

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME(NT)-II Sem	L	T/P/D	C
	4	-/-	4

(A82915) NANO COMPOSITES**AIM**

The course presents and analyzes the essential data on nanoscale reinforcing materials dispersed in several matrix materials like polymers, metals and ceramics. The subject is mainly focused on the synthesis, properties and modelling of the nanocomposites.

Objectives

- To synthesize and evaluate nanostructure reinforce matrix material
- To understand the importance of various nanomaterial matrix
- To discuss various application including aerospace applications

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Unit – I

Introduction to Nanocomposites, Composite material, Mechanical properties of Nano composite material: stress - strain relationship, toughness, strength, plasticity.

Unit – II

Bulk metal and Ceramic Nanocomposites: Ceramic/Metal Nanocomposite, Nanocomposites: mechanical alloying, thermal Spray synthesis, from sol-gel synthesis Metal Matrix Nanocomposites, Thin film nanocomposite: Multilayer and Granular Films, Nanocomposite for hard coatings, Carbon nanotube-based nanocomposites, Functional Low dimensional Nanocomposite,

Unit – III

Polymer-based nanocomposites, **Processing of polymer nanocomposites:** Extrusion method, Exfoliation & intercalation, Solution casting method, impregnation techniques: Hot melt impregnation, solution impregnation.

Unit – IV

Modeling of nanocomposites, Modeling methods: **Continuum methods:** Analytical continuum modeling, Computational continuum modeling, **MOLECULAR MODELING:** Molecular dynamics, Monte Carlo, Ab initio methods

Unit – V

Processing of nanocomposites: Powder metallurgy method, Pressure Infiltration technique, Stir Casting, Nano composites for hard coatings, DLC coatings.

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TEXT BOOKS:

1. Nanocomposite Science & Technology by P.M. Ajayan, L.S. Schadler and P.V. Braun, Wiley-VCH GmbH Co.
2. Introduction to Nano Technology by Charles. P.Poole Jr and Frank J. Owens; Wiley India Pvt Ltd.
3. Nanotechnology, A gentle introduction to the next big idea by Mark Ratner, Daniel Ratner Pearson education.
4. Polyoxometalate Chemistry for Nano- Composite Design

REFERENCE BOOKS:

1. Encyclopedia of Nanotechnology by H.S.Nalwa
2. Encyclopaedia of Nano Technology by M.Balakrishna rao and K.Krishna Reddy, Vol I to X Campus books.

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(A80527) ARTIFICIAL NEURAL NETWORKS**(ELECTIVE-III)**www.universityupdates.in**UNIT- I**

Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT- II

BACK PROPAGATION: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT- III

SINGLE LAYER PERCEPTRONS: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron – convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment

Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection.

www.universityupdates.in**UNIT- IV**

SELF ORGANIZATION MAPS: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patten classification.

UNIT- V

NEURO DYNAMICS: Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm

Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:

1. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

REFERENCES:

1. Artificial neural networks/ B.Vegnanarayana/PHI
2. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
3. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
4. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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**(A80363) MAINTENANCE AND SAFETY ENGINEERING
(ELECTIVE-III)**

UNIT-I

Introduction, Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.

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UNIT-II

Types of Maintenance: Preventive Maintenance, Elements of Preventive Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

Inventory Control in Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods

UNIT- III

Quality and Safety in Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Preventive Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

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UNIT-IV

Reliability, Reliability Centered maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components

Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

UNIT-V

Maintainability: Maintainability Importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS

1. Reliability, Maintenance and Safety Engineering/ Dr. A.K.Guptha/ Laxmi Publications.
2. Industrial Safety Management/ L.M. Deshmukh/TMH.

REFERENCES:

1. Maintenance Engineering & Management / R.C.Mishra/ PHI.
2. Reliability Engineering / Elsayed/ Pearson.
3. Engineering Maintenance a modern approach/ B.S Dhallon/ C.R.R Publishers.
4. A Text Book of Reliability and Maintenance Engineering/Alakesh Manna/IK International Publishing House.
5. Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.

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(A80324) RENEWABLE ENERGY SOURCES**(ELECTIVE-III)**www.universityupdates.in**UNIT – I**

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on tilted surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage And Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

www.universityupdates.in**UNIT – III**

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.

