LIST OF OPEN ELECTIVES OFFERED FOR R22 M.TECH PROGRAMMES

DEPARTMENT OF CIVIL ENGINEERING	
Computer Aided Structural Engineering/ Structural Engineering	**Environmental Engineering**
1. Green Building Technology 2. Construction Project Management 3. Safety and Construction Practice Regulations	1. Energy From Waste 2. Environmental Pollution and Control

DEPARTMENT OF CSE	
Artificial Intelligence/ Artificial Intelligence & Data Science/ Computer Networks and Information Security/ Computer Networks/ Cyber Security/ Computer Science and Engineering/ Computer Science/ Web Technology/ Information Technology	**Data Science**
1. Intellectual Property Rights 2. Fault Tolerance Systems 3. Intrusion Detection Systems 4. Digital Forensics 5. Optimization Techniques 6. Cyber Physical Systems 7. Graph Analytics	1. Statistical Foundations for Data Science 2. Big Data Analytics 3. Advanced Artificial Intelligence 4. Service Oriented Architectures

DEPARTMENT OF ECE
1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials

DEPARTMENT OF EEE
1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Photovoltaic Systems

DEPARTMENT OF MECHANICAL ENGINEERING			
AMS	**CAD/CAM**	**Engineering Design**	**Thermal Engineering**
1. Business Analytics 2. Waste to Energy 3. Principles of Automation 4. Artificial Neural Networks	1. Business Analytics 2. Waste to Energy 3. Concurrent Engineering 4. Industrial Safety	1. Business analytics 2. Waste to Energy 3. Industrial Safety 4. Principles of Automation	1. Business Analytics 2. Waste to Energy 3. Basics of Refrigeration Systems 4. Introduction to Thermal Storage Systems

*Important: *Open Elective subject must be chosen from the list of open electives offered by OTHER departments.

An M.Tech Thermal Engineering student cannot take Open Electives offered by ME Dept, but can select from open electives offered by OTHER departments.

In case of only **one Engineering Department** offering M.Tech. Programs, Students are advised to take open electives offered by other M.Tech. Specializations.

In case of only one M.Tech. Specialization being offered by a college; students can take any subject from the list of open electives, but there should be *no repetition of titles/subjects* included in the course structure.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. CASE/SE

GREEN BUILDING TECHNOLOGY (Open Elective)

Course Objectives:
- Exposure to the green building concepts and their significance.
- Understand the judicious use of energy and its management.
- Enhance awareness of end-user energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes:
- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Know the Sun-earth relationship vis-a-vis its effect on climate.
- Be acquainted with the end-user energy requirements
- Be familiar with the audit procedures of energy

UNIT-I
Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT-II
Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT-III
Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT-IV
End-use, energy utilization and requirements - Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and thewall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer.

UNIT-V
Energy management options - Energy audit and energy targeting - Technological options for energy management.

REFERENCES:
1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
3. Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.
4. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. CASE/SE

CONSTRUCTION PROJECT MANAGEMENT (Open Elective)

Course Objectives: The student will be able to understand:
- The different phases of the project
- And prioritize the various activities
- The importance of resources allocation
- And identify the various factors affecting the project for better risk management

Course Outcomes:
- Plan and develop project organization for executing construction projects.
- Prepare work break down plan and estimate resources requirements.
- Learn the techniques used for planning, scheduling and control of construction projects.
- Apply the techniques for a real-world project and demonstrate the learning.

UNIT – I
Introduction: Phase of project, project management and its relevance, stakeholders of a project, structure of project organization, management levels, and traits of a project manager.

UNIT – II
Construction Planning: Introduction, activities involved types of project plan, work breakdown structure. Planning terminologies, Critical path method, forward and backward pass, AOA, AON, Precedence Diagramming Method (PDM), PERT, Line of balance,

UNIT – III
Project scheduling and resource levelling: Introduction, Resource allocation and levelling for unlimited resources, Resource allocation for limited resources, Multi resource allocation, Optimal scheduling.

UNIT – IV
Project Monitoring and Control: Introduction, Project updating, Time Cost Trade off Analysis and Earned Value Analysis. IT tools for project data updating.

UNIT – V
Project Risk Management: Risk register, identification, evaluation, allocation, avoidance andsharing of risk. Delay Analysis and Case Studies.

REFERENCES:
1. Construction project scheduling and control. Mubarak, Saleh A, John Wiley & Sons, 2015, 3rd Edition.
2. Construction project management: Theory and practice. Jha, Kumar Neeraj, Pearson EducationIndia, 2011, First Edition.
3. Project management: strategic design and implementation, Cleland, David I. McGraw-Hill Education, 2007, 5th Edition.
4. Construction project scheduling. Callahan, Michael T., Daniel G. Quackenbush, and James E. Rowings. McGraw-Hill 1992, 1st Edition.
5. Construction project management. Clough, Richard H., Glenn A. Sears, and S. Keoki Sears. JohnWiley & Sons, 2000, 4th Edition.
6. Project management for engineering and construction. Oberlender, Garold D. McGraw-Hill

Education, 2014, First Edition.

7. Precedence and arrow networking techniques for construction. Harris, Robert Blynn. University ofMichigan, 1973, First Edition.
8. Critical chain: A business novel. Goldratt, E. M., Routledge, 2017.
9. Project management body of knowledge (pmbok® guide), Guide, A., In Project Management Institute, 2021, Seventh Edition.
10. Construction Project Management - Guidelines: Part 1 General, IS 15883 (Part 1), Bureau of Indian Standards, 2009.
11. Construction Project Management - Guidelines: Part 2 Time Management, IS 15883 (Part 2), Bureau of Indian Standards, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. CASE/SE

SAFETY AND CONSTRUCTION PRACTICE REGULATIONS (Open Elective)

Course Objectives: The student will be able to understand:
- The various issues related to construction.
- The importance of safety in the construction.
- The various government regulations.

UNIT - I
Introduction to Construction Industry- Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics inconstruction safety.

