Syllabus of Ph.D. Entrance Examination

Session 2012-13

2012-13
## INDEX

### FACULTY OF ENGINEERING

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### FACULTY OF TECHNICAL EDUCATION

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### FACULTY OF ENGINEERING

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Note: There will be 100 objective type of questions minimum passing marks will be 40.
No negative marking.

COMPUTATIONAL METHODS FOR COMMUNICATION
Solution of linear simultaneous and transcendental equations. Eigen values problems.
Iterative method. Jacobi's method. and solution of communication problem. Analytical
method. separation of variables orthogonal functions, series expansion, some practical
applications of communication. Numerical integration, Euler's rule. Trapezoidal rule.
Simpson rule. Newton Cote's method, Newton - Raphson method and Gaussian Quadrature
method. Finite Element. method, solution of poisson and wave equations and other
communication problems. Basic MATLAB function and applications. Fuzzy Set theory and
application to communication problems. Fuzzy MATLAB tools OFT. FFT and MATLAB
tools for wavelet transform.

SATELLITE COMMUNICATION
Satellite Channel analysis, cross-links, Carrier to Noise ratios, Frequency reuse with spot
beams. Multiple beams Satellite front end, Front-end noise Noise temperature, Front end
filters. Satellite multiple access methods. FOMA, TOMA. COMA Systems. OS-COMA and
frequency hopped COMA, Satellite jamming. Code acquisition and tracking. Satellite
applications. Data Communication and VSAT network Mobile satellite services(GEO and
NONGEO)

ADVANCED DIGITAL COMMUNICATION
Digital PAM. binary PAM formats, line coding. bandlimited digital PAM systems. Nyquist
pulse shaping, equalization, synchronization techniques. bit and frame synchronization.
Coded pulse modulation. voice digitization rate (VDR) of PCM, DPCM. DM. ADM. CVSD.
log PCM, their performance: comparison, VDR reduction by speech coding. VOCODERS.

**OPTICAL COMMUNICATION**


Optical Amplifiers - EDFA, Photonic Switching.

Optical Networks - SONET/SDH. Optical Interfaces. Ring Topology, Star Architecture

**COMPUTER COMMUNICATION**

Protocol performance evaluation, protocol specification & verification, Routing and congestion in network layer, routing & congestion control algorithms Network layer in Internet and ATM networks. Network synchronization, traffic analysis, Network management in routing control. Connection management in transport layer. Protocols or transport layer Internet transport protocols like TCP, UDP etc. ATM protocols Data security & cryptography techniques, access management in application layer, World Wide Web, e-mail, concept or virtual terminals. Study or different computer networks.

DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS
Discrete Time signals - sequences, representation
Discrete Time Systems - linear, Time invariant, LTI System, properties, constant - coefficient difference equation.
Frequency Domain Representation of discrete time signals & systems
Discrete - Time Random Signals
Z Transform - properties, R.O.C, stability, Causality criterion
Inverse Z- Transform. Recursive and Non recursive systems, Realization of discrete time system
D.F. T - properties, linear and circular convolution
Discrete Cosine transform, relationship between OFT & OCT.
Application or MATLAB for design of digital filters
Effect of finite register length in filter design.
Advanced signal processing techniques and transforms: Multirate Signal processing - Down sampling/upsampling, Int. to discrete Hilbert transform, wavelet transform, Haar transform etc.Application or DSP to Speech Signal Processing.

INFORMATION THEORY AND CODING
Information theory: Marginal, joint and conditional entropy, information rate ,mutual information, channel capacity of various channels, Cascaded channels, repetition of signals Shannon's theorem, Shannon- Hartley theorem, BW-S/N ratio trade off, continuous channel,
negative entropy. Coding: Irreducibility, separability, coding efficiency, source encoding, Shannon-Fano code, Huffman code, Data compression, Channel encoding - minimum distance, error detection and correction, FEC and ARQ, block code, convolutional codes, cyclic codes, signal error correction, multiple error correction, Burst error correction, Cryptography, Encryption, Decryption.

MODERN TELEPHONE SWITCHING SYSTEMS
Electronic space Division switching :- Stored program control (SPC), switching matrices, multistage switching, enhance services photonic switching. Time Division switching :- Time division space, and time switching, multiplexed switching, combination switching, T-S, T-S, T-S, switching n-stage combination switching, PBX switching, PBX networking, digital PBX. Traffic Engg. :- Traffic load, Grade of service, ErJang's formulas, blocking modeling switching systems, Blocking model. Subscriber Loop, Dialing Systems :- Switching hierarchy & routing, Transmission plan, numbering plan, charging plan, signalling technique. Local Access Techniques :- Digital subscriber lines, DSL, ADSL etc, WLL, FIL.