BIO-MASS: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

UNIT – IV

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

OTEC : Principles, utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT – V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic

conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable Energy Sources / Twidell & Weir / Taylor and Francis / 2nd Special Indian Edition
2. Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons

REFERENCE BOOKS:

1. Energy Resources Utilization and Technologies / Anjaneyulu & Francis / BS Publications/2012
2. Principles of Solar Energy / Frank Krieth & John F Kreider / Hemisphere Publications
3. Non-Conventional Energy / Ashok V Desai / Wiley Eastern
4. Non-Conventional Energy Systems / K Mittal / Wheeler
5. Renewable Energy Technologies / Ramesh & Kumar / Narosa
6. Renewable Energy Resources / Tiwari and Ghosal / Narosa

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(A80338) COMPUTATIONAL FLUID DYNAMICS**(ELECTIVE-III)**www.universityupdates.in**UNIT-I**

Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

UNIT - II

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - III

Introduction to first order wave equation: Stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT - IV

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

www.universityupdates.in**UNIT-V**

Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
2. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa

Publications

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REFERENCES:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis/Oxford University Press/2nd Edition

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**(A82918) NANOTOXICOLOGY
(ELECTIVE-IV)**

Objective:

To learn and understand social impact and health issues of environmental pollution caused due nanoindustries.

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UNIT-I:

Introduction : Concept of Nanotoxicology - Laboratory rodent studies - Ecotoxicologic studies - Methodology - for Nanotoxicology -toxicity testing.

UNIT-II:

Mechanism : Mechanism of nanosize particle toxicity - Reactive oxygen species mechanisms of NSP toxicity - Interactions between Nanoparticles and Living Organisms: Mechanisms and Health Effects.

UNIT-III:

Cytotoxicity: Interactions of Nanoparticles with Cells and their Cellular Nanotoxicology - Cytotoxicity of Ultrafine Particles - Cytotoxicity and Potential Mechanism of Nanomaterials.

UNIT-IV:

Human Exposure to Nanosized Materials : Nanopollution - Nanomaterials in Environment - Toxicology of Airborne - Manufactured nanomaterials in the environment. Biological Activities of Nanomaterials and Nanoparticles - Respiratory Tract - Efficient deposition of inhaled NSPs - Deposition of NSPs in the respiratory - Deposition of NSPs in the respiratory.

UNIT-V:

Risk Assessment and Execution : Portals of entry and target tissue - Risk assessment - Ethical - Legal and Social Implications - Nanoparticle Toxicology and Ecotoxicology, The Role of Oxidative Stress - Development of Test Protocols for Nanomaterials - Regulation of Engineered Nanomaterials in Europe and USA

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TEXT BOOKS

1. NANOTALK Conversations With Scientists and Engineers About Ethics, Meaning, and Belief in the Development of Nanotechnology by Rosalyn W. Berne, PhD LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS 2006 Mahwah, New Jersey London.
2. Yuliang Zhao and Hari Singh Nalwa, 'Nanotoxicology: Interactions of Nanomaterials with Biological Systems, American Scientific

Publishers, 2007

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3. "Nanotoxicology - Interactions of Nanomaterials with Biological Systems", Ed Yuliang Zhao and Hari Singh Nalwa, June 2006.

REFERNECE BOOKS:

1. E P. Widmaier, H. Raff, K.T. Strang, Vander, Sherman and Luciano, 'Human Physiology: The Mechanisms of Body. Functions', 9th edition, McGraw Hill, New York, 2004
2. Gunter Oberd?ster, Eva Oberdorster and Jan Oberdorster, Environmental Health Perspectives, Volume 113 Number 7 , July 2005
3. D. Drobne, 'Nanotoxicology for safe and Sustainable Nanotechnology', Nanotoxicology for safe and sustainable Nanotechnology , 58, pp. 471-478, December 2007
4. Monteiro-Riv, 'Nanotoxicology: Characterization, Dosing and Health Effects', Informa Healthcare publishers, 2007
5. A Reference handbook of nanotoxicology by M.Zafar Nyamadzi

OUTCOME OF THE STUDY:

1. To provide knowledge on social impact of nanoindustry.
2. To design and conduct experiments, as well as to analyze the results.
3. To enhance the various analytical techniques and to identify and solve problems.
4. To understand the risk assessment and execution.