UNIT - II
Safety in various construction operations- Excavation- under- water works- under- pinning &shoring Ladders & Scaffolds- Tunneling- Blasting- Demolition- Pneumatic caissons- confinedSpace Temporary Structures. Indian Standards on construction safety- National Building CodeProvisions on construction safety.

UNIT - III
Safety in material handling and equipments-Safety in storage & stacking of constructionmaterials.

UNIT - IV
Safety in these of construction equipments- Vehicles, Cranes, Tower Cranes, Lifting gears,Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools inconstruction. Temporary power supply.

UNIT - V
Contract Labor (R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rulesregarding wages. Building & Other Construction Workers (RE&CS) Act,1996 and Central Rules, 1998: Applicability, Administration, Registration, Welfare Board & Welfare Fund, Training of Building workers, General Safety, Health & Well fare provisions, Penalties.

REFERENCES:
1. K.N.Vaid, Construction Safety Management.
2. V.J. Davies and K. Tomasin, Construction Safety Handbook.
3. James B. Fullman, Construction Safety, Security & Loss Prevention.
4. Linger L, Modern Methods of Material Handling
5. R.T. Ratay, Hand book of Temporary Structures in Construction.
6. National Building Code of India
7. Relevant Indian Standards published by BIS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. Environmental Engineering

ENERGY FROM WASTE (Open Elective)

Prerequisite: None

UNIT- I
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT- II
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT- III
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT- IV
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT- V
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES:
1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. Environmental Engineering

ENVIRONMENTAL POLLUTION AND CONTROL (Open Elective)

Course Objectives:
- Impart knowledge on aspects of air pollution & control and noise pollution.
- Impart concepts of treatment of waste water from industrial source.
- Differentiate the solid and hazardous waste based on characterization.
- Introduce sanitation methods essential for protection of community health.
- Provide basic knowledge on sustainable development.

Course Outcomes: At the end of the course, the students will be able to:
- Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
- Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards.
- Differentiate the treatment techniques used for sewage and industrial wastewater treatment.
- Inventing the methods of environmental sanitation and the management of community facilities without spread of epidemics.
- Appreciate the importance of sustainable development while planning a project or executing an activity.

UNIT – I:
Air Pollution:
Air pollution Control Methods – Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

UNIT – II:
Industrial waste water Management:
Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT – III:
Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling. Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT – IV:
Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT – V:
Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

TEXT BOOKS

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, "Environmental Engineering", Mc-Graw Hill International Editions, New York 1985.
2. J. G. Henry and G.W. Heinke, "Environmental Science and Engineering", Pearson Education.

REFERENCES:

1. G. L. Karia and R.A. Christian, "Waste water treatment- concepts and design approach", Prentice Hall of India
2. M. N. Rao and H. V. N. Rao, "Air pollution", Tata McGraw Hill Company.
3. Ruth F. "Weiner and Robin Matthews Environmental Engineering", 4th Edition Elsevier, 2003.
4. K. V. S. G. Murali Krishna, "Air Pollution and Control" by, Kousal & Co. Publications, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

INTELLECTUAL PROPERTY RIGHTS (Open Elective)

Course Objectives:
1. To explain the art of interpretation and documentation of research work
2. To explain various forms of intellectual property rights
3. To discuss leading international regulations regarding Intellectual Property Rights

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:
1. Understand types of Intellectual Property
2. Analyze trademarks and its functionality
3. Illustrate law of copy rights and law of patents

UNIT- I
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT - III
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT - IV
Trade Secrets: Trade secret law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT - V
New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:
1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

FAULT TOLERANCE SYSTEMS (Open Elective)

Course Objectives:
1. To know the different advantages and limits of fault avoidance and fault tolerance techniques.
2. To impart the knowledge about different types of redundancy and its application for the design of computer system being able to function correctly even under presence of faults and data errors.
3. To understand the relevant factors in evaluating alternative system designs for a specific set of requirements.
4. To understand the subtle failure modes of "fault-tolerant" distributed systems.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:
1. Become familiar with general and state of the art techniques used in design and analysis of fault tolerant digital systems.
2. Be familiar with making system fault tolerant, modeling and testing, and benchmarking to evaluate and compare systems.

UNIT - I
Introduction to Fault Tolerant Computing: Basic concepts and overview of the course; Faults and their manifestations, Fault/error modeling, Reliability, availability and maintainability analysis, System evaluation, performance reliability tradeoffs.

UNIT - II
System level fault diagnosis: Hardware and software redundancy techniques. Fault tolerant system design methods, Mobile computing and Mobile communication environment, Fault injection methods.

UNIT - III
Software fault tolerance: Design and test of defect free integrated circuits, fault modeling, built in self-test, data compression, error correcting codes, simulation software/hardware, fault tolerant system design, CAD tools for design for testability.

UNIT - IV
Information Redundancy and Error Correcting Codes: Software Problem. Software Reliability Models and Robust Coding Techniques, Reliability in Computer Networks Time redundancy. Re execution in SMT, CMP Architectures, Fault Tolerant Distributed Systems, Data replication.

UNIT - V
Case Studies in FTC: ROC, HP Non-Stop Server. Case studies of fault tolerant systems and current research issues.

TEXT BOOK:
1. Fault Tolerant Computer System Design by D. K. Pradhan, Prentice Hall.

REFERENCES:
1. Fault Tolerant Systems by I. Koren, Morgan Kauffman.
2. Software Fault Tolerance Techniques and Implementation by L. L. Pullum, Artech House Computer Security Series.
3. Reliability of Computer Systems and Networks: Fault Tolerance Analysis and Design by M. L. Shooman, Wiley.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

INTRUSION DETECTION SYSTEMS (Open Elective)

Prerequisites: Computer Networks, Computer Programming

Course Objectives:
1. Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion.
2. Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share.

Course Outcomes: After completion of the course, students will be able to:
1. Possess a fundamental knowledge of Cyber Security.
2. Understand what vulnerability is and how to address most common vulnerabilities.
3. Know basic and fundamental risk management principles as it relates to Cyber Security and Mobile Computing.
4. Have the knowledge needed to practice safer computing and safeguard your information using Digital Forensics.
5. Understand basic technical controls in use today, such as firewalls and Intrusion Detection systems.
6. Understand legal perspectives of Cyber Crimes and Cyber Security.

