



GUJARAT TECHNOLOGICAL UNIVERSITY

(Established by Government of Gujarat under Gujarat Act No.: 20 of 2007)

ગુજરાત ટેકનોલોજીકલ યુનિવર્સિટી

(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)

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GTU - ADVT NO: 03/2024 & 05/2024

Date: 03/09/2024

SYLLABUS FOR THE WRITTEN TEST FOR TEACHING POST **RECRUITMENT OF GTU & GPERI**

PART-A: PRIMARY & CONVENTIONAL EXAMINATION (WRITTEN) (GENERAL STUDIES)

Duration: 60 minutes

Total Marks: 50

Medium: English

Number of Questions: 50

Sr. No	Type of Test/Topics Covered Composite Time: 60 minutes	Total Marks : 50
PART - 1 (GENERAL STUDIES):		
1)	English Grammar	
2)	General Science and Environment	
3)	Computer / I.C.T. Aptitude and Data Analysis & Interpretation	
4)	Indian Economy / Geography / Natural Resources / Population	
5)	a) The Constitution of India: i. Preamble ii. Fundamental Rights and Duties iii. Directive Principles of State Policy iv. Powers of the President v. Powers of the Governor vi. Judiciary System vii. Election Commission viii. Comptroller and Auditor General b) Right to Information Act, 2005 (RTI Act)	

Winners of : ICT Enabled University Award E-India - 2009 ❖ Manthan Award - 2009 ❖ GESIA Award - 2010
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Chandkheda : Nr. Campus of Vishwakarma Government Engineering College, Sabarmati - Koba Highway, Nr. Visat Three Roads, Chandkheda, Ahmedabad - 382 424. Gujarat, India Ph. : 079 - 232 67 500 Fax : +91 - 79 232 67 580
Ahmedabad : 2nd Floor, ACPC Building, L. D. College of Engineering Campus, Navrangpura, Ahmedabad, (Gujarat) India - 380 015.
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6)	<u>Current Affairs:</u> Important Events- Regional / National / International
7)	<u>Professional/Technical Education:</u> Education System in Gujarat-State Policy, Knowledge Consortium of Gujarat (KCG), Higher Education Institutions (IIT, NITs, IIMs, IISc, IISER, IIITMs, NITTTRs, UGC, AICTE, PCI, DEC, BCI, NCTE, INC, COA, MCI, DCI, VCI), Higher Education System (Diploma, Degree, Masters, Doctorate, Vocational Education and Training (VET)), Rashtriya Uchchattar Shiksha Abhiyan (RUSA), Higher Education Funding Agency (HEFA), Higher Education Ranking Agency (NBA, NAAC), University Administration Systems, Propagation of Professional and Technical Education, Regulatory and Sanctioning Institutions

PART-B (OBJECTIVE-EDUCATION QUALIFICATION RELATED)

Duration: 120 minutes

Total Marks: 200

Medium: English

Number of Questions: 100

❖ Assistant Professor (Computer):

Section 1: Research Methodology

General Introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.



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Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
- locating relevant information,
- use of library & electronic databases,
- preparation & presentation of literature review,
- research article reviews,
- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.

Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research

Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H-index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

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Section 2: Engineering Mathematics

Discrete Mathematics:

- Propositional and First Order Logic
- Sets, Relations, Functions, Partial Orders and Lattices
- Monoids, Groups,
- Graphs: connectivity, matching, coloring
- Combinatorics: counting, recurrence relations, generating functions

Linear Algebra:

- Matrices
- Determinants
- System of Linear equations
- Eigenvalues and Eigenvectors
- LU decomposition

Calculus:

- Limits, Continuity and Differentiability
- Maxima and Minima
- Mean value Theorem
- Integration.

Probability and Statistics:

- Random variables
- Uniform, Normal, Exponential, Poisson and Binomial Distributions
- Mean, Median, Mode and Standard deviation
- Conditional Probability And Bayes Theorem



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Section 3: Digital Logic

- Boolean Algebra,
- Combinational and Sequential Circuits
- Minimization
- Number Representations and Computer Arithmetic (Fixed and Floating Point).

Section 4: Computer Organization and Architecture

- Machine Instructions and Addressing Modes
- ALU, Data-Path and Control Unit
- Instruction Pipelining, Pipeline Hazards
- Memory Hierarchy: Cache, Main Memory and Secondary Storage;
- I/O interface (Interrupt and DMA mode).

Section 5: Programming and Data Structures

- Programming in C
- Recursion
- Arrays, Stacks, Queues, Linked Lists, Trees, Binary Search Trees, Binary Heaps, Graphs.

Section 6: Algorithms

- Searching, Sorting, Hashing
- Asymptotic Worst Case Time and Space Complexity
- Algorithm Design Techniques: Greedy, Dynamic Programming and Divide-and-Conquer
- Graph Traversals, Minimum Spanning Trees, Shortest Paths



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Section 7: Theory of Computation

- Regular Expressions and Finite Automata
- Context-free Grammars and Push-down Automata
- Regular and Context-free Languages, Pumping Lemma
- Turing Machines and Undecidability

Section 8: Compiler Design

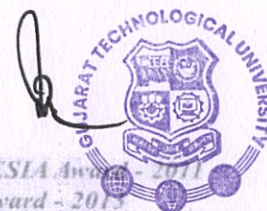
- Lexical analysis, parsing, syntax-directed translation
- Runtime environments.
- Intermediate code generation.
- Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination.