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**(A82911) BIOMEDICAL APPLICATIONS IN NANOTECHNOLOGY
(ELECTIVE - IV)**

Objective: Aim: The course is intended to cover fundamental terms of biotechnology and building blocks; biological nanostructures, biosensors and biomedical applications of nanotechnology, nanodrugs and drug delivery systems.

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UNIT I:

Nano Therapeutics: Introduction, Manufacturing of Nanoparticles, Nanoparticles in Drug Delivery-Available Applications, Future understanding for Treatment, Thermo responsive delivery systems, pH responsive Delivery systems, External stimuli based delivery systems (Magnetic, photosensitive and ultra sound sensitive delivery systems). Stealth nanoparticles -multi targeting systems, Drug and Gene Delivery, Magnetic Resonance Imaging, Hyperthermia.

UNIT II:

Micro/Nanomachining and Fabrication of Materials for Biomedical Applications : Introduction, Overview of Ion Implantation Process, Micro/Nanomachining of "Soft" Polymeric Biomaterials: Orthopedic Applications, Blood-Contacting Devices, and Other Applications. Micro/Nanomachining of "Hard" Metallic Biomaterials: Dental Implants, Blood-Contacting Devices, Other Applications.

UNIT II:

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Core/Shell nanostructure for Bioimaging: Core/shell structured nanoparticles for bioimaging, inorganic core/shell nanoparticles, silver/silica in fluorescence imaging, iron oxide/silica in magnetic imaging.

UNIT IV:

Biosensors : Generation of Biosensors – Immobilization, characteristics, applications – Conducting polymer based sensors – DNA Biosensors.

UNIT V:

Diagnostic Applications of Nanoparticles: Gene Therapy using nanoparticles – Nanofluids (Aqueous dispersed applications of nanoparticles) – Nanoparticles in bioanalytical Techniques (Quantum dots, SPR based and peptide based sensors) – Advances in cancer therapy.

Text Books:

1. Leon Lachman et al –at Theory and Practice of Industrial

Pharmacy,3rd Edition,Lea and Febiger, 1986.

2. Nanotechnology importance and applications-M.H.Fulekar
3. BioMEMS and Biomedical Nanotechnology-Volume I Biological and Biomedical Nanotechnology.
4. BIOMEDICAL NANOSTRUCTURES Edited by Kenneth E. Gonsalves, Craig R.Halberstadt, Cato T. Laurencin, Lakshmi S. Nair

REFERENCE BOOKS:

1. ADVANCED MAGNETIC NANOSTRUCTURES- Edited by David Sellmyer, Ralph Skomski- springer.
2. BIOMEDICAL APPLICATIONS OF NANOTECHNOLOGY- EDITED BY Vinod Labhasetwar, Diandra L. Leslie-Pelecky
3. Core/shell structured nanoparticles for biomedical applications by nagarajan sounderya and youg zhang, springer publications

OUTCOME OF THE STUDY:

1. To familiarize student with biological systems, sensors and building blocks.
2. To familiarize about biomedical applications, nanodrugs, molecular modeling of drugs and drugs delivery systems

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**(A82916) NANOTECHNOLOGIES FOR WATER AND ENVIRONMENT
APPLICATIONS
(ELECTIVE - IV)**

Objective:

To learn and understand social impact of environmental pollution caused due nanoindustries.

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Unit-I:

Introduction: Introduction to Environmental Applications, Implications of Nanotechnology & Research needs

Unit-II:

Nanostructured Catalysts TiO_2 Nanoparticles for Water purification: TiO_2 as a semiconductor photocatalyst, Photo catalytic mechanism, general pathways & kinetics, Intrinsic Photocatalytic activity, Reaction variables, Photocatalytic Degradation of Specific Waterborne pollutants.

Unit-III:**Nanoparticles for treatment of Chlorinated Organic Contaminants**

Introduction, Overview of Chlorinated Organic Solvents, Biodegradation of Chlorinated Organic Solvents, Nanoscale zero-valence iron (NZVI), Application of other Nanoscale metallic particles in chlorinated organic compound degradation.

Unit-IV:

Nanoparticles for treatment of Arsenic: Introduction, Environmental Chemistry of Arsenic, Treatment of Arsenic using Nanocrystalline TiO_2 , Treatment of Arsenic using nanoparticles other than TiO_2 .

Unit-V:

Nanomembranes: Nanomembranes in Drinking water treatment, Nanomembranes in Sea desalination.

Environmental Risks of Nanomaterials: Routes of NMS into the Water environment, Hazardous effects of NMs on Human and Animal Health, Risk Management.

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TEXT BOOKS:

1. Nanotechnologies for Water Environment Applications American Society of Civil Engineers (ASCE) Publications by Tian C.Zhang Zhiqiang Hu, Rao Y. Surampalli, R.D.Tyagi, Keith C.K.Lai and Irene

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Mc.Lao

2. Nanotechnology In Water Purification Applications Caister Academic Press by T.Eugene, Michele de Kwaadsteniet, Marelize Botes and J.Manuel Lopez-Romero.

Outcomes :

- To provide knowledge on social impact of nanoindustry.
- To design and conduct experiments, as well as to analyze the results.
- To enhance the various analytical techniques and to identify and solve problems.
- To understand the socio-ethical responsibility

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(A82917) NANOTECHNOLOGY FOR ENERGY SYSTEMS**(ELECTIVE - IV)****Objectives :**

The purpose of this course is an introduction to various forms of energy used in industries and methods of converting from one form to another by using Nanotechnology. Students should be provided with the opportunity to explore these various forms of energy, particularly in terms of Nanotechnology and how they are converted and how their use impact on the environment.

Unit-I

Battery materials and batteries: Lithium-Ion based batteries.

Unit-II

Renewable energy Technology: Energy challenges, nanomaterials and nanostructures in energy harvesting, developments and implementation of nanotechnology based renewable energy technologies,

Unit-III

Solar cell structures: quantum well and quantum dot solar cells, photo-thermal cells for solar energy harvesting, Thin film solar cells, CIGS solar cells, Dye sensitized solar cells.

Unit-IV

Hydrogen storage Technology: Hydrogen production methods, purification, hydrogen storage methods. Hydrogen storage materials: metal hydrides and metal-organic framework materials, volumetric and gravimetric storage capacities, hydriding and dehydriding kinetics, high enthalpy formations and thermal management during hydriding reaction, multiple catalytic – degradation of sorption properties, automotive applications.

Unit-V

Fuel cell Technology: Fuel cell Principles, types of fuel cells (Alkaline Electrolyte, Phosphoric acid, Molten Carbonate, solid oxide and direct methanol and Proton exchange fuel cells), Principle and operation of Proton Exchange Membrane (PEM) fuel cell,

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TEXT BOOKS & REFERENCES:

1. Renewable Energy Resources by J. Twidell and T.Weir, E&FN Spon Ltd.
2. Hydrogen from Renewable Energy Source by D.Infield

www.universityupdates.in

3. Fundamentals of Industrial Catalytic Process by C.H. Bartholomew and Robert J. Farraoto, John Wiley & Sons Inc.
4. Fuel storage on Board Hydrogen storage in Carbon Nanostructures by R.A. Shatwell.
5. Fuel cell Technology Handbook by Hoogers, CRC Press.
6. Hand book of fuel cells: Fuel cell technology and applications by Vielstich, Wiley: CRC Press.

Outcomes :

- To demonstrate knowledge of the sources of energy and the methods of energy conversion in Nanotechnology.
- To appreciate the role of Nano technology in energy and its efforts to improve lifestyle.
- Understand the basic principles of Renewable Energy technology, Micro Fuel Cell Technology and Micro Fluid System.
- To conduct experiments to verify basic principles of energy conversion.

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(A80087) INDUSTRY ORIENTED MINI PROJECTwww.universityupdates.in**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

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-	-/6/-	2

(A80089) SEMINARwww.universityupdates.in**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

IV Year B.Tech. ME(NT)-II Sem

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-	-/15/-	10

(A80088) PROJECT WORK**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

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-	-/-	2

(A80090) COMPREHENSIVE VIVAwww.universityupdates.in