UNIT - I
The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention, Network and Host-based IDS

UNIT - II
Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sop Hesitated groups-Automated: Drones, Worms, Viruses

UNIT - III
A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

UNIT - IV
Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection

UNIT - V
Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware detection -Obfuscation, polymorphism- Document vectors.
Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero-day detection-Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception-Future: Collaborative Security

TEXT BOOKS:
1. Peter Szor, The Art of Computer Virus Research and Defense, Symantec Press ISBN 0-321-30545-3.
2. Markus Jakobsson and Zulfikar Ramzan, Crimeware, Understanding New Attacks and Defenses.

REFERENCE BOOKS:
1. Saiful Hasan, Intrusion Detection System, Kindle Edition.
2. Ankit Fadia, Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection.

Online Websites/Materials:
1. https://www.intechopen.com/books/intrusion-detection-systems/

Online Courses:
1. https://www.sans.org/course/intrusion-detection-in-depth
2. https://www.cybrary.it/skill-certification-course/ids-ips-certification-training-course

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

DIGITAL FORENSICS (Open Elective)

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:
1. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: On completion of the course the student should be able to
1. Understand relevant legislation and codes of ethics.
2. Computer forensics and digital detective and various processes, policies and procedures.
3. E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Email and web forensics and network forensics.

UNIT - I
Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT - II
Cyber Crime Scene Analysis:
Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III
Evidence Management & Presentation:
Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case,
Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V
Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

TEXT BOOKS:
1. John Sammons, The Basics of Digital Forensics, Elsevier

2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

REFERENCES:
1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

OPTIMIZATION TECHNIQUES (Open Elective)

Prerequisite: Mathematics –I, Mathematics –II
Course Objectives:
1. To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
2. Constrained and unconstrained optimization techniques for solving and optimizing electrical and electronic engineering circuits design problems in real world situations.
3. To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to:
1. explain the need of optimization of engineering systems.
2. understand optimization of electrical and electronics engineering problems.
3. apply classical optimization techniques, linear programming, simplex algorithm, transportation problem.
4. apply unconstrained optimization and constrained non-linear programming and dynamic programming.
5. Formulate optimization problems.

UNIT - I
Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surface - classification of Optimization problems.
Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT - II
Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. Degeneracy.
Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT - III
Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints: Kuhn – Tucker conditions.
Single Variable Nonlinear Unconstrained Optimization: Elimination methods: Uni Model function-its importance, Fibonacci method & Golden section method.

UNIT - IV
Multi variable nonlinear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hooke - Jeeves, Rosenbrock's search methods. Gradient methods: Gradient of function & its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

UNIT - V
Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:
1. Optimization Techniques & Applications by S.S.Rao, New Age International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

REFERENCES:
1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in Operations Research 3rd edition, 2003.
2. H. A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Optimization Techniques by Belegundu & Chandrupatla, Pearson Asia.
4. Optimization Techniques Theory and Practice by M.C. Joshi, K.M. Moudgalya, Narosa Publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

CYBER PHYSICAL SYSTEMS (Open Elective)

Course Objective: To learn about design of cyber-physical systems

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:
1. Understand the core principles behind CPS
2. Identify Security mechanisms of Cyber physical systems
3. Understand Synchronization in Distributed Cyber-Physical Systems

UNIT - I
Symbolic Synthesis for Cyber-Physical Systems
Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT - II
Security of Cyber-Physical Systems
Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT - III
Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT - IV
Real-Time Scheduling for Cyber-Physical Systems
Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT - V
Model Integration in Cyber-Physical Systems
Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

TEXT BOOKS:
1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. AI/AIDS/CNIS/CN/CYS/CS/CSE/IT/WT

GRAPH ANALYTICS (Open Elective)

Course Objectives:
1. To explore the concept of Graphs and related algorithms.
2. To learn new ways to model, store, retrieve and analyze graph-structured data.
3. To be aware of advanced concepts in graph analytic techniques and its applications.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:
1. Understand Large-scale Graph and its Characteristics
2. Analyze Breadth-First Search Algorithm
3. Illustrate Recent Advances in Scalable Network Generation

UNIT - I
Introduction and Application of Large-scale Graph: Characteristics, Complex Data Sources - Social Networks, Simulations, Bioinformatics; Categories- Social, Endorsement, Location, Co-occurrence graphs; Graph Data structures, Parallel, Multicore and Graph Algorithms

UNIT - II Algorithms: Search and Paths
A Work-Efficient Parallel Breadth-First Search Algorithm (or How To Cope With the Nondeterminism of Reducers), Multi-Objective Shortest Paths

UNIT - III Algorithms: Structure
Multicore Algorithms for Graph Connectivity Problems, Distributed Memory Parallel Algorithms for Massive Graphs, Massive-Scale Distributed Triangle Computation and Applications

UNIT - IV Models
Recent Advances in Scalable Network Generation, Computational Models for Cascades in Massive Graphs, Executing Dynamic Data-Graph Computations Deterministically Using Chromatic Scheduling.

UNIT - V Frameworks and Software
Graph Data Science Using Neo4j, A Cloud-Based Approach to Big Graphs, Interactive Graph Analytics at Scale in Arkouda

TEXT BOOKS:
1. David A. Bader, Massive Graph Analytics, CRC Press

REFERENCES:
1. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications", (Structural Analysis in the Social Sciences), Cambridge University Press, 1995.
2. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press, 2010.
3. Tanja Falkowski, "Community Analysis in Dynamic Social Networks", (Dissertation), University Magdeburg, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. DATA SCIENCE

STATISTICAL FOUNDATIONS FOR DATA SCIENCE (Open Elective)

Prerequisites: Mathematics courses of first year of study.

Course Objectives:
1. The Number Theory basic concepts useful for cryptography etc
2. The theory of Probability, and probability distributions of single and multiple random variables
3. The sampling theory and testing of hypothesis and making inferences
4. Stochastic process and Markov chains.