Section 9: Operating System

- System calls, processes, threads, inter-process communication, concurrency and synchronization
- Deadlock
- CPU and I/O scheduling
- Memory management and virtual memory.
- File systems.

Section 10: Databases

- ER-model
- Relational model: relational algebra, tuple calculus, SQL
- Integrity constraints, normal forms
- File organization, indexing (e.g., B and B+ trees)
- Transactions and concurrency control.



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Section 11: Computer Networks

- Concept of layering: OSI and TCP/IP Protocol Stacks
- Basics of packet, circuit and virtual circuit switching
- Data link layer: framing, error detection, Medium Access Control, Ethernet bridging
- Routing protocols: shortest path, flooding, distance vector and link state routing
- Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT)
- Transport layer: flow control and congestion control, UDP, TCP, sockets
- Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

❖ Assistant Professor (Management):

Section 1: Research Methodology

General Introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.

Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
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- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.

Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research

Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H-index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

Section 2: General Management

- The Concept of Management-Functions of Management-Theories and concept of Management- Line authority staff authority
- The concept and significance of organizational behavior – Classical and Modern Theories of Organizational Structure – Organizational Design – personality – Perception – Values – Attitudes – Learning – Motivation-

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Understanding and Managing Group Behavior – Communication – Leadership – Managing change – Managing conflicts.

- The concept of Corporate Strategy; Components of Strategy Formulation- Competitor Analysis- Strategic Dimensions and Group Mapping-Industry Analysis-Strategies in Industry Evolution-Ethics and Management System-Ethical issues and Analysis in Management-Value based organizations- Personal framework for ethical choices.

Section 3: Production and Operation Research

- Role and Scope of Production Management- Facility Location;-Layout Planning and Analysis; Production Planning and Control – Production Process Analysis;- Demand Forecasting for Operations-Production Scheduling;-Work measurement-Time and Motion Study-Statistical Quality Control.-Role and Scope of Operations Research; Linear Programming- Sensitivity Analysis-Transportation Model-Inventory Control-Queuing Theory-Decision Theory-Markov Analysis-PERT / CPM.

Section 4: Marketing Management

- Marketing – Concept; Nature and Scope; Marketing myopia; Marketing mix; Different environments and their influences on marketing; Understanding the customer and the competition.
- Role and Relevance of Segmentation and Positioning -Static and Dynamic understanding of BCG Matrix and Product Life Cycle-Brands-4Ps and NPD-Test Marketing Concepts.
- Promotion mix –Advertising- Public Relations- Distribution channel-Wholesaling and Retailing. -Marketing Research -Consumer Behavior theories and models-Sales Function-Export Marketing – Indian and global context.



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- Nature and Scope of Financial Management-Financial System- Valuation Concepts – Risk and Return-CAPM and APT.
- Capital budgeting decisions-Capital Structure – Cost of capital-Dividend Policies Theories and Determinants-Working Capital Management -Cash management-Inventory management-Receivables management-Elements of Derivatives.
- Mergers and Acquisitions-International Financial Management.

Section 6: Human Resource Management

- Significance; Objectives; Functions; A diagnostic model; External and Internal environment; Forces and Influences; Organizing HRM function.
- Recruitment and Selection – Performance Appraisal System –Development of Personnel-Methods of Training & Development programs; Evaluation-Career Planning and Development-Compensation and Benefits – Job evaluation techniques-Employee Discipline –Grievance Management – Industrial Relations –Trade Unions –Collective Bargaining
- Industrial Democracy and Employee Participation –Employee Participation – Future of Human Resource Management.
- Significance; Objectives; Functions; A diagnostic model; External and Internal environment; Forces and Influences; Organizing HRM function.
- Recruitment and Selection – Performance Appraisal System –Development of Personnel-Methods of Training & Development programs; Evaluation-Career Planning and Development-Compensation and Benefits – Job evaluation techniques-Employee Discipline –Grievance Management –
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❖ Assistant Professor: School of Applied Sciences and Technology (SAST)

General Introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.

Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
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(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)

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Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H- index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

Section 2: Engineering Mathematics

Linear Algebra:

- Systems Of Linear Equations
- Matrix Algebra
- Eigen Values And Eigen Vectors

Calculus:

- Evaluation Of Definite And Indefinite Integrals, Application Of Definite Integral To Obtain Area And Volume
- Limit, Continuity, And Differentiability
- Gradient, Divergence And Curl, Vector Identities
- Taylor Series
- Functions Of Single Variable
- Mean Value Theorems, Local Maxima And Minima
- Partial Derivatives
- Total Derivative
- Line, Surface And Volume Integrals
- Directional Derivatives



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Ordinary Differential Equation (ODE):

- Initial And Boundary Value Problems
- Euler-cauchy Equations
- Higher Order Linear Equations With Constant Coefficients
- First Order (Linear And Nonlinear) Equations

Partial Differential Equation (PDE):

- First And Second Order One-dimensional Wave Equation And Two Dimensional Laplace Equation
- Fourier Series
- Separation Of Variables
- Solutions Of One-Dimensional Diffusion Equation

