simple amplifier and test with audio input, LDR-based automatic night light, Analysis of transistor operation points using multimeter.

Mini Project: Automatic Fan Controller – Build a temperature or light-controlled fan using a BJT and sensor.

Module-IV

Theoretical Concepts: Binary number system, Boolean logic, Logic gates (AND, OR, NOT, NAND, NOR, XOR), Truth tables, basic combinational circuits, 555 Timer IC: Astable and monostable modes, Basic IC usage and datasheet interpretation.

Experimental Activities: Construct logic gates using ICs and verify truth tables, implement half-adder logic circuit, Build and test 555 timer-based LED blinker, Create timed response circuit using monostable mode.

Mini Project: Digital Dice or Quiz Buzzer – Implement using 555 timer and logic ICs.

Suggested Readings:

1. Principles of Electronics – V.K. Mehta & Rohit Mehta (S. Chand)
2. Basic Electronics: Devices, Circuits and IT Fundamentals – N. M. Malvino
3. Electronic Principles – Albert Paul Malvino and David Bates
4. Getting Started in Electronics – Forrest M. Mims III
5. Make: Electronics – Learning Through Discovery – Charles Platt

Mini Project: **Flasher** Circuit – Build an LED flasher using an RC circuit and test frequency variation.

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Theoretical Concepts: Semiconductor fundamentals, Bipolar Junction Transistors (BJTs): NPN, PNP, BJT as switch and amplifier, Sensor integration (LDR, thermistor).

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Mini Project: Automatic Fan Controller – Build a temperature or light-controlled fan using a BJT and sensor.

Module-IV

Theoretical Concepts: Binary number system, Boolean logic, Logic gates (AND, OR, NOT, NAND, NOR, XOR), Truth tables, basic combinational circuits, 555 Timer IC: Astable and monostable modes, Basic IC usage and datasheet interpretation.

Experimental Activities: Construct logic gates using ICs and verify truth tables, implement half-adder logic circuit, Build and test 555 timer-based LED blinker, Create timed response circuit using monostable mode.

Mini Project: Digital Dice or Quiz Buzzer – Implement using 555 timer and logic ICs.

Suggested Readings:

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Existing Examination and Evaluation Scheme for FYUGP offered through "Design Your Degree"

A. Project		Capstone Project	4 Credit	3 Credit
I.	Presentation of Capstone/ Activity Based Project Reports by the subject Experts 45 X 3 Credit	45	X	X
II.	Presentation of Project Reports	20	50	30
III.	Self Assessment	05	X	X
IV.	Peer Assessment	05	X	X
Total		**75**	**50**	**30**
B. Written Examination		X	25	25
C. Internal Assessment		25	25	20
Grand Total (A+B+C)		**100**	**100**	**75**

Proposed new Examination Evaluation Scheme

Course Title	Credits	Internal Assessment	External Assessment		Total
			Written Examination	Mini Project	
Fundamentals of Climate Change	02	10	25	15	50
Design Thinking	04	25	25	50	100
Science Technology & Society	04	25	25	50	100
Project Work/ Capstone Project	04	25	00	75	100
Principles of Management	04	25	25	50	100
Basic Microeconomics	04	25	25	50	100
E-Commerce	04	25	25	50	100
Artificial Intelligence	04	25	25	50	100
Data Science	04	25	25	50	100
Hands-on Electronics: Concept, Circuits and Creativity	04	25	25	50	100