Course Outcomes: After learning the contents of this course, the student must be able to
1. Apply the number theory concepts to cryptography domain
2. Apply the concepts of probability and distributions to some case studies
3. Correlate the material of one unit to the material in other units
4. Resolve the potential misconceptions and hazards in each topic of study.

UNIT - I
Greatest Common Divisors and Prime Factorization: Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers Congruences: Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences

UNIT - II
Simple Linear Regression and Correlation: Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Discrete Probability Distributions: Binomial Distribution, Poisson distribution.

UNIT - III
Continuous Probability Distributions: Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Fundamental Sampling Distributions: Random Sampling, Sampling Distributions, Sampling, Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, F Distribution.

UNIT - IV
Estimation & Tests of Hypotheses: Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimating a Proportion for single mean, Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation.

UNIT - V
Stochastic Processes and Markov Chains: Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n step transition probabilities, Markov chain, Steady state condition, Markov analysis.

TEXT BOOKS:
1. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition, Addison Wesley, ISBN 978 0-321-50031-1
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S. D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi

REFERENCES:
1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications
2. T.T. Soong, Fundamentals of Probability And Statistics For Engineers, John Wiley & Sons Ltd, 2004.
3. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. DATA SCIENCE

BIG DATA ANALYTICS (Open Elective)

Course Objectives
1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

Courses Outcomes
1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in Social Media and Mining.

UNIT - I
Getting an Overview of Big Data: What is Big Data? History of Data Management – Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data
Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-Memory Computing Technology for Big Data.

UNIT - II
Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie
Understanding MapReduce Fundamentals and Hbase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing

UNIT - III
Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Points to Consider during Analysis, Developing an Analytic Team, Understanding Text Analytics
Analytical Approaches and Tools to Analyze Data: Analytical Approaches, History of Analytical Tools. Introduction to Popular Analytical Tools, Comparing Various Analytical Tools, Installing R

UNIT - IV
Data Visualization-I: Introducing Data Visualization, Techniques Used for Visual Data Representation, Types of Data Visualization, Applications of Data Visualization, Visualizing Big Data, Tools Used in Data Visualization, Tableau Products
Data Visualization with Tableau (Data Visualization-II): Introduction to Tableau Software, Tableau Desktop Workspace, Data Analytics in Tableau Public, Using Visual Controls in Tableau Public

UNIT - V
Social Media Analytics and Text Mining: Introducing Social Media, Introducing Key Elements of Social Media, Introducing Text Mining, Understanding Text Mining Process, Sentiment Analysis, Performing Social Media Analytics and Opinion
Mining on Tweets
Mobile Analytics: Introducing Mobile Analytics, Introducing Mobile Analytics Tools, Performing Mobile Analytics, Challenges of Mobile Analytics

TEXT BOOKS:
1. Big data, blackbook, dreamtech press, 2015

2. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley 2015.
3. Simon Walkowiak, Big Data Analytics with R, Packt Publishing, ISBN: 9781786466457

REFERENCES:
1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiley CIO Series, 2013.
2. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
3. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. DATA SCIENCE

ADVANCED ARTIFICIAL INTELLIGENCE (Open Elective)

Course Objectives: Knowledge on significance of planning, Learning, Perception and Action
Course Outcomes:
1. Understand the concepts of Game Playing and Planning.
2. Analyze parallel and Distributed AI and Learning
3. Illustrate Expert Systems, Perception and Action
4. Analyze Genetic algorithms, Artificial Immune Systems

UNIT - I
Game Playing: introduction, The Min - Max search procedure, adding alpha-beta cutoffs, Additional Refinements, Iterative Deepening, References on Specific Games
Planning: Introduction, An Example Domain, The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear planning using Constraint Posting, Hierarchical Planning, Reactive systems, Other Planning Techniques

UNIT - II
Parallel and Distributed AI: Psychological Modeling, Parallelism in Reasoning Systems, Distributed Reasoning Systems
Learning: Introduction, Rote learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples: Induction, Explanation based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic learning

UNIT - III
Expert Systems: Representing and using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real time Search, Perception, Action, Robot Architectures

UNIT - IV
Genetic algorithms: Copying Nature's Approaches: A Peek into the Biological World, Genetic Algorithms (GAs), Significance of the Genetic Operators, Termination Parameters, Niching and Speciation, Evolving Neural Networks, Theoretical Grounding, Ant Algorithms
Artificial Immune Systems: Introduction, The Phenomenon of Immunity, Immunity and Infection, The Innate Immune System- The first line of Defence, The Adaptive Immune System - The second line of defence, Recognition, Clonal Selection, Learning, Immune Network Theory, Mapping Immune Systems to Practical Applications, Other Applications

UNIT - V
Prolog - The Natural Language of Artificial Intelligence: Introduction, Converting English to Prolog facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic Operators, Matching in Prolog, Backtracking, Cuts, Recursion, Lists, Dynamic Databases, Input/Output and Streams. Some Aspects Specific to LPA Prolog.

TEXT BOOKS:
1. Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, 3rd Edition, McGraw Hill
REFERENCES:
1. Artificial Intelligence, 3rd Edn, Patrick Henry Winston, Pearson Education.
2. Artificial Intelligence, Shivani Goel, Pearson Education.
3. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech. II Year I Sem. DATA SCIENCE

SERVICE ORIENTED ARCHITECTURES (Open Elective)

Course Objectives: To establish essential coverage of service oriented architectural models and its underlying design paradigm, along with documentation of the methodology.
Course Outcomes:
1. Understand case studies of service-oriented architectures
2. Solving problems in service orientation
3. Understanding principles of SOA
4. Knowledge on characteristics of SOA
5. Perform service-oriented analysis and design

UNIT - I
Introduction, Case Study Backgrounds: Case Studies -Transit Line Systems, Inc., Midwest University Association

UNIT - II
Understanding Service-Orientation: Introduction to Service-Orientation, Problems Solved by Service-Orientation, Effects of Service-Orientation on the Enterprise, Goals and Benefits of Service-Oriented Computing, Four Pillars of Service-Orientation