MOBILE COMMUNICATION

DESIGN OF COMMUNICATION NETWORKS
Design considerations: Analog design trade offs - Bandwidth, performance, systems ~complexity. Digital design trade offs - performance, bandwidth. bps/Hz comparisons, digital

INTERNET AND INTRANET

DETECTION AND ESTIMATION THEORY
Stochastic signal, orthogonal representation of signals, random process, Markov process, correlation function, power spectral density. Tchebycheff inequality Detection in presence of noise, correlator, optimum filter, matched filter. Weighted probabilities and hypothesis testing, composite hypothesis, likelihood ratio detection, sequential detection. Principles of estimation, properties of estimator, Cramer - Rao Bound, Baye's maximum likelihood and least square estimation, parameter estimation, estimation of continuous waveforms, time invariant linear estimation

DIGITAL IMAGE PROCESSING
Introduction to Image Processing System:
Manipulation on Images:
Image Smoothing:
Neighbourhood averaging, Median filtering lowpass filters, average of multiple images,
Image sharpening by differentiation technique, High pass filtering.

Image Restoration:
Degradation models for continuous function, effect of diagonalization. On degradation.
Algebraic approach to restoration Interactive restoration, gray level interpolation.
Image Encoding & Segmentation:
Encoding: Mapping, Quantizer, Coder
Segmentation: Detection of discontinuation by point detection, line detection, edge
detection. Edge linking & boundary detection: Local analysis, Global by graph theoretic
techniques,
Thresholding: Definition, Global thresholding
Filtering: Median, Gradient. Simple Method of representation signatures, Boundary
Segments, Skeleton of region

MICROWAVE and MILIMETER WAVE COMMUNICATION

MICROWAVE COMMUNICATION
Microwave radio system: Transmitter & receivers block diagram, FM microwave repeater,
divestuly protection, microwave terminal station, repeater station I Microwave links: Block
design path characteristics, system pain, free space path, i SIN ratio. I Microwave digital
communication block diagram, regeneration repeater, digital modulation & demodulation at
microwave frequencies analog & digital multiplying, line codes. Local microwave
distribution system. Propagation of microwave: line of sight, duct propagation as super
refraction, Troposcatter links. beams. Satellite front end, Front-end noise. Noise temperature
Front end filters. Satellite multiple access methods, FDMA. TDMA, CDMA Systems, DS-
CDMA and frequency hopped CDMA, Satellite jamming, Code acquisition and tracking.
Satellite applications. Data Communication and VSAT network. Mobile satellite services
(GEO and NONGEO).

MICROWAVE MEASUREMENTS
Microwave power measurements Measurement of low, medium and high microwave powers.
Slotted line techniques for VSWR Measurement. Measurement of high VSWR using double
minima method. VSWR Measurement using reflectometer techniques. Impedance
Measurement. Measurement of scattering parameters using network analyzer. Frequency

**RADAR ENGINEERING**

Prediction of range performance, Minimum Detectable signal, Receiver Noise, Probability. Density function, signal to noise ratio, cross section of target, cross section fluctuation, pulse repetition freq and range ambiguities. CW and freq Modulated radar, MTI, Pulse Doppler radar. Tracking radar phased array radar, synthetic aperture radar, Air surveillance radar, millimeter wave, laser radars. Radar Transmitter power, Various transmitter tubes and their characteristics, modulators, Line type modulator, hard tube modulator solid state transmitter. Radar Antenna: Antenna parameters, Antenna Radiation pattern, Aperture distribution Pattern synthesis, effects of errors on radiation pattern, stabilization of antenna parabolic reflector antenna, Scanning feed reflector antenna, lens antenna, electronically steered phased array antenna Detection of Radar signal in Noise, detection criteria, matched filter receiver, correlation detection, detector characteristics, ECM (Electromagnetic Compatibility), ECCM (Electronic Counter- Counter measurement) CFAR (Constant False Alarm Rate) Receiver, Radar Signal design and corresponding receiver design, Millimeter wave radar

**CRYPTOGRAPHY AND DATA SECURITY**

Internet and Communication Protocol, A brief history of Internet OSI TCPIP, the need for tunnelling and encryption keys, Tunnelling, Internet Protocol security. Deterring Needs- The evaluation of security assessments, assessing needs in house, the management role, web access question. Containers network bulneralility detection, penetration testing internal security needs. Structured query language security and other specialties. Trends in Internet crime. Denial of service attack, tools, that works for and agmust the Network, IP Spoofing attacke the Telnet hole, Language vulnerabilities. Other-Java and Active X, Unix root control, Trojan Hares. Virtual private network, Fire walls and disaster recovery planning, Security tools. Different encryption & decryption algorithm concept of private & Public keys.

