

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00002	Neural Network and Fuzzy System	3	0	0	3

UNIT-I

Introduction: Evolution of neural networks, Biological Neurons, Artificial neurons, Basic model of Artificial Neural Network (ANN), Classification, Topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement; Connectionist modeling: McCulloch – Pits model, Perceptron, Adaline, Madaline, Basic Learning laws, Hebb's rule, Delta rule, widrow and Hoff LMS learning rule.

UNIT-II

Feed Forward Neural Networks:

Single -layer perceptron: Topology, learning algorithms, Perceptron convergence theorem, limitations. Multi-layer perceptron: Topology, Back propagation learning algorithm, Kolmogorov Theorem, limitations.

UNIT-III

Recurrent Neural Networks:

Recurrent Neural Networks: Basic concepts, Architecture and training algorithms, Hopfield network: Topology, learning algorithm. Applications of Neural networks: Communication, Robotics, and pattern recognition.

UNIT-IV

Fuzzy Logic:

Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, Fuzzy sets and elements: Representation, Operations and Properties, Fuzzy Relations: Cardinality, Operations, Properties, Membership function and uncertainty. Fuzzy equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method;

UNIT-V

Fuzzification, Membership value assignment, development of rule base and decision-making system. Defuzzification to crisp sets, Defuzzification methods, Applications of fuzzy theory: fuzzy logic control.

Text Book

1. S. Hakins, Neural Networks, Pearson Education.
2. T. J. Ross, Fuzzy Logic with Engineering Applications, TMH

Reference Book

1. B. Yegnanarayana, Artificial Neural Networks, PHI, India.
2. F. O. Karray and C. De Silva., Soft Computing and Intelligent Systems Design, Theory, Tools and Applications, Pearson Education, India.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00003	Industrial Electronics	3	0	0	3

UNIT I

Power semiconductor devices

Operation, characteristics and construction of Power diodes, Power transistor, Power MOSFET. Thyristor: Construction of Silicon controlled rectifier (SCR), Modes of operation, V-I characteristics, two transistor analogies of SCR, turn-on and turn-off methods, thermal characteristics of SCR. Other members of SCR family such as DIAC, TRIAC, IGBT, GTO.

UNIT II

SCR Analysis and Phase Controlled Rectifier

Triggering methods of SCR and other members, types of commutation, analysis of SCR commutation circuits, Operation and characteristics of UJT, relaxation oscillator. Phase Controlled rectifiers, Half wave and full wave configurations, Phase controlled rectifiers with R, RL and RLE load. Use of freewheel diode in controlled rectifiers.

UNIT III

DC-DC Converters and Regulators:

Principle of chopper operation, Chopper classifications, constant frequency system, variable frequency system. Buck converter, Boost converter, Buck-Boost converter. Cuk converters, series, shunt, fixed voltage regulators and adjustable voltage regulators.

UNIT IV

Inverters:

Classification and analysis of single phase inverters, Voltage and Current Commutated Inverters, PWM inverters. Voltage Source Inverter and Current source inverters.

UNIT V

Cyclo converter and AC Voltage Converters:

Classification and operation of single phase Cyclo-converters and AC Voltage Controller, analysis for different types of loads.

Text Books

1. M. H. Rashid, 'Power Electronics - Circuits, Devices and Applications', PHI
2. P. S. Bimbhra, 'Power Electronics', Khanna publishers.

Reference Books

1. V. Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers.
2. V.R. Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press.

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Course Code	Course Name	Hours Per Week			Total
		L	T	P	Credits
OE00005	Digital Electronics	3	0	0	3

UNIT I Number System:

Introduction to binary numbers, data representation, binary, octal, hexadecimal number system and their conversion, Various coding schemes such as BCD codes, Excess-3 code, Gray code. Binary arithmetic, Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms, minimization techniques, Sum of products and Product of Sums Simplification, Karnaugh's map method, Quine Mecluskey method.