UNIT - III
Service-Orientation Principles: A profile for the Standardized Service Contract principle, A profile for the Service Loose Coupling principle, A profile for the Service Abstraction principle, A profile for the Service Reusability principle, A profile for the Service Autonomy principle, A profile for the Service Statelessness principle, A profile for the Service Discoverability principle, A profile for the Service Composability principle (Appendix-A of the Textbook)

UNIT - IV
Understanding SO Architectures: Introduction to SOA, The Four Characteristics of SOA,The Four Common Types of SOA, The End Result of Service-Orientation and SOA, SOA Project and Lifecycle Stages

UNIT - V
Service-Oriented Analysis and Design: Web Service Modeling Process, Decompose the Business Process (into Granular Actions), Filter Out Unsuitable Actions, Define Entity Service Candidates, Identify Process-Specific Logic, Apply Service-Orientation, Identify Service Composition Candidates, Analyze Processing Requirements, Define Utility Service Candidates, Define Microservice Candidates, Apply Service-Orientation, Revise Service Composition Candidates, Revise Capability Candidate Grouping

TEXT BOOK:
1. Thomas Erl, Service-Oriented Architecture Concepts, Technology and Design, PH

REFERENCE BOOKS:
1. SOA in Practice: The Art of Distributed System Design Nicolai M. Josuttis, O'Reilly Media, Inc.
2. Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier
3. Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn.
4. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
5. Web Services, G. Alonso, F. Casati and others, Springer.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF ECE M.Tech. II Year I Sem.

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None

Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes:
- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT- I
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF ECE M.Tech. II Year I Sem.

INDUSTRIAL SAFETY (Open Elective)

Course Objectives:
- To provide information regarding different elements of industrial water pollution and Methods of treatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

Course Outcomes: At the end of the course, student will be able to:
- Know how to take safety measures in executing works
- Identify the need for maintenance (or) replacement of equipment
- Understand the need for periodic and preventive maintenance

UNIT- I
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT- II
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT- III
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,
- i. Screw down grease cup,
- ii. Pressure grease gun,
- iii. Splash lubrication,
- iv. Gravity lubrication,
- v. Wick feed lubrication
- vi. Side feed lubrication,
- vii. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT- IV
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,
- i. Any one machine tool,
- ii. Pump
- iii. Air compressor
- iv. Internal combustion engine,
- v. Boiler,
- vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT- V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

i.   Machine tools,
ii.   Pumps,
iii. Air compressors,
iv.   Diesel generating (DG) sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment,
Advantages of preventive maintenance. Repair cycle concept and importance

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF ECE M.Tech. II Year I Sem.

OPERATIONS RESEARCH (Open Elective)

Prerequisite: None

Course Outcomes: At the end of the course**,** the student should be able to
- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real-world problem and simulate it.

UNIT- I
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT- II
Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method - sensitivity analysis - parametric programming

UNIT- III
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT

UNIT- IV
Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT- V
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

TEXT BOOKS/ REFERENCE BOOKS:
1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF ECE M.Tech. II Year I Sem.

COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)

Prerequisite: None

UNIT- I
Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT- II
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre-project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT- III
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT- IV
Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT- V
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TEXT BOOKS/ REFERENCE BOOKS:
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF ECE M.Tech. II Year I Sem.

COMPOSITE MATERIALS (Open Elective)

Prerequisite: None

UNIT– I
INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT– IV
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS/ REFERENCE BOOKS:
1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K. K. Chawla.
5. Composite Materials Science and Applications – Deborah D. L. Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None

Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes:
- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT- I
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

INDUSTRIAL SAFETY (Open Elective)

Course Objectives:
- To provide information regarding different elements of industrial water pollution and Methods of treatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

Course Outcomes: At the end of the course, student will be able to:
- Know how to take safety measures in executing works
- Identify the need for maintenance (or) replacement of equipment
- Understand the need for periodic and preventive maintenance

UNIT- I
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT- II
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT- III
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,
- viii. Screw down grease cup,
- ix. Pressure grease gun,
- x. Splash lubrication,
- xi. Gravity lubrication,
- xii. Wick feed lubrication
- xiii. Side feed lubrication,
- xiv. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT- IV
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,
- vii. Any one machine tool,
- viii. Pump
- ix. Air compressor
- x. Internal combustion engine,
- xi. Boiler,
- xii. Electrical motors, Types of faults in machine tools and their general causes.

UNIT- V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

    v.   Machine tools,
    vi.   Pumps,
    vii.   Air compressors,
    viii.   Diesel generating (DG) sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment,
Advantages of preventive maintenance. Repair cycle concept and importance

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

OPERATIONS RESEARCH (Open Elective)

Prerequisite: None

Course Outcomes: At the end of the course, the student should be able to
- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real-world problem and simulate it.

UNIT- I
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT- II
Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method - sensitivity analysis - parametric programming

UNIT- III
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT

UNIT- IV
Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT- V
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

TEXT BOOKS/ REFERENCE BOOKS:
1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)

Prerequisite: None

UNIT- I
Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT- II
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre-project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT- III
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT- IV
Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT- V
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TEXT BOOKS/ REFERENCE BOOKS:
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

COMPOSITE MATERIALS (Open Elective)

Prerequisite: None

UNIT– I
INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT– IV
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS/ REFERENCE BOOKS:
7. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
8. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
9. Hand Book of Composite Materials-ed-Lubin.
10. Composite Materials – K. K. Chawla.
11. Composite Materials Science and Applications – Deborah D. L. Chung.
12. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
DEPARTMENT OF EEE M.Tech. II Year I Sem.

PHOTOVOLTAIC SYSTEMS (Open Elective)

Course Objectives:
- To introduce photovoltaic systems
- To deal with various technologies of solar PV cells
- To understand details about manufacture, sizing and operating techniques
- To have knowledge of design considerations.

Course Outcomes: After completion of the course, students will be able to:
- Identify photovoltaic system components and system types
- Calculate electrical energy and power
- Correctly size system components, design considerations of solar equipment
- Design a basic grid-tie PV system.

UNIT-I:
SOLAR ENERGY
Sun and Earth, Solar Spectrum, Solar Geometry, Solar radiation on horizontal and inclined planes, Instruments for measurement of solar radiation, Solar cell, Equivalent circuit, V-I characteristics, Performance improvement.