**COMPUTATIONAL METHOD FOR ELECTROMAGNETICS**


**OPTICAL COMMUNICATION**


**VLSI DESIGN**

statements. synthesis of VHDL code, synthesis examples, files & TEXTIO. Designing with programmable logic devices ROM, PLA'S. PAL'S. PLD'S.. designing with programmable gate arrays. FPGAS. CPLD'S (Complex programmable logic devices).

Floating point arithmetic - Multiplication & other operation. Hardware testing and Design - Combinational logic testing. sequential logic testing. scan testing. boundary scan. built in self test Design Examples & Case studies - USART design. micro controller design, design of- micro controller CPU . filter design etc.

MICROWAVE COMMUNICATION
Microwave radio system: Transmitter & receivers block diagram. FM microwave repeater. diversity protection switching microwave terminal station, repeater station Microwave links: Block diagram. path characteristics, system gain, free space path loss, SIN ratio. Microwave sources: Vacuum tube & solid state devices. microwave modulators microwave amplifiers, transmitting & receiving antennas, microwave detectors. Microwave components: waveguide, joints. Tees. frequency meters, attenuators, ferrite devices. direction couplers etc.

MOBILE COMMUNICATIONS

INTERNET & INTRANET
Development of Internet, Designing principles of Internet, Internetworking architecture Internetworking issues. Network layer structure, Internet protocol standards, Internet IP. Ipv6 The ISO Internet protocol, ISO routing protocols. The world wide web: Web fundamentals,

DIGITAL SIGNAL PROCESSING

Computation of D.F. T: FFT Decimation in Time & Decimation in Frequency.


Hamming, kaiser window filter design method, relationship of Kaiser to other windows. Application of MATLAB for Design of Digital Filters, Effect of Finite Register Length in Filter Design.

DIGITAL COMMUNICATION AND CODING

MICROWAVE THEORY AND TECHNIQUES
Characteristics features of microwaves, applications of microwaves, Maxwell's equations, plane wave in dielectric and conducting media, waveguide analysis, VSWR, and impedance, waveguide discontinuities. Microwave Network Representations: S-matrix representations, matrices of some typical microwave components such as attenuator, matched load, power divider, directional coupler, magic tee etc. Ferrite devices, wave propagation in ferrite medium, faraday rotation, isolator, circulator etc.

ANTENNA ENGINEERING

MICROWAVE & MILLIMETER WAVE INTEGRATED CIRCUITS
Analysis of strip lines, microstrip lines, other microstrip like planer transmission lines etc. analysis of slot lines and coplanar guides quasi- static approach and fullwave discontinuities. Microstrip line charectcuization of bends & junction. Lumped element in MICs; Technology of hybrid MICs. Design of MIC components- transitions, couplers, filters, Power dividers, oscillators, modulators, phase shifters & amplifiers Analysis of basic transmission lines for millimetre wave frequencies-Integrated fin line, insulated image guide, trapped guide, non-radiative guide, groove guide. Transitions, bends and discontinuities at MM waves Measurement techniques Design of millimeter wave components, couplers, power dividers, filters, oscillators, switches, phase shifters and amplifiers.

MICROWAVE DEVICES
Microwave diodes and circuits, varactor diodes, millimeter wave varactor diodes. Detailed calculations of varactor characteristics, Manley Rowe power relations, Varactor applications in a Parametric amplifier and up and down convener. P-I-N diodes. Use of P-I-N diode as a microwave switch. limiters and phase shifters. Schottky barrier devices: Detector and mixer diode circuits. Tunnel diodes. Avalanche transit time devices, bulk Gallium Arsenide devices. Microwave linear beam tubes Klystrons, Reflex Klystron, TWTs Crossed feed tubes magnetrons backward and forward cross feed amplifiers and oscillators.
BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS FOR Ph.D ENTRANCE TEST
SUBJECT - COMPUTER SCIENCE AND ENGINEERING

Max. Marks : 100

Note : There will be 100 objective type of questions minimum passing marks will be 40.
No negative marking.

ADVANCED DATA STRUCTURE AND ALGORITHM –
Introduction to basic data structure, Randomized algorithm, a min-cut algorithm, Las Vegas
and Monte Carlo, Binary Planner Partition, a probabilistic recurrence, computational model
& complexity classes. The fundamental Data-structure problem. Random treaps, Mulmuley
games, analysis of treaps, skiplists. Analyzing random skip lists, Hash families, strongly
universal hash families, Hashing with O(1) search time, Nearly perfect hash families, achieving
bounded query time storage management, markov chains. Graph connectivity, Random walks on
d graph, on line paging algorithm, adversary models. Genetic algorithms & its application.
Parallel & distributed algorithms.