Probability and Statistics:

- Linear Regression
- Sampling Theorems
- Descriptive statistics – Mean, median, mode, and standard deviation
- Random Variables – Discrete and Continuous, Poisson and Normal Distribution
- Conditional Probability

Numerical Methods:

- Single And Multi-step Methods For First Order Differential Equations
- Newton's And Lagrange Polynomials
- Numerical Solutions Of Linear And Non-linear Algebraic Equation
- Error Analysis
- Integration By Trapezoidal And Simpson's Rule
- Numerical Differentiation

Section 3: General Biology

- Biochemistry: Biomolecules - structure and function
- Biological membranes - structure, membrane channels and pumps, molecular motors, action potential and transport processes;

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- Basic concepts and regulation of metabolism of carbohydrates, lipids, amino acids and nucleic acids;
- Photosynthesis, respiration and electron transport chain.
- Enzymes - Classification, catalytic and regulatory strategies;
- Enzyme kinetics - Michaelis- Menten equation;
- Enzyme inhibition-competitive, non-competitive and uncompetitive inhibition.
- Microbiology: Bacterial classification and diversity;
- Microbial Ecology - microbes in marine, freshwater and terrestrial ecosystems; Microbial interactions;
- Viruses - structure and classification;
- Methods in microbiology; Microbial growth and nutrition;
- Nitrogen fixation;
- Microbial diseases and host-pathogen interactions;
- Antibiotics and antimicrobial resistance.
- Immunology: Innate and adaptive immunity, humoral and cell mediated immunity;
- Antibody structure and function;
- Molecular basis of antibody diversity;
- T cell and B cell development;
- Antigen-antibody reaction;
- Complement;
- Primary and secondary lymphoid organs;
- Major histocompatibility complex (MHC);
- Antigen processing and presentation;
- Polyclonal and monoclonal antibody;
- Regulation of immune response;
- Immune tolerance; Hypersensitivity;
- Autoimmunity;
- Graft versus host reaction;
- Immunization and vaccines.



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Section 4: Genetics, Cellular and Molecular Biology

- Genetics and Evolutionary Biology: Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extra chromosomal inheritance; Microbial genetics - transformation, transduction and conjugation; Horizontal gene transfer and transposable elements; Chromosomal variation; Genetic disorders; Population genetics; Epigenetics; Selection and inheritance; Adaptive and neutral evolution; Genetic drift; Species and speciation.
- Cell Biology: Prokaryotic and eukaryotic cell structure; Cell cycle and cell growth control; Cell-cell communication; Cell signaling and signal transduction; Post-translational modifications; Protein trafficking; Cell death and autophagy; Extra-cellular matrix.
- Molecular Biology: Molecular structure of genes and chromosomes; Mutations and mutagenesis; Regulation of gene expression; Nucleic acid - replication, transcription, splicing, translation and the irregularity mechanisms; Non-coding and micro RNA; RNA interference; DNA damage and repair.

Section 5: Fundamentals of Biological Engineering

- Engineering principles applied to biological systems: Material and energy balances for reactive and non-reactive systems; Recycle, bypass and purge processes; Stoichiometry of growth and product formation; Degree of reduction, electron balance, theoretical oxygen demand.
- Classical thermodynamics and Bioenergetics: Laws of thermodynamics; Solution thermodynamics; Phase equilibria, reaction equilibria; Ligand binding; Membrane potential; Energetics of metabolic pathways, oxidation and reduction reactions.
- Transport Processes: Newtonian and non-Newtonian fluids, fluid flow - laminar and turbulent; Mixing in bioreactors, mixing time; Molecular diffusion and film theory; Oxygen transfer and uptake in bioreactor, $k_L a$

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and its measurement; Conductive and convective heat transfer, LMTD, overall heat transfer coefficient; Heat exchangers.

Section 6: Bioprocess Engineering and Process Biotechnology

- Bioreaction engineering: Rate law, zero and first order kinetics; Ideal reactors - batch, mixed flow and plug flow; Enzyme immobilization, diffusion effects - Thiele modulus, effectiveness factor, Damkohler number; Kinetics of cell growth, substrate utilization and product formation; Structured and unstructured models; Batch, fed-batch and continuous processes; Microbial and enzyme reactors; Optimization and scale up.
- Upstream and Downstream Processing: Media formulation and optimization; Sterilization of air and media; Filtration - membrane filtration, ultrafiltration; Centrifugation - high speed and ultra; Cell disruption; Principles of chromatography - ion exchange, gel filtration, Hydrophobic interaction, affinity, GC, HPLC and FPLC; Extraction, adsorption and drying. Instrumentation and Process Control: Pressure, temperature and flow measurement devices; Valves; First order and second order systems; Feedback and feed forward control; Types of controllers - proportional, derivative and integral control, tuning of controllers.

Section 7: Plant, Animal and Microbial Biotechnology

- Plants: Totipotency; Regeneration of plants; Plant growth regulators and elicitors; Tissue culture and cell suspension culture system - methodology, kinetics of growth and nutrient optimization; Production of secondary metabolites; Hairy root culture; Plant products of industrial importance; Artificial seeds; Somaclonal variation; Protoplast, protoplast fusion - somatic hybrid and cybrid;
- Transgenic plants - direct and indirect methods of gene transfer techniques; Selection marker and reporter gene; Plastid transformation.