UNIT-II:
SOLAR CELLS
Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, Encapsulation systems, Manufacture, Power rating, Hotspot effect, Design qualifications.

UNIT-III:
PROTECTION AND MEASUREMENTS
Flat plate arrays, Support structures, Module interconnection and cabling, Lightning protection, Performance measurement using natural sun light and simulator, Determination of temperature coefficients, Internal series resistance, Curve correction factor.

UNIT-IV:
PHOTOVOLTAIC SYSTEMS
Photovoltaic systems, Types, General design considerations, System sizing, Battery sizing, Inverter sizing, Design examples, Balance of PV systems.

UNIT-V:
MAXIMUM POWER POINT TRACKERS
Maximum power point trackers, Perturb and observe, Incremental conductance method, Hill climbing method, Hybrid and complex methods, Data based and other approximate methods, Instrument design, Other MPP techniques, Grid interactive PV system.

TEXTBOOKS:
1. F.C. Treble, "Generating electricity from Sun", Pergamon Press.
2. A.K. Mukherjee, Nivedita Thakur, Photovoltaic systems: Analysis and design, PHI, 2011.

REFERENCES:
1. C.S.Solanki," Solar Photovoltaic's: Fundamentals, Technologies and applications", PHI, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. AMS

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None

Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes: At the end of the course, students will be able to
- demonstrate knowledge of data analytics.
- demonstrate the ability of think critically in making decisions based on data and deep analytics.
- demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- demonstrate the ability to translate data into clear, actionable insights.

UNIT - I:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT - II:
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT - III:
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT - IV:
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting. Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT - V:
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. AMS

WASTE TO ENERGY (Open Elective)

Prerequisites: An introductory knowledge of solid and hazardous waste along with some basic understanding of solid waste management at industries

Course Objectives: To prepare the students for successful career in the energy industry, energy service companies, energy utility and consultancy agencies and in the academic and R&D institutions. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy issues.
To produce energy professionals, who are sensitive to, and well aware of, the energy issues and concerns, and who can apply their specialized knowledge for the sustainable development.

Course Outcomes: Understood and acquired fundamental knowledge on the science and engineering of energy technologies and systems. Acquired the expertise and skills required for energy auditing and management, economical calculation of energy cost, development, implementation, maintenance of energy systems. Become capable of analysis and design of energy conversion systems. Acquired skills in the scientific and technological communications and project preparation, planning and implementation of energy project

UNIT-I:
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal- Methods – Yields and application- Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: Gasifiers- Fixed bed system- Downdraft and updraft gasifiers- Fluidized bed gasifiers- Design, construction and operation- Gasifiers burner arrangement for thermal heating Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III:
Biomass Combustion: Biomass stoves- Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, Inclined grate combustors, Fluidized bed combustors, Design, construction and operation- Operation of all the above biomass combustors.

UNIT-IV:
Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status- Bio energy system – Design and constructional features- Biomass resources and their classification-Biomass Conversion Process

UNIT-V:
Thermo chemical conversion – Direct combustion – biomass gasification- pyroloysis and liquefaction-biochemical conversion- anerobic digestion- Types of biogas Plants- Applications Alcohol production from biomass- Bio diesel production- Urban waste to energy conversion Biomass energy programme in India.

TEXT BOOKS:
1.   Non-Conversional Energy by Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology – A Practical Hand Book by Khandelwal, K.C and Mahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd, 1983.

REFERENCE BOOKS:
1. Food, Feed and Fuel from Biomass by Challal, D.S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology by C.Y. WereKo- Brobby and E.B. Hagan, John Wiley & Sons, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. AMS)

PRINCIPLES OF AUTOMATION (Open Elective)

UNIT- I:
Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT- II:
Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT – III:
Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT- IV:
Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT- V:
Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

REFERENCE BOOKS:
1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Education.
2. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
3. Automation, Buckinghsm W, / Haper & Row Publishers, New York, 1961
4. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. AMS

ARTIFICIAL NEURAL NETWORKS (Open Elective)

Course Objectives: Objectives of this course are
- To introduce the basics of Neural Networks and its architectures.
- To introduce the Fuzzy sets and Fuzzy Logic system components
- To deal with the applications of Neural Networks and Fuzzy systems

Course Outcomes: After this course, the student
- To understand artificial neural network models and their training algorithms
- To understand the concept of fuzzy logic system components, fuzzification and defuzzification
- Applies the above concepts to real-world problems and applications.

UNIT – I:
Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.
Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT – II:
Feed Forward Neural Networks: Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.
Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT – III:
Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).
Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem.
Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT – IV:
Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT – V:
Fuzzy Logic System: Fuzzification, Membership value assignment, development of rule base and decision-making system, Defuzzification to crisp sets, Defuzzification methods.

TEXT BOOKS:

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications– PHI Publication.
2. Satish Kumar, Neural Networks, TMH, 2004.

REFERENCE BOOKS:

1. James A Freeman and Davis Skapura, Neural Networks, Pearson Education, 2002.
2. Simon Hakins, Neural Networks, Pearson Education.
3. C. Eliasmith and Ch. Anderson, Neural Engineering, PHI.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. CAD/CAM

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None

Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes: At the end of the course,
- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT- I:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II:
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III:
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV:
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting. Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V:

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

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2. Business Analytics by James Evans, persons Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. CAD/CAM

WASTE TO ENERGY (Open Elective)

Prerequisites: An introductory knowledge of solid and hazardous waste along with some basic understanding of solid waste management at industries

Course Objectives: To prepare the students for successful career in the energy industry, energy service companies, energy utility and consultancy agencies and in the academic and R&D institutions. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy issues.
To produce energy professionals, who are sensitive to, and well aware of, the energy issues and concerns, and who can apply their specialized knowledge for the sustainable development.