DISTRIBUTED COMPUTING –
Introduction to the distributed systems, Pros and Cons of distributed Processing, distributed
databases, distributed Resources, distributed Networks management. Design Considerations;
Communication line loading, Partitioning and Allocation, Network Data Base design
Consideration, data Communications distributed Networks-Uylessd, Black. Fundamental of
Network and distributed Operating System, Remote Service Robustness Design issues,
distributed file system, Naming and Transparency, Remote file Access, File replication,
Distributed coordination; Event ordering, Mutual exclusion, Atomicity, concurrency control,
Deadlock handling, various algorithms. Distributed shared Memory; Architecture, Design &
Implementation issues, Granularity, structure, replacement strategy. Thrashing
synchronization: clock synchronization, Event Ordering, Mutual Exclusion Process
COMPUTATIONAL MATHEMATICS –
Real Analysis: Functional of several variables, continuity; partial derivatives; Taylor’s theorem, applications to stationary value problems; Language multipliers; directional derivatives, the operators div, curl, grad; Jacobians, Jacobian theorems; double, triple, line and surface integral; theorems of Gauss and Stokes: applications. Algebra: n-D-vectors, vector spaces, linear dependence. Determinants and matrices of order n-Rank, eigen values, quadric forms, applications. Barkatullah University Institute of Technology, B.U., Bhopal Basic MATLAB function and applications. Fuzzy Set Theory and application to communication problems, Fuzzy MATLAB tools. DFT, FFT and MATLAB tools for wavelet transform.

OBJECT ORIENTED MODELING & DESIGN
Overview of Object Oriented concepts:

NETWORK SECURITY AND CRYPTOGRAPHY
Basic concepts: Information Systems reviewed; Batch Systems; On-line Systems; Wide Area Networks (WAN), Metropolitan Area Networks (MAN), Local Area Networks (LANs: applications types). Security defined; Roles. Models: Characteristics of security models, Reference monitor concept, Formal Security Models – Harrison-Piazzo model, Ulman Model, Bell La-Fadila Model, Object-oriented Model, Clares Willson, Chines Wall Model etc.

**ARTIFICIAL INTELLIGENCE & FUZZY LOGIC**

Game Playing: Overview, Minimax search procedure, adding Alfa-Beta cutoffs, Additional Refinements, Iterative Deepening, References on specific Games

Planning: Overview. An Example Domain components of a planning system Goal Stack planning, nonlinear planning using constraint posting hierarchical planning, reactivesystems

Other Planning Techniques Understanding: what is understanding? What makes understanding hard? Understanding as constraint satisfaction

Natural Language Processing: Introduction, Syntactic Processing, semantic analysis, Discourse and pragmatic processing


Common Sense: Qualitative Physics, Common Sense, ontologies, memory organization, case based reasoning.


**COMPUTER AIDED DESIGN**

Introduction:
The nature and role of design, the nature of CAD, type of CAD system, concept of integrated CAD benefits of CAD, the price of CAD, system, origin of CAD, applications of CAD.

**Computer aided design system hardware:**

Introduction graphics input devices as light pens, analog devices, keyboard devices etc. graphics display devices as CRT displays, plasma panel display etc. graphics output devices as pen plotters, electrostatic plotters other, graphics output devices and modes of their operation, CAD system configuration.
Computer aided design system software:
Introduction operating system, the overlay graphics systems, graphics database handling and structure, operating features, symbols, macros, editing facility, data selection, graphics transformation plotting, graphics standards as GKS and CORE, GKS 3-D and PHIGS, IGIS others graphics standards. Transformation systems: Display, windowing and clipping, two dimensional transformation, three dimensional transformation, linear transformation, display files of three dimensional data, visualization of three dimensional data, eye co-ordinator system, joystick function, distortion. Use of micro computers in CAD system: Microcomputer systems, CAD system based on microcomputers, choice of microcomputer system by considering microprocessor, primary memory, backup storage, communication system, software for CAD system. Computer aided design of filters, printed & integrated circuits.

ADVANCED COMPUTER ARCHITECTURE

ARTIFICIAL NEURAL NETWORK
Ann Definition, Taxonomy of neural net classifiers for fixed patterns, Mc-Culloch & Pitts Model, structure and working of human brain & comparison with basic ANN model, single layer network. Perceptron training algorithm, linear separability, Hebb’s learning rule, widrow & Holf’s learning rule / Delta rule, ADALINE, MADALINE, Comparison of ANN with human brain and AI characteristics and application of ANN.

Multilayer perception, problem with linear activation function, different activation functions like sigmoidal/squashing function, linear threshold function, hyperbolic tangent and Guassian function. Rumelbart’s error back propogation algorithm (EBPA) with proof, momentum, limitations, characteristics and Application of EBPA, case study: NETTALK, two dimensional pattern recognition etc. Unit III
Fast training of MLP: EBP using direct solution methods (EBPVD), DR symmetric Gaussian Elimination Method (DRSGE), Random MBD (Minimum Bit Distance) Gram-Schmidt methods (RMGS), case study: Function approximations, Pattern recognition and vowel recognition. Counter Propagation Network: Network Structure, functioning in Normal & Training mode, characteristics of CPN.