UNIT II Logic Gates and Combinational Logic:

Digital Logic Gates such as AND,OR, NAND,NOR, EX-OR,EX-NOR. Realization of Boolean functions using logic gates. Adders, subtractors, BCD adder, magnitude comparator, decoders and encoders, multiplexers and demultiplers, code converters. Analysis and design of combinational circuits. Implementation of combinational logic using multiplexers, decoders etc.

UNIT III Sequential Circuits:

Introduction, comparison of sequential and combinational circuits. Various types of flip-flops and their conversions, triggering of flip flops, timing issues, setup and hold times, registers, counters, ring, johnson, asynchronous and synchronous counters.

UNIT IV Memories:

ROM, PLA and PAL. Memories: organisation and construction of RAM, SRAM, DRAM, ROM, PROM, EPROM, EEPROM. o

UNIT V Logic Families:

DTL, RTL, TTL, IIL, PMOS, NMOS and CMOS logic families, interfacing between TTL and MOS vice-versa.

Text Books

1. D Roy Chudhury, Digital Electronics, Vol-I & II, TMH.
2. M. Mano, Digital and Computer Design, Pearson Education.

References Books

1. Leach and Malvino, Digital Principles and Applications, TMH.
2. Jacob Millman & Herbert Taub, Pulse, Digital and Switching Waveforms, MGM.
3. A. Anand Kumar: Digital Circuits, PHI.
4. S. Salivahanam & Ari Vahagan, Digital Circuits and Design, Vikas Publishing House.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
OE00006	Basics of Entrepreneurship	3	0	0	3

UNIT I

Discover Yourself: Finding Your Flow, Introduction to the principles of Effectuation, Introduction to Wadhvani Foundation's 5M, identify your entrepreneurial style, Entrepreneurial Style Quiz; to reveal the specific entrepreneurial traits, capabilities, drivers etc., Help students to discover their passion and interest before embarking on the long journey.

Identify Problems Worth Solving: What is a business opportunity and how to identify it, Find problems around you that are worth solving, Methods for finding and understanding problems (Observation, Questioning, Design Thinking (DT), Jobs to be done (JTBD), How to run problem interviews to understand the customer's world view, Introduction to Design Thinking - Process and Examples, Generate ideas that are potential solutions to the problem identified- DISRUPT, GOOTB: Run problem interviews with prospects, Class Presentation: Present the problem you "love", Form teams.

UNIT II

Identify Customer Segments and Early Adopters: The difference between a consumer and a customer (decision maker); Market Types, Segmentation and Targeting, Defining the persona; Understanding Early Adopters and Customer Adoption Patterns, Identify the innovators and early adopters for your startup Come up with creative solutions for the identified problems, Deep dive into Gains, Pains and "Jobs-To-Be-Done" (using Value Proposition Canvas, or VPC), Identify the UVP of your solution using the Value Proposition section of the VPC.

Get Started with Lean Canvas: Basics of Lean Approach and Canvas; Types of Business Models (b2b; b2c), Sketch the canvas- "Document your Plan A", Introduction to Risks; Identify and document your assumptions (Hypotheses); Identify the riskiest parts of your plan, Class Presentation: Present your Lean Canvas

UNIT III

Validation: Develop the solution demo- build solution (mock-ups) demo, how to run solution interviews, GOOTB (Get-Out-Of-The-Building); run solution interviews, Does your solution solve the problem for your customers: the problem-solution test sizing the opportunity- differences between a startup venture and a small business; Industry Analysis: Understanding what is Competition and it's role, Analyze competition, Case study: Blue Ocean Strategy, Building an MVP (minimum viable product) -Identify an MVP and build it; Document and validate your assumptions, Build-Measure-Learn feedback loop and the MVP/Javelin Board, How to do MVP Interviews, GOOTB: Run MVP interviews, Is there a market for your product -The product-market fit test, Class Presentation: Present your MVP

UNIT IV

Money: Revenue Streams, Pricing and Costs, Financing Your New Venture, Understand income, costs, gross and net margins, Identify primary and secondary revenue streams, Value, price, and costs; Different pricing strategies, Understand product costs and operations costs; Basics of unit costing

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Team: Shared Leadership, Role of a good team in a venture's success; What to look for in a team; How do you ensure there is a good fit? Defining clear roles and responsibilities, How to pitch to candidates to join your startup, Explore collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board.