Course Outcomes: Understood and acquired fundamental knowledge on the science and engineering of energy technologies and systems. Acquired the expertise and skills required for energy auditing and management, economical calculation of energy cost, development, implementation, maintenance of energy systems. Become capable of analysis and design of energy conversion systems. Acquired skills in the scientific and technological communications and project preparation, planning and implementation of energy project

UNIT-I:
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal- Methods – Yields and application- Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: Gasifiers- Fixed bed system- Downdraft and updraft gasifiers- Fluidized bed gasifiers- Design, construction and operation- Gasifiers burner arrangement for thermal heatingGasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III:
Biomass Combustion: Biomass stoves- Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, Inclined grate combustors, Fluidized bed combustors, Design, construction and operation- Operation of all the above biomass combustors.

UNIT-IV:
Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status- Bio energy system – Design and constructional features- Biomass resources and their classification- BIOMASS CONVERSION PROCESS

UNIT-V:
Thermo chemical conversion – Direct combustion – biomass gasification- pyroloysis and liquefaction- biochemical conversion- anerobic digestion- Types of biogas Plants- Applications Alcohol production from biomass- Bio diesel production- Urban waste to energy conversion Biomass energy programme in India.

TEXT BOOKS:
1. Non-Conversional Energy by Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology – A Practical Hand Book by Khandelwal, K.C and Mahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd, 1983.

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1. Food, Feed and Fuel from Biomass by Challal, D.S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology by C.Y. WereKo- Brobby and E.B. Hagan, John Wiley & Sons, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. CAD/CAM

CONCURRENT ENGINEERING (Open Elective)

Prerequisites: Computer-Aided Design

Course objective: To provide a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support.

Course Outcomes:
- Understand the need of concurrent engineering and strategic approaches for product design.
- Apply concurrent design principles to product design.
- Design assembly workstation using concepts of simultaneous engineering.
- Design automated fabricated systems – Case studies.

UNIT- I
Introduction: Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development
Use of Information Technology: IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co-design.

UNIT- II
Design Stage: Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design.
Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

UNIT- III
Manufacturing Concepts and Analysis: Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative, physical approach - An intelligent design for manufacturing system.

UNIT- IV
JIT system - low inventory - modular - Modeling and reasoning for computer-based assembly planning - Design of Automated manufacturing.
Project Management: Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost.

UNIT- V
Concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development.

TEXT BOOK:
1. Concurrent Engineering: Automation Tools and Technology by Andrew Kusaik, Wiley John and Sons Inc., 1992.

REFERENCE BOOKS:
1. Integrated Product Development by Anderson MM and Hein, L. Berlin, Springer Verlag, 1987.
2. Design for Concurrent Engineering by Cleetus, J. Concurrent Engineering Research Centre, Morgantown W V, 1992.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. CAD/CAM

INDUSTRIAL SAFETY (Open Elective)

Course Objectives:
- To provide information regarding different elements of industrial water pollution and Methods of treatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

Course Outcomes: At the end of the course, student will be able to:
- Know how to take safety measures in executing works
- Identify the need for maintenance (or) replacement of equipment
- Understand the need for periodic and preventive maintenance

UNIT- I
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT- II
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT- III
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,
- xv. Screw down grease cup,
- xvi. Pressure grease gun,
- xvii. Splash lubrication,
- xviii. Gravity lubrication,
- xix. Wick feed lubrication
- xx. Side feed lubrication,
- xxi. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT- IV
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,
- xiii. Any one machine tool,
- xiv. Pump
- xv. Air compressor
- xvi. Internal combustion engine,
- xvii. Boiler,
- xviii. Electrical motors, Types of faults in machine tools and their general causes.

UNIT- V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

    ix.   Machine tools,
    x.   Pumps,
    xi.   Air compressors,
    xii.   Diesel generating (DG) sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment,
Advantages of preventive maintenance. Repair cycle concept and importance

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. ENGG. DESIGN

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None
Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes: At the end of the course,
- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT- I:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

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Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

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Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting. Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V:
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. ENGG. DESIGN

WASTE TO ENERGY (Open Elective)

Prerequisites: An introductory knowledge of solid and hazardous waste along with some basic understanding of solid waste management at industries

Course Objectives: To prepare the students for successful career in the energy industry, energy service companies, energy utility and consultancy agencies and in the academic and R&D institutions. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy issues.
To produce energy professionals, who are sensitive to, and well aware of, the energy issues and concerns, and who can apply their specialized knowledge for the sustainable development.

Course Outcomes: Understood and acquired fundamental knowledge on the science and engineering of energy technologies and systems. Acquired the expertise and skills required for energy auditing and management, economical calculation of energy cost, development, implementation, maintenance of energy systems. Become capable of analysis and design of energy conversion systems. Acquired skills in the scientific and technological communications and project preparation, planning and implementation of energy project

UNIT-I:
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal- Methods – Yields and application- Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: Gasifiers- Fixed bed system- Downdraft and updraft gasifiers- Fluidized bed gasifiers- Design, construction and operation- Gasifiers burner arrangement for thermal heatingGasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III:
Biomass Combustion: Biomass stoves- Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, Inclined grate combustors, Fluidized bed combustors, Design, construction and operation- Operation of all the above biomass combustors.

UNIT-IV:
Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status- Bio energy system – Design and constructional features- Biomass resources and their classification- BIOMASS CONVERSION PROCESS

UNIT-V:
Thermo chemical conversion – Direct combustion – biomass gasification- pyroloysis and liquefaction- biochemical conversion- anerobic digestion- Types of biogas Plants- Applications Alcohol production from biomass- Bio diesel production- Urban waste to energy conversion Biomass energy programme in India.

TEXT BOOKS:
1. Non-Conversional Energy by Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology – A Practical Hand Book by Khandelwal, K.C and Mahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd, 1983.

REFERENCE BOOKS:
1. Food, Feed and Fuel from Biomass by Challal, D.S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology by C.Y. WereKo- Brobby and E.B. Hagan, John Wiley & Sons, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. ENGG. DESIGN

INDUSTRIAL SAFETY (Open Elective)

UNIT – I:
Safety Philosophy and principles of Accident prevention Introduction, accident, injury, unsafe act, unsafe condition, reportable accidents, need for safety, breakdown of accidents, hazardous industries. Theories & Principle of accidents Casualty, cost of accident, computation of cost, utility of cost data. Accident reporting & Investigation Identification of the key facts, corrective actions, classification of facts. Regulation American (OSHA) and Indian Regulation.