DATA CENTRE MANAGEMENT

FAULT TOLERANT & REAL TIME SYSTEM
Fault detection and diagnosis, System Reliability and methods of improving it. Theory of Redundant System design. Fault tolerant circuit design. Fault tolerant architectures. Components of a real time system. Real time operating system, tasks and task scheduling, task synchronization and data transfer factors in selecting a real time operating system. The design specifications, the development environment, ASM Diagram and Data flow analysis. Response time specification.
ADVANCED SOFTWARE ENGINEERING
Introduction, Software life–cycle models, software requirements specification, formal requirement, specification-axiomatic and algebraic specification, Function–oriented software design, object oriented design, UML, coding and unit testing, data design architectural styles & pattern architectural design, assessment of alternate architectural design, mapping data flow into software architecture, Modeling component level design, SW reuse, Software quality & testing—SEI CMM and ISO-9001, software reliability and fault–tolerance, computer aided software engg.(CASE), Web Engg., Formal Methods, clean room software Engg., component based development, software reengg.

ADVANCED DBMS –

COMPUTER GRAPHICS AND ANIMATION –
Transformation and Projections, Bresenham’s line drawing algorithm, Homogenous coordinate system(2D & 3D), transformation matrices for translation, scaling, rotation, shear rotation about an arbitrary axis(3D), parallel projection, perspective projection, clipping, Sutherland cohen algorithm, cyrusbeck algorithm curves & surfaces, Development of Bresenham’s algorithm to draw octant of a circle, Bezier curves, B spline curves, solid modeling, Hidden surface removal, shading, introduction to multimedia, Non Temporal media, Audio, Video, Graphics animation.

PARALLEL COMPUTING
Parallel processing, Parallel computer structure, designing of parallel algorithms, analyzing algorithms, general principles of parallel computing, Parallel sorting algorithms, Batcher’s bitonic sort. Bitonic sort using the perfect shuffle, parallel bubble sort, add-even transport sort, Tree sort, quick sort, sorting on the CRCW, CRFW, EREW models, searching a sorted sequence, CREW,CRCW,&EREW searching, searching on arandom sequence EREW,ERCW,CREW & CRCW searching on the tree, mesh .anetwork for
merging, merging on the CRFW, ERFW models, computing Fourier Transforms, Computing the DFT in parallel, a parallel FFT algorithm.

**EMBEDDED SYSTEM**

Hardware fundamentals: Gates, timing diagram, memory, microprocessor, buses, DMA. Interrupts: Microprocessor architecture, interrupts basics, Interrupt latency, shared data problem. System partitioning, building the architectural model, Input and output processing, Hardware and software portioning, timing requirement. Microprocessor selection, Microprocessor versus micro-control analysis CISC versus RISC study of major embedded Microprocessor architecture memory system design. system optimization architecture for embedded software: round robin, found robin with interrupts. Function-queue scheduling and real time operating system. Real time operating system: tasks and task states. Task and data. Semaphores and shared data operating system service: inter task communication, timer service. Memory management, events and interaction between interrupt routines and real time operating system. software selection issues. Selection an RTOS, RTOS performance metric, RTOS scalability and tool support compiler selection

Embedded system design using real time operating system: encapsulating semaphores and queues, hard real time scheduling consideration saving memory space. Development tools and debugging: hosh and target machines. Linker/location, Target system tasing. Instruction set, Asset macro. Establishing a software development environment C runtime environment embedded debuggers Cross-development methods embedded file formats, readers creating object files, the build process loading software on to remote targets.

**WEB TECHNOLOGY & E-BUSINESS**

NATURAL LANGUAGE PROCESSING
Introduction; Goals of natural language processing and computational Linguistics. Finite state automata and transducers, Morphology. Parsing: Context free Grammers, Generalized phrase structure Grammer, Earley Parsing
Algorithm. Transformational grammer, computational models and knowledge representations, semantics; Interpretation, time, tense, lexical semantics , machine translations, Natural Language Interfaces, Natural Language Generators.

ROBOTICS AND COMPUTER VISION
Basic components of robotics system, Kinematics and manipulators, selection of Coordinate frames, Homogeneous transformation, solution of kinematics equations, Lagrangian equations and manipulator dynamics,Control design, Languages for Robots and Applications. 3D-vision, Prespective vision, CCD camera study, real time processing, Segmentation using Genetic Algorithm: Adaptive algorithm for indore scene, and outdoor scene. Interpretation of pictures, shape recognition, dynamics scan analysis. Introduction to AGV, clustering and non supervised learning method.