UNIT V

Marketing and Sales: Positioning-Understand the difference between product and brand and the link between them, Define the positioning statement for your product/service and how it should translate into what your customers should see about that brand in the marketplace, Channels & Strategy-Building Digital Presence and leveraging Social media, creating your company profile page, Measuring the effectiveness of selected channels, Budgeting and planning

Sales Planning- Understanding why customers buy and how buying decisions are made; Listening, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customers needs, not on product features), Follow-up and closing a sale; Asking for the sale. **Support:** Planning & Tracking; Importance of project management to launch and track progress, understanding time management, work flow, and delegation of tasks, Business Regulation; Basics of business regulations of starting and operating a business; Importance of being compliant and keeping proper documentation, how to find help to get started

Text Books

1. V. Desai, Fundamentals of Entrepreneurship & small business management, Himalaya Publishing House.
2. S.S. Khanka, Entrepreneurial Development, S. Chand Publication.
3. P.T. Vijayashree and M. Alagammal, Entrepreneurship Development & Small Business Management, Margham Publication.

References Books

1. S. Shane, A General theory of entrepreneurship: The individual opportunity nexus, Edward Elgar Publication.
2. J. A. Timmons and S. Spinelli, New Venture Creation: Entrepreneurship for the 21st century TMH.
3. R. D. Hisrich, M. P. Peters, D. A. Shepherd and P. Mombourquette, Entrepreneurship, TMH.



Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
OE00007	Mechanical Estimation and Costing	3	0	0	3

UNIT I

Introduction to Estimation and Costing: Estimation - Definition, Importance and Aims, Qualities and functions of an Estimator, Source of errors in estimation, Constituents of Estimation, Costing - Definition and Aims, Standard cost and its Advantages, Difference between estimation and costing, Advantages of efficient costing.

UNIT II

Elements of Costs: Elements of cost- material, labour, expenses, Material - Direct material, indirect material and examples, Calculation of Material cost, Labour - direct, indirect labour and examples, Calculation of labour cost, Expenses - direct, indirect expenses and examples, Classification of expenses - factory, administrative, selling and distribution expenses and example, Fixed and variable expenses and examples, Components of cost - prime cost, factory cost, office cost, total cost, Selling price, Block diagram to show the relationship between elements and components of cost, Simple problems on above, Allocation of on-cost - methods and simple problems.

UNIT III

Mechanical Estimation: Estimation in machine shop - Definition of cutting speed, feed, depth of cut, Estimation of time for various operations like Turning, Knurling, Facing, Drilling, Boring, Reaming, Threading, Tapping, Milling, Grinding, Shaping and Planning, Estimation in sheet metal shop - Sheet material and gauge number, Sheet metal joints, Select suitable formula for estimation, Estimate the material required for preparation of container open on one side Cylindrical drum, funnel and tray, Estimation in foundry shop-pattern allowances, estimation of pattern cost, simple problems on C.I pulley and C.I. Wheel, Estimation in welding shop - estimation of gas welding cost, estimation of arc welding cost - Simple problems.

UNIT IV

Indirect Expenses and Depreciation: Explain indirect expenses- depreciation, obsolescence, inadequacy, idleness, repair and maintenance, define depreciation and state its causes, (Physical and functional), Explain methods of calculating depreciation, Solve simple problems on each method.

UNIT V

Mensuration and Estimation Of Material Cost: Mention Area of irregular and plane figures with sketches, Mention Volume and surface area of solids (formulae only), Estimate the material costs of step pulley, spindle lathe centre, Rivets, Fly wheel, crankshaft, chain link, wedge and Gib-headed key-Simple problems only.