UNIT – II:
Safety Management Division of responsibility, Location of Safety function, size of safety department, qualification for safety specialist, safety committee – structure and functions.

UNIT – III:
Safe Working Condition and Their Development SOP for various Mechanical equipment, Incidental safety devices and methods, statutory of provisions related to safeguarding of Machinery and working condition.

UNIT – IV:
Safety in Operation and Maintenance Operational activities and hazards, starting and shut down procedures, safe operation of pumps, compressor, heaters, reactors, work permit system, entry into continued spaces.

UNIT – V:
Safety in Storage and Emergency Planning Safety in storage, handling of chemicals and gases, storage layout, ventilation, safety in chemical laboratories, emergency preparedness on site plan, off site plan, toxic hazard control.

TEXT BOOKS:
1. Safety and Accident Prevention in Chemical Operation – H.H. Faweett and Wood
2. Personal Protective Equipment – NSC Bombay

REFERENCE BOOKS:
1. Ergonomics - P. Krishna Murthy
2. Fire Prevention Hand Book – Derek James

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. ENGG. DESIGN

PRINCIPLES OF AUTOMATION (Open Elective)

UNIT- I:
Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT- II:
Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT – III:
Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT- IV:
Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT- V:
Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

REFERENCE BOOKS:
1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Education.
2. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
3. Automation, Buckinghsm W, / Haper & Row Publishers, New York, 1961
4. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. TE

BUSINESS ANALYTICS (Open Elective)

Prerequisite: None
Course objectives:
- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes: At the end of the course,
- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT- I:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II:
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III:
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT- IV:
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting. Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT- V:
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. TE

BASICS OF REFRIGERATION SYSTEMS (Open Elective)

Course Objectives:
- To understand the principles of refrigeration.
- To understand different vapor Absorption systems.
- To know Aircraft Air refrigeration systems.
- To gain knowledge about refrigerants.
- Ozone depletion potential and global warming potential.

Course Outcomes: On successful completion of the course, the student will be able to:
- Illustrate the basic concepts of refrigeration system.
- Analyze the vapour compression cycle and interpret the usage of refrigerants.
- Explain the components of vapour absorption system.
- Demonstrate the use of refrigerants.
- Discuss the theory Ozone depletion potential and global warming potential.

UNIT- I:
Vapor Compression Refrigeration: Analysis of vapor compression refrigeration cycle - reversed Carnot cycle for vapour - effect of suction temperature and condensing temperature on cycle performance – Practical refrigeration cycle – sub-cooled liquid and super-heated vapor refrigeration cycles their effect on performance. Multi Pressure Systems- removal of flash gas- intercooling – compound compression (conversion)-multi vapor systems- cascade systems- dual compression-system practices.

UNIT- II:
Simple vapor Absorption systems- actual vapor absorption cycle- representation of the cycle on H-C diagram- common refrigerant- (Absorbent)Adsorbent) systems. Practical single effect Water- Lithium Bromide Absorption system- double effect system Electrolux refrigerator- newer mixtures for absorption systems.

UNIT- III:
Aircraft Air refrigeration – Functions – working conditions – types. Steam jet water vapor systems-thermoelectric refrigeration systems - vortex refrigeration system - pulse tube refrigeration.

UNIT- IV:
Refrigerants: Desirable properties- thermo dynamic-chemical and transport properties - designation of refrigerants - inorganic, halo carbon refrigerants - secondary refrigerants - Properties of mixtures of refrigerants

UNIT- V:
Ozone depletion potential and global warming potential – effect of refrigerants- alternative refrigerants-newer refrigerants.

TEXT BOOKS:
1. R & A/C by F. Stoecker & Jerold. W. Jones-MGH Intl., 1982.
2. R & A/C by C. P. Arora, TMGH -2000.

REFERENCE BOOKS:
1. R & A/C by Manohar Prasad.
2. Principles of Refrigeration by Roy. J. Dossat, 1997.
3. Refrigeration by Gosney- Oxford University Press-1980.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. TE
INTRODUCTION TO THERMAL STORAGE SYSTEMS (Open Elective)

Course objectives:
- To Understand the Necessity of Thermal Storage – Types-Energy Storage Devices
- To Understand Sensible Heat Storage System.
- To Know Parallel Flow and Counter Flow Regenerators.
- To Gain Knowledge about specific areas of Application of Energy Storage.
- Latent Heat Storage Systems.

Course Outcomes: At the end of the course, students will be able to
- state the types-energy storage devices – comparison of energy storage technologies.
- Identify and describe Basic concepts and modeling of heat storage units - modeling of simple water and rock bed storage system.
- Explain at a level understandable by a non-technical person how various Parallel flow and counter flow regenerators.
- Calculate phase change problems.
- Explain greenhouse heating – power plant applications – drying and heating for process industries.

UNIT – I:
Introduction: Necessity of thermal storage – types-energy storage devices – comparison of energy storage technologies - seasonal thermal energy storage - storage materials.

UNIT – II:
Sensible Heat Storage System: Basic concepts and modeling of heat storage units - modeling of simple water and rock bed storage system – use of TRNSYS – pressurized water storage system for power plant applications – packed beds.

UNIT – III:
Regenerators: Parallel flow and counter flow regenerators – finite conductivity model – non – linear model – transient performance – step changes in inlet gas temperature – step changes in gas flow rate – parameterization of transient response – heat storage exchangers.

UNIT – IV:
Latent Heat Storage Systems: Modeling of phase change problems – temperature-based model - enthalpy model - porous medium approach - conduction dominated phase change – convection dominated phase change.

UNIT – V:
Applications: Specific areas of application of energy storage – food preservation – waste heat recovery – solar energy storage – green house heating – power plant applications – drying and heating for process industries.

TEXT BOOK:
1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.

REFERENCE BOOKS:
1. Schmidt. F. W and Willmott. A. J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 1981.
2. Lunardini. V. J, Heat Transfer in Cold Climates, John Wiley and sons 1981.