ADVANCED COMMUNICATION
Digital PAM, binary PAM formats, line coding, band limited digital PAM systems.

SOFTWARE PROJECT MANAGEMENT
Managing software projects Software product, process and project management CMM, KPAs. For project management, software process Improvement, resources management, team work
and structure, training, project metric, documentation, project management. For conventional
and object oriented software projects, software project, knowledge based management Project
planning. Project planning infrastructure, process planning feasibility analysis cost and efforts
estimation, models and technique, risk analysis and RAMM plan, project scheduling and
tracking plan .SQA and quality planning ,SCM activities and plan , project management plan.

PROJECT EXECUTION AND CLOSURE
Data collection, measurement, reviews, monitoring and control , status reporting ,process
input and output synchronization, deliverables , milestone recording and their analysis ,
defect analysis and prevention , audits Project closure analysis and reporting. Project
management for special classes of software project - Using CASE tools, CASE, re-
engineering ,reverse ,forward engineering Client/server software engineering, web
engineering , outsourcing , software project management standards

BIOINFORMATICS
Bioinformatics – an overview
Introduction, objectives of bioinformatics, kind of data used, information molecules, basic
structures of nucleic acids, DNA ,RNA, DNA sequencing and polymerise chain
reaction(PCR), proteins structure, functions, protein folding and characterization. Biological
Databases Introduction, types of databases, nucleotide and protein sequence database,major
bioinformatics databases, Introduction to biostatics, data integration,data analysis. Operating
systems (LINUX, UNIX), HTML, XML, CML,BSML, etc,.Sequence analysisModels for
sequence analysis, methods for alignment (Dot matrices),methods for optimal alignment (gap
penalties and storing matrices), tools forsequence alignment – Fasts, BLAST, PSI –blast,
Multiple Sequence Alignment(MSA)– tool and applications. Phylogenetic analysis
Phylogenetic trees, distance matrix (MD) and character based methodas,gene prediction tools
, gene mapping, DNA sequencing, algorithms foralignment of sequencing fragments, DNA
micro arrays.
ProteomicsProteomics analysis, tools for proteome analysis, different structural proteins,
protein classification, methods of structure prediction (known folds and unknown folds),
protein function prediction, metabolic pathways , gene networks their properties and analysis.
DATA MINING AND ITS APPLICATIONS

1 Introduction:
Data mining: Definitions, KDD v/s Data Mining, DBMS v/s Data Mining. DM techniques, Mining problems. Issues and Challenges in DM, DM Application areas.

Association Rules & Clustering Techniques:
Introduction, Various association algorithms like Apriori, Partition, Pineer search etc., Generalized association rules. Clustering paradigms: Partitioning algorithms like KMedoid, CLARA, CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; categorical clustering algorithms, STIRR, ROCK, CACTUS.

Other DM techniques and Web Mining:
Image and Video representation techniques, feature extraction, motion analysis, content based image and video retrieval, clustering and association paradigm, knowledge discovery.

WIRELESS & MOBILE COMPUTING
Application Issue: Wireless Application control Dynamic DNS, File system synchronization protocol, context aware application security, analysis of existing wireless network.
PATTERN RECOGNITION
Introduction to pattern recognition, types of images, regular pattern, irregular pattern, fuzzy methods. Statistical pattern recognition feature selection, syntactic pattern recognition, Clustering and non supervised learning methods. Combine detection method, edge detection, edge linking, gradient, laplacian, line detection, motion based, point detection snake method. Boundary description, detection, matching, merging, segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.
Explanation of how fuzzy approach can be applied to pattern recognition, classificatory analysis preprocessing, feature detection and primitive extraction, adaptive classification of fuzzy grammar. Algorithms of pattern recognition, neural network fundamentals, approach for pattern recognition.

HUMAN COMPUTER INTERACTION
Interaction between computation and the physical world. Input and output devices in their various forms – devices such as keyboards and printer, robotic sensors and effectors. Interaction between computation and biological world – Sensor for biological substances and process and effectors that can intervene in them. Interaction between computation and people – traditional discipline of human computer interaction, authorization process that entitle people to access computational resources. Computer to Computer Interaction – Networking, Parallel / Distributed Computing / Grid

INFORMATION ARCHITECTURE & SECURITY

ADAPTIVE COMPUTING
DISTRIBUTED COMPUTING –

COMPUTATIONAL MATHEMATICS
Real Analysis: Functional of several variables, continuity; partial derivatives; Taylor’s Derivatives, the operators div, curl, grad; Jacobians, Jacobian theorems; double, triple, line and surface integral; theorems of Gauss and Stokes: applications. Algebra: n-Dvectors, vector spaces, linear dependence. Determinants and matrices of order n-Rank, eigen values, quadric forms, applications. Basic MATLAB function and applications. Fuzy Set Theory and application to communication problems. MATLAB tools for wavelet transform. Propositional logic, predicate logic, conjunction, Disjunction, Tautology.

OBJECT ORIENTED MODELING & DESIGN
Overview of Object Oriented concepts:
Need for Object Oriented Programming, characterization of Object oriented languages Object Oriented Design: Objects structure concepts, methodology for object oriented
design(Booch, & chen & chen), Design modelling, system design life cycle Object oriented programming: an overview of C++ programming, loops and decisions, structures and functions, objects and classes, array and pointers, Inheritance, virtual functions, files and stream.

Object oriented data bases: relational VS object oriented data bases, the architecture of OO databases, query languages for OO databases, Gemstone, O2, Orion.

Distributed Object Oriented Systems: object management group, CORDA.

NETWORK SECURITY AND CRYPTOGRAPHY

Basic concepts: Information Systems reviewed; Batch Systems; On-line Systems; Wide Area Networks (WAN), Metropolitan Area Networks (MAN), Local Area Networks (LANs: applications types).


ADVANCED COMPUTER ARCHITECTURE-


NEURAL NETWORK

Kohonen self-organizing feature map resemblance with human brain, feature map algorithm-how alpha and d changes with time, examples and properties. Adaptive Barkatullah University Institute of Technology, B.U., Bhopal

Resonance Theory(ART): Architecture, classification, implementation & training.

Optical neural network, Cognitron and Neocognitron.

ADVANCED SOFTWARE ENGINEERING-

Introduction ,Software life –cycle models, software requirements specification, formal requirement, specification-axiomatic and algebraic specification, Function –oriented software design ,object oriented design, UML, coding and unit testing, data design architectural styles & pattern architectural design ,assessment of alternate ,architectural design ,mapping data flow into software architecture Modeling component level design, SIW reuse, Software quality & testing—SEI CMM and ISO-9001,software reliability and fault –tolerance, computer aided software engg.(CASE), Web
Engg., Formal Methods , clean room software Engg, component based development, software re engg.

ADVANCED DBMS

COMPUTER GRAPHICS AND ANIMATION
Transformation and Projections. Bresenham’s line drawing algorithm, Homogenous coordinate system(2D & 3D), transformation matrices for translation, scaling, rotation,shear rotation about an arbitrary axis(3D), parallel projection, perspective projection, clipping. Sutherland cohen algorithm, cyrusbeck algorithm curves & surfaces, Development of Bresenham’s algorithm to draw octant of a circle, Bezier curves, Bspline curves, solid modeling, Hidden surface removal, shading, introduction to multimedia, Non Temporal media, Audio, Video, Graphics animation..

PARALLEL COMPUTING
Parallel processing, Parallel computer structure, designing of parallel algorithms, analyzing algorithms, general principles of parallel computing, Parallel sorting algorithms, Batcher’s bitonic sort. Bitonic sort using the perfect shuffle, parallel bubble sort, odd-even transport sort, Tree sort, quick sort, sorting on the CRCW, CRFW, EREW models, searching a sorted sequence, CREW,CRCW,&EREW searching, searching on a random sequence EREW,ERCW,CREW & CRCW searching on the tree, mesh ,a network for merging ,merging on the CRFW,ERFW models, computing Fourier Transforms, Computing the DFT in parallel, a parallel FFT algorithm.

COMPUTER AIDED SIMULATION & MODELING.
System & models: The concept of a system, system environment, stochastic activities, continuous and discreet system, system modeling, type of models, stastic physical models, dynamic physical models, stastic mathematical models, dynamic, mathematical models,
principals used in muddling, simulation of a pare persuit problem simulation of an inventory problem.

Simulation of continuous system:-
Continuous system models, differential equations, analog computers, analog methods, hybrid computers, digital analog simulations continuous system simulation languages, CSMP III hybrid simulation, feedback system, simulation of an interactive system, real time simulation.
Discrete system simulation:-
Probability concepts in simulation, random number generations and their testing stochastic variable generation, fixed time - step vs. event-to event model.
Simulation of queuing systems :
Arrival pattern, poisson arrival pattern, the exponential distribution, the hyperexponential distribution, service times, simulation of a single-server queue, the normal distribution, measures of queues.

GEOGRAPHICAL INFORMATION SYSTEMS
Principle of GIS, Data Acquisition, Spatial Data Bases, data structures and algorithms for GIS, spatial data, manipulation and analysis, query processor, visualization ,spatial decision support system, use of a typical GIS package. GIS system architecture, GIS design and implementation, application

EMBEDDED SYSTEM-
Hardware fundamentals:- Gates, timing diagram, memory, microprocessor, buses, DMA. Interrupts:- Microprocessor architecture, interrupts basics, Interrupt latency, shared data problem. System partitioning, building the architectural model, Input and output processing, Hardware and software portioning, timing requirement. Microprocessor selection, Microprocessor versus micro-control analysis CISC versus RISC study of major embedded Microprocessor architecture memory system design . system optimization architecture for embedded software:- round robin, found robin with interrupts. Function-queuescheduling and real time operating system. Real time operating system:- tasks and task states. Task and data. Semaphores and shared data operating system service:- inter task communication . timer service. Memory management . events and interaction between interrupt routines and real time operating system . software selection issues. Selection an RTOS. RTOS performance metrice . RTOS scalability and tool support compiler selection Embedded system design using real time operating system : encapsulating semaphores and queues.hard real time scheduling consideration saving memory space. Development tools and debugging :-hosh and
target machines. Linker/location. Target system testing, Instruction set. Asset macro. Establishing a software development environment C runtime environment embedded debuggers Cross- development methods embedded file formats. readers creating object files-the build process loading software

**E-BUSINESS: CONCEPTS, TOOLS & APPLICATION**


**ROBOTICS AND COMPUTER VISION**

Basic components of robotics system, Kinematics and manipulators, selection of Coordinate frames, Homogeneous transformation, solution of kinematics equations, Lagrangian equations and manipulator dynamics, Control design, Languages for Robots and Applications. 3D-vision, Prespective vision, CCD camera study, real time processing, Segmentation using Genetic Algorithm: Adaptive algorithm for indore scene, and outdoor scene. Interpretation of pictures, shape recognition, dynamics scene analtsis. Introduction to AGV, clustering and non supervised learning method.

**ADVANCED COMMUNICATION**

code. and Walsh's code. ISDN & Value added communication system simulation & Analysis using MATLAB.

SOFTWARE PROJECT MANAGEMENT –
Managing software projects Software product, process and project management CMM, KPAs
For project management, software process Improvement, resources management, team work and structure, training, project metric, documentation, project management. For conventional and object oriented software projects, software project, knowledgebased management
Project planning Project planning infrastructure, process planning feasibility analysis cost and efforts estimation, models and technique, risk analysis and RAMM plan, project scheduling and tracking plan. SQA and quality planning, SCM activities and plan, project management plan.

PROJECT EXECUTION AND CLOSURE Data collection, measurement, reviews, monitoring and control, status reporting, process input and output synchronization, deliverables, milestone recording and their analysis, defect analysis and prevention, audits. Project closure analysis and reporting.
Project management for special classes of software project - Using CASE tools, CASE, re-engineering, reverse, forward engineering Client/server software engineering, web engineering, outsourcing, software project management standards

DATA MINING AND ITS APPLICATIONS
Introduction:
Image and Video: A Case study. Image and Video representation techniques, feature extraction, motion analysis, content based image and video retrieval, clustering and association paradigm, knowledge discovery.

**WIRELESS & MOBILE COMPUTING**

Introduction to wireless, cellular, Digital, PCs mobile radio, speech coding for wireless system and application PCM, DPCM, DM, Vocoder & linear Predictive coding. Performance comparison. Media access control, Telecom system satellite system, broadcast system.


Computer Networks and Web Technology -

Introduction, history and development of computer networks, networks topologies.

Physical Layer: theoretical basis, transmission media, analog transmission, digital transmission, switching.


Introduction to X.25, ISO protocols. Today the Internet is being used for myriad of applications - electronic publishing, electronic commerce, distance education, collaborative working, etc. This course intends to investigate the underlying principles and practices that support these applications. Introduction to computer networks; Content preparation - HTML, DHTML, VRML, SGML, XML and other markup schemes; Images - compression, formats; Audio - compression, formats; Content Delivery - protocols - HTTP and variants, Internet servers, proxy servers; Search engines; Data on the web; Content Display - browsers, plugins, helper applications; Interactivity -Java, Active-X; Component technologies, JavaBeans, CORBA; Security, Electronic payment systems, Firewalls, Encryption, Watermarks; Performance, Benchmarking the Web.
Software Architecture & Design

Course Contents:
Complex software systems require abstraction and analysis at an architectural level of abstraction. In this course we study, typical software system structures (architectural styles), techniques for designing and implementing these structures, models for characterizing and reasoning about architectures, and tools architectural modelling. Role of architecture in Software engineering; Enterprise Architectures, Zachman's Framework; Architectural Styles, Design Patterns; Architecture Description Languages; Product-line architectures; Component based development

E-GOVERNANCE

IPR & Cyber Laws:

UNIX INTERVALS AND SHELL PROGRAMMING