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- Animals: Culture media composition and growth conditions; Animal cell and tissue preservation; Anchorage and non-anchorage dependent cell culture; Kinetics of cell growth; Micro & macro-carrier culture; Hybridoma technology; Stem cell technology; Animal cloning; Transgenic animals; Knock-out and knock-in animals.
- Microbes: Production of biomass and primary/secondary metabolites - Biofuels, bioplastics, industrial enzymes, antibiotics; Large scale production and purification of recombinant proteins and metabolites; Clinical-, food- and industrial- microbiology; Screening strategies for new products.

Section 8: Recombinant DNA technology and Other Tools in Biotechnology

- Recombinant DNA technology: Restriction and modification enzymes; Vectors - plasmids, bacteriophage and other viral vectors, cosmids, Ti plasmid, bacterial and yeast artificial chromosomes; Expression vectors; DNA and genomic DNA library; Gene isolation and cloning, strategies for production of recombinant proteins; Transposons and gene targeting;
- Molecular tools: Polymerase chain reaction; DNA/RNA labelling and sequencing; Southern and northern blotting; In-situ hybridization; DNA fingerprinting, RAPD, RFLP; Site-directed mutagenesis; Gene transfer technologies; CRISPR-Cas; Biosensing and biosensors.
- Analytical tools: Principles of microscopy - light, electron, fluorescent and confocal; Principles of spectroscopy - UV, visible, CD, IR, fluorescence, FT-IR, MS, NMR; Electrophoresis; Micro-arrays; Enzymatic assays; Immunoassays - ELISA, RIA, immunohistochemistry; immune blotting; Flow cytometry; Whole genome and ChIP sequencing.
- Computational tools: Bioinformatics resources and search tools; Sequence and structure databases; Sequence analysis - sequence file formats, scoring matrices, alignment, phylogeny; Genomics, proteomics, metabolomics; Gene prediction; Functional annotation; Secondary structure and 3D structure prediction; Knowledge discovery in biochemical databases; Metagenomics; Metabolic engineering and systems biology.

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❖ Assistant Professor (Civil):

Section 1: Research Methodology

General introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.

Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
- locating relevant information,
- use of library & electronic databases,
- preparation & presentation of literature review,
- research article reviews,
- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.

Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research



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Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
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Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

Section 2: Engineering Mathematics

Linear Algebra:

- Systems Of Linear Equations
- Matrix Algebra
- Eigen Values And Eigen Vectors

Calculus:

- Evaluation Of Definite And Indefinite Integrals,
- Application Of Definite Integral To Obtain Area And Volume
- Limit, Continuity, And Differentiability
- Gradient, Divergence And Curl, Vector Identities
- Taylor Series
- Functions Of Single Variable
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- Fourier Series
- Separation Of Variables
- Solutions Of One-Dimensional Diffusion Equation

Probability and Statistics:

- Linear Regression
- Sampling Theorems
- Descriptive statistics – Mean, median, mode, and standard deviation
- Random Variables – Discrete and Continuous, Poisson and Normal Distribution
- Conditional Probability

Numerical Methods:

- Single And Multi-step Methods For First Order Differential Equations
- Newton's And Lagrange Polynomials
- Numerical Solutions Of Linear And Non-linear Algebraic Equation
- Error Analysis
- Integration By Trapezoidal And Simpson's Rule
- Numerical Differentiation

Section 3: Structural Engineering

Engineering Mechanics:

- Free Vibrations Of Undamped SDOF System
- Internal Forces In Structures



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- System of forces, free-body diagrams, equilibrium equations
- Centre Of Mass
- Frictions And Its Applications

Solid Mechanics:

- Simple Bending Theory, Flexural And Shear Stresses, Shear Centre
- Simple Stress And Strain Relationships
- Buckling Of Column, Combined And Direct Bending Stresses
- Uniform Torsion, Transformation Of Stress
- Bending Moment And Shear Force In Statically Determinate Beams

Structural Analysis:

- Method Of Superposition
- Statically Determinate And Indeterminate Structures By Force/ Energy Methods
- Analysis of trusses, arches, beams, cables and frames
- Influence Lines
- Displacement Methods: Slope Deflection and Moment Distribution Methods
- Stiffness And Flexibility Methods Of Structural Analysis

Construction Materials and Management:

- Construction Materials: Structural Steel – Composition, Material Properties And Behaviour
- Construction Management: Types of construction projects
- Concrete – Constituents, Mix Design, Short-Term And Long-Term Properties
- Project Planning And Network Analysis – PERT and CPM
- Cost Estimation

Concrete Structures:

- Bond and Development Length
- Working Stress and Limit State Design Concepts
- Prestressed Concrete Beams



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(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)

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- Design Of Beams, Slabs, Columns

Steel Structures:

- Connections – Simple And Eccentric, Beam-Column Connections, Plate Girders and Trusses
- Design Of Tension and Compression Members, Beams and Beam-Columns, Column Bases
- Working Stress And Limit State Design Concepts
- Concept Of Plastic Analysis -Beams And Frames

Section 4: Geotechnical Engineering

Soil Mechanics:

- Principle Of Effective Stress And Quicksand Condition
- Shear Strength, Mohr's Circle, Effective And Total Shear Strength Parameters, Stress-Strain Characteristics Of Clays And Sand
- Unified and Indian Standard Soil Classification System
- Three-Phase System And Phase Relationships, Index Properties
- Compaction Of Soils
- One- Dimensional Consolidation, Time Rate Of Consolidation
- Permeability – One Dimensional Flow, Seepage Through Soils – Two – Dimensional Flow, Flow Nets, Uplift Pressure, Piping, Capillarity, Seepage Force
- Stress Paths

Foundation Engineering:

- Deep Foundations – Dynamic And Static Formulae, Axial Load Capacity Of Piles In Sands And Clays, Pile Load Test, Pile Under Lateral Loading, Pile Group Efficiency, Negative Skin Friction
- Sub-Surface Investigations – Drilling Bore Holes, Sampling, Plate Load Test, Standard Penetration And Cone Penetration Tests
- Combined Footing And Raft Foundation
- Contact Pressure

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- Pressure Bulbs, Shallow Foundations – Terzaghi's And Meyerhoff's Bearing Capacity Theories, Effect Of Water Table
- Stress Distribution In Soils – Boussinesq's Theory
- Earth Pressure Theories – Rankine And Coulomb; Stability Of Slopes – Finite And Infinite Slopes, Bishop's Method
- Settlement Analysis In Sands And Clays

Section 5: Water Resources Engineering

Fluid Mechanics:

- Concept Of Boundary Layer and Its Growth
- Continuity, Momentum And Energy Equations And Their Applications
- Flow In Pipes, Pipe Networks
- Properties Of Fluids, Fluid Statics
- Potential Flow, Laminar And Turbulent Flow
- Concept Of Lift And Drag

Hydraulics:

- Dimensional analysis and hydraulic similitude
- Forces on immersed bodies
- Channel Hydraulics – Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles
- Flow measurement in channels and pipes

Hydrology:

- Application of Darcy's Law
- Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface runoff models, ground water hydrology – steady state well hydraulics and aquifers

Irrigation:

- Cross Drainage Structures



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- Gravity Dams and Spillways
- Types Of Irrigation Systems and Methods
- Lined And Unlined Canals, Design Of Weirs On Permeable Foundation
- Crop Water Requirements – Duty, Delta, Evapotranspiration

Section 6: Environmental Engineering

Water and Waste Water Quality & Treatment:

- Basics of water quality standards – Physical, chemical and biological parameters
- Water Quality Index
- Drinking Water Treatment
- Sewerage System Design, Quantity Of Domestic Wastewater, Primary Treatment and Secondary Treatment
- Unit Processes And Operations
- Water Requirement
- Effluent Discharge Standards
- Sludge Disposal
- Reuse Of Treated Sewage For Different Applications
- Water Distribution System

Air Pollution:

- Types Of Pollutants, Their Sources And Impacts
- Air Quality Index And Limits
- Air Quality Standards
- Air Pollution Control

Municipal Solid Wastes:

- Engineered Systems For Solid Waste Management (Reuse/ Recycle, Energy Recovery, Treatment And Disposal)
- Characteristics, Generation, Collection and Transportation Of Solid Wastes

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Section 7: Transportation Engineering

Transportation Infrastructure:

- Geometric Design Of Railway Track – Speed and Cant
- Geometric Design Of Highways – Cross-Sectional Elements, Sight Distances, Horizontal And Vertical Alignments
- Taxiway and Exit Taxiway Design
- Concept Of Airport Runway Length, Calculations and Corrections

Highway Pavements:

- Design Factors For Flexible And Rigid Pavements
- Desirable Properties Of Bituminous Paving Mixes
- Highway Materials – Desirable Properties And Tests
- Design Of Flexible And Rigid Pavement Using IRC Codes

Traffic Engineering:

- Traffic Studies On Flow And Speed, Peak Hour Factor, Accident Study, Statistical Analysis Of Traffic Data
- Highway Capacity
- Traffic Signs
- Types Of Intersections
- Microscopic And Macroscopic Parameters Of Traffic Flow, Fundamental Relationships
- Signal Design By Webster's Method

Section 8: Geomatics Engineering

- Basics Of Remote Sensing And GIS
- Errors And Their Adjustment
- Principles Of Surveying
- Traversing And Triangulation Survey
- Total Station
- Photogrammetry And Remote Sensing – Scale, Flying Height
- Horizontal And Vertical Curves
- Distance And Angle Measurement – Leveling And Trigonometric Leveling

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- Maps – Scale, Coordinate System

❖ Assistant Professor (Mechanical):

Section 1: Research Methodology

General introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.

Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
- locating relevant information,
- use of library & electronic databases,
- preparation & presentation of literature review,
- research article reviews,
- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.

Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research

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Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H-index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

Section 2: Engineering Mathematics

Linear Algebra

- Systems Of Linear Equations
- Matrix Algebra
- Eigenvalues And Eigenvectors

Calculus

- Limit
- Functions Of A Single Variable
- Continuity and Differentiability
- Indeterminate Forms
- Mean Value Theorems
- Evaluation Of Definite And Improper Integrals
- Taylor Series (In One And Two Variables)
- Partial Derivatives
- Double And Triple Integrals
- Total Derivative
- Fourier Series
- Maxima and Minima



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- Gradient, Divergence and Curl
- Directional Derivatives
- Vector Identities
- Line, Surface and Volume Integrals
- Applications Of Gauss Theorem, Stokes, and Green's Theorems

Differential equations

- Initial and Boundary Value Problems
- Higher-Order Linear Differential Equations With Constant Coefficients
- First-Order Equations (Linear And Nonlinear)
- Euler-Cauchy Equation
- Laplace Transforms
- Solutions of heat, wave and Laplace's equations

Complex variables

- Taylor and
- Laurent Series
- Cauchy-Riemann Equations
- Analytic Functions
- Cauchy's Integral Theorem and Integral Formula

Probability and Statistics

- Definitions Of Probability, Sampling Theorems, Conditional Probability
- Median, Mean, Mode, and Random Variables
- Binomial
- Poisson and Normal Distributions

Numerical Methods

- Integration By Trapezoidal and Simpson's Rules
- Numerical Solutions Of Linear And Non-Linear Algebraic Equations
- Single and Multi-Step Methods For Differential Equations

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Section 3: Applied Mechanics and Design

Engineering Mechanics

- Friction And Its Applications Including Rolling Friction
- Free-Body Diagrams and Equilibrium
- Screw Jack
- Brakes
- Belt-Pulley
- Clutches
- Vehicles
- Wedge
- Trusses and Frames
- Virtual Work
- Impulse And Momentum (Linear and Angular) and Energy Formulations
- Kinematics And Dynamics Of Rigid Bodies in Plane Motion
- Lagrange's Equation

Mechanics of Materials

- Thin Cylinders
- Elastic Constants
- Stress and Strain
- Poisson's Ratio
- Mohr's Circle For Plane Stress And Plane Strain
- Bending and Shear Stresses
- Shear Force And Bending Moment Diagrams
- Deflection Of Beams
- Concept Of Shear Centre
- Euler's Theory Of Columns
- Torsion Of Circular Shafts
- Thermal Stresses
- Energy Methods
- Testing Of Materials With Universal Testing Machine
- Strain Gauges and Rosettes
- Testing Of Hardness and Impact Strength



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Theory of Machines

- Velocity and Acceleration Analysis Of Plane Mechanisms
- Dynamic Analysis Of Linkages
- Displacement
- Cams
- Gears and Gear Trains
- Flywheels And Governors
- Gyroscope
- Balancing Of Reciprocating and Rotating Masses

Vibrations

- Resonance
- Effect Of Damping
- Free And Forced Vibration Of Single Degree Of Freedom Systems
- Vibration Isolation
- Critical Speeds Of Shafts

Machine Design

- Failure Theories
- Design For Static and Dynamic Loading
- Principles Of The Design Of Machine Elements Such As Bolted, Riveted And Welded Joints
- Fatigue Strength and the S-N Diagram
- Gears
- Shafts
- Brakes and Clutches
- Rolling and Sliding Contact Bearings
- Springs

Section 4: Fluid Mechanics and Thermal Sciences

Fluid Mechanics

- Fluid Statics
- Fluid Properties



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- Stability Of Floating Bodies
- Forces On Submerged Bodies
- Control-Volume Analysis Of Mass, Momentum And Energy
- Differential Equations Of Continuity And Momentum
- Fluid Acceleration
- Dimensional Analysis
- Bernoulli's Equation
- Boundary-Layer
- Viscous Flow Of Incompressible Fluids
- Flow through Pipes
- Elementary Turbulent Flow
- Head Losses In Pipes, Bends and Fittings
- Basics Of Compressible Fluid Flow

Heat-Transfer

- One Dimensional Heat Conduction
- Modes Of Heat Transfer
- Heat Transfer Through Fins
- Resistance Concept and Electrical Analogy,
- Lumped Parameter System
- Unsteady Heat Conduction
- Thermal Boundary Layer
- Heisler's Charts
- Heat Transfer Correlations For Flow Over Flat Plates and through Pipes
- Dimensionless Parameters In Free And Forced Convective Heat Transfer
- Heat Exchanger Performance
- Effect Of Turbulence
- Radiative Heat Transfer
- LMTD and NTU methods
- Wien's Displacement Law
- Stefan- Boltzmann Law
- View Factors
- Black And Grey Surfaces
- Radiation Network Analysis



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Thermodynamics

- Properties Of Pure Substances
- Behaviour Of Ideal And Real Gases
- Zeroth And First Laws Of Thermodynamics
- Second Law Of Thermodynamics
- Availability And Irreversibility
- Thermodynamic Systems And Processes
- Thermodynamic Property Charts And Tables
- Calculation Of Work And Heat In Various Processes
- Thermodynamic Relations

Applications

- Power Engineering: Vapour And Gas Power Cycles, Air And Gas Compressors, Concepts Of Regeneration And Reheat
- I.C. Engines: Diesel and dual cycles, Air-standard Otto
- Refrigeration and air-conditioning: Basic Psychrometric Processes, Properties Of Moist Air, Vapour And Gas Refrigeration and Heat Pump Cycles, Psychrometric Chart
- Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines

Section 5: Materials, Manufacturing and Industrial Engineering

Engineering Materials

- Stress-Strain Diagrams For Engineering Materials
- Phase Diagrams
- Structure And Properties Of Engineering Materials
- Heat Treatment

Casting, Forming and Joining Processes

- Solidification And Cooling
- Riser And Gating Design
- Design Of Patterns, Molds And Cores



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ગુજરાત ટેકનોલોજીકલ યુનિવર્સિટી

(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)

Accredited with A+ Grade by NAAC

- Different Types Of Castings
- Fundamentals Of Hot And Cold Working Processes
- Plastic Deformation And Yield Criteria
- Principles Of Powder Metallurgy
- Load Estimation For Bulk (Forging, Extrusion, Rolling, Drawing) And Sheet (Shearing, Deep Drawing, Bending) Metal Forming Processes
- Principles Of Welding, Soldering, Brazing, and Adhesive Bonding

Machining and Machine Tool Operations

- Basic Machine Tools
- Mechanics Of Machining
- Single And Multi-Point Cutting Tools
- Tool Life And Wear
- Tool Geometry and Materials
- Economics Of Machining
- Principles Of Work Holding, Jigs And Fixtures
- Principles Of Non-Traditional Machining Processes
- Abrasive Machining Processes
- NC/CNC machines and CNC programming

Metrology and Inspection

- Interferometry
- Linear And Angular Measurements
- Limits, Fits And Tolerances
- Comparators
- Alignment and Testing Methods
- Form And Finish Measurement
- Concepts Of Coordinate-Measuring Machine (CMM)
- Tolerance Analysis In Manufacturing And Assembly

Computer Integrated Manufacturing

- Additive Manufacturing
- Basic concepts of CAD/CAM and their Integration Tools



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Production Planning and Control

- Materials Requirement Planning
- Aggregate Production Planning
- Forecasting Models
- Scheduling
- Lean Manufacturing

Inventory Control

- Safety Stock Inventory Control Systems
- Deterministic Models

Operations Research

- Simplex Method
- Linear Programming
- Transportation
- Assignment
- Simple Queuing Models
- Network Flow Models
- PERT and CPM

❖ Assistant Professor (Electrical):

Section 1: Research Methodology

General introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.



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Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
- locating relevant information,
- use of library & electronic databases,
- preparation & presentation of literature review,
- research article reviews,
- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.

Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research

Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H-index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs,

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Section 2: Engineering Mathematics

Linear Algebra

- Eigenvectors
- Systems of linear equations
- Matrix Algebra
- Eigenvalues

Calculus

- Theorems of Integral Calculus
- Mean Value Theorems
- Evaluation Of Definite And Improper Integrals
- Maxima And Minima
- Partial Derivatives
- Multiple Integrals
- Vector Identities
- Fourier Series
- Directional Derivatives
- Surface Integral
- Line Integral
- Volume Integral
- Stokes's Theorem
- Divergence Theorem
- Gauss's Theorem
- Green's Theorem

Differential equations

- Cauchy's Equation
- Higher-Order Linear Differential Equations With Constant Coefficients
- First-Order Equations (Linear And Nonlinear)
- Method Of Variation Of Parameters
- Partial Differential Equations
- Initial And Boundary Value Problems
- Euler's Equation



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- Method Of Separation Of Variables

Complex variables

- Solution Integrals
- Cauchy's Integral Theorem
- Analytic Functions
- Cauchy's Integral Formula
- Laurent Series
- Taylor Series
- Residue Theorem

Probability and Statistics

- Conditional Probability
- Sampling Theorems
- Mean
- Mode
- Median
- Standard Deviation
- Discrete and Continuous distributions
- Random Variables
- Poisson Distribution
- Binomial Distribution
- Normal Distribution
- Correlation Analysis
- Regression Analysis

Section 3: Electric circuits

Network elements

- Dependent Sources, R, L, C, M Elements
- Ideal Voltage And Current Sources
- Network solution methods: KVL, KCL, Node And Mesh Analysis
- Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer Theorem
- Resonance
- Transient Response of dc & ac networks
- Sinusoidal Steady-State Analysis



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- Balanced Three-Phase Circuits
- Two-Port Networks
- Complex Power And Power Factor in ac circuits
- Star-Delta Transformation

Section 4: Electromagnetic Fields

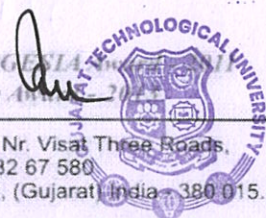
- Electric Field Intensity
- Coulomb's Law
- Electric Flux Density
- Divergence
- Gauss's Law
- Electric field and potential due to point, line, plane and spherical charge distributions
- Effect Of Dielectric Medium
- Biot-Savart's Law
- Capacitance Of Simple Configurations
- Ampere's Law
- Curl
- Self And Mutual Inductance Of Simple Configurations
- Lorentz Force
- Inductance
- Faraday's Law
- Magnetomotive Force
- Magnetic Circuits
- Reluctance

Section 5: Signals and Systems

- Average Value Calculation for any General Periodic Waveform
- Shifting and Scaling Properties
- Representation of Continuous and Discrete-Time Signals
- Linear Time-Invariant and Causal Systems
- Laplace Transform and Z Transform
- R.M.S. Value
- Sampling Theorem
- Fourier Series Representation of Continuous and Discrete-Time Periodic Signals
- Applications of Fourier Transform for Continuous and Discrete-Time Signals