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Text Books

1. B.P. Sinha, Mechanical Estimation and Costing, TMH.
2. S.K. Sharma & Savita Sharma, Industrial Engineering & Operations management, Kataria publishers.
3. T.R. Banga and S.C. Sharma, Industrial Organisation and Engineering Economics, Khanna Pub..

Reference Books

1. R.L. Shrimali & P.C. Jain, Mechanical estimating and costing, Khanna Publishers.
2. Dennis Lock, Handbook of Engineering Management, Butterworth & Heinemanky Ltd.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
OE00008	Fundamentals of Service Marketing	3	0	0	3

UNIT I

Concept and characteristics of service, classification criteria, service sectors. Significance of services, nature and role of service marketing. Difference between goods and services, service sector challenges in service marketing and economic growth key factors. Highly intangible services, productivity in service contexts.

UNIT II

Services in marketing mix, elements of service in marketing mix and its components. Service development process, product life cycle, pricing features and factors affecting pricing, significance of place and location. Direct channel and channel of distribution, intermediaries and franchisee, service process design.

UNIT III

Strategic issues in service marketing, meaning, definition and importance of market segmentation, service positioning and its objectives. Levels of positioning, steps involved in differentiation, comparison of differentiation and positioning.

UNIT IV

Meaning of marketing mix in service marketing, formulation and concept of service offering. Types of new services, branding of services and assessment of service quality to customers. Target market and influencing factors. Types of marketing in service industries, service quality models.

UNIT V

Application of service marketing, meaning of financial services, hospitality services, professional services, health services, educational services etc with special reference to changes in life style, technology, changing economy detailed overview. Types and scope of non-business and non-profit organizations and their objectives. Non-profit Vs profit-oriented marketing.

Text Books

1. Christopher H. Lovelock and Jochen Wirtz, Services Marketing, Pearson Education.
2. Hoffman, Marketing of Services, Cengage Learning.
- Ramneek Kapoor, Services Marketing: Concepts and Practices, TMH

Reference Books

1. K.Rama Mohana Rao, Services Marketing, Pearson Education india.
2. Kenneth E Clow, Services Marketing Operation Management and Strategy, Biztantra.
3. Halen Woodroffe, Services Marketing, McMillan.

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
OE00013	Photovoltaic systems	3	0	0	3

UNIT I

Introduction to PV system

Renewable & non-renewable energy sources for power generation. Need for sustainable energy sources. Challenges with India's power sector & India's power scenario. Working principle of solar cell.

UNIT II

PV Cell: series & parallel interconnection

PV cell characteristics, short circuit, open circuit and peak power parameters, I-V & P-V curves, datasheet study, cell efficiency, effect of temperature & insolation, temperature effect calculation example & fill factor. Load line, identical & non-identical cells in series, protecting cells in series, identical cells in parallel, non-identical cells in parallel, protecting cells in parallel, interconnecting modules in series & parallel.

UNIT III

Battery for PV application

Battery classification, battery parameters. Batteries for PV system (Lead-acid & Nickel-Cadmium batteries). PV system design: Load profile, battery sizing, days of autonomy & recharge, PV array sizing.

UNIT IV

DC-DC converters

DC-DC converters (Non-isolated): Buck converter, Boost converter & Buck-Boost converter. Critical inductance & capacitance. DC-DC converter for PV applications.

UNIT V

MPPT Algorithms

Significance of maximum power tracking, MPPT concept. MPPT: Reference cell & Sampling method, Perturb & observe, Incremental conductance method.

Text Books

1. Chetan Singh Solanki, Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, PHI.
2. Chenming, H. and White, R.M., Solar Cells from Basics to Advanced Systems, TMH.
3. R. Messenger, J. Ventre, Photovoltaic Systems Engineering, 2nd ed., CRC Press.

References Books

1. M. R. Patel, Wind and Solar Power Systems, CRC Press.
2. T. Markvart, Solar Electricity, John Wiley & Sons.
3. A Elbaset Adel, Ali Mohammed Hamdi Abd El-Sattar Montaser, Performance Analysis of Grid-Connected Photovoltaic Power Systems Lambert Academic Publishing.

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