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Section 6: Electrical Machines

- Single-phase transformer: Equivalent Circuit, Open Circuit And Short Circuit Tests, Phasor Diagram, Regulation And Efficiency
- Three-phase transformers: connections, vector groups, parallel operation
- Electromechanical Energy Conversion Principles
- Auto-Transformer
- DC machines: separately excited, series and shunt, motoring and generating
- mode of operation and their characteristics, speed control of dc motors
- Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control
- Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors
- Types Of Losses And Efficiency Calculations Of Electric Machines

Section 7: Power Systems

- Models And Performance Of Transmission Lines And Cables
- Basic Concepts Of Electrical Power Generation
- Ac And Dc Transmission Concepts
- Economic Load Dispatch (With And Without Considering Transmission Losses)
- Electric Field Distribution And Insulators
- Series And Shunt Compensation
- Distribution Systems
- Bus Admittance Matrix
- Per-Unit Quantities
- Gauss- Seidel And Newton-Raphson Load Flow Methods
- Power Factor Correction
- Voltage And Frequency Control
- Symmetrical Components
- Principles of Over-Current, Differential, Directional And Distance Protection
- Symmetrical and Unsymmetrical Fault Analysis
- Circuit Breakers
- System stability concepts
- Equal Area Criterion



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Section 8: Control Systems

- Feedback Principle
- Mathematical Modelling And Representation Of Systems
- Transfer Function
- Transient And Steady-State Analysis Of Linear Time-Invariant Systems
- Block Diagrams And Signal Flow Graphs
- Stability Analysis Using Routh-Hurwitz And Nyquist Criteria
- Root Loci
- Bode Plots
- Lag, Lead And Lead-Lag Compensators
- Solution Of State Equations Of LTI Systems
- P, PI And PID Controllers
- State-Space Model

Section 9: Electrical and Electronic Measurements

- Measurement Of Voltage, Current, Power, Energy And Power Factor
- Bridges And Potentiometers
- Instrument Transformers
- Oscilloscopes, Error Analysis
- Phase, Time and Frequency measurement
- Digital Voltmeters And Multimeters
- Time And Frequency Measurement

Section 10: Analog and Digital Electronics

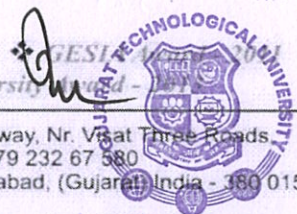
- Simple diode circuits: Clamping, Clipping, Rectifiers
- Amplifiers: Biasing, Equivalent Circuit and Frequency Response
- Oscillators And Feedback Amplifiers
- Operational amplifiers: characteristics and applications; single stage active filters
- Active Filters: Sallen Key, Butterworth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

Section 11: Power Electronics

- Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion

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- Buck, Boost And Buck-Boost Converters
- Single and Three-Phase Configuration Of Uncontrolled Rectifiers
- Bidirectional ac to dc Voltage Source Converters
- Voltage And Current Commutated Thyristor Based Converters
- Magnitude And Phase Of Line Current Harmonics For Uncontrolled and Thyristor-Based Converters
- Single-Phase And Three-Phase Voltage And Current Source Inverters
- Power Factor And Distortion Factor Of ac to dc Converters
- Sinusoidal Pulse Width Modulation

❖ Assistant Professor (School of Pharmacy):

Section 1:

Research Methodology

General introduction to Research

- History of Science & Technology: Importance of research,
- Role of research,
- Aims & objectives,
- research process,
- Phases of research.

Research problem Formulation

- Review of Research Literature: Purpose and use of literature review,
- locating relevant information,
- use of library & electronic databases,
- preparation & presentation of literature review,
- research article reviews,
- Theoretical models and frame work.
- Identification of gaps in research,
- formulation of research problem,
- Definition of research objectives.



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Research Design

- Qualitative Methods: Types of hypothesis and characterization
- Quantitative Methods: Statistical methods for testing and evaluation
- Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research

Research Publication & Presentation

- Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research.
- Quality indices of research publication: impact factor, immediacy factor, H-index and other citation indices.

Research Ethics and Morals

- Issues related to plagiarism,
- Collaborative models and ethics, acknowledgements.
- Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

Section 2:

- Physical Chemistry
- Physical Pharmacy
- Organic Chemistry
- Pharmaceutical Chemistry
- Pharmaceutics
- Pharmacology
- Pharmacognosy
- Pharmaceutical Analysis



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- Biotechnology
- Microbiology
- Pathophysiology
- Biopharmaceutics And Pharmacokinetics
- Clinical Pharmacy And Therapeutics
- Human Anatomy & Physiology
- Pharmaceutical Engineering
- Pharmaceutical Management
- Pharmaceutical Jurisprudence Dispensing & Hospital Pharmacy

Registrar



*Winners of : ICT Enabled University Award E-India - 2009 ❖ Manthan Award - 2009 ❖ GESIA Award - 2011
❖ Digital Learning WES - 2011 Award ❖ AIMS International Innovative University Award - 2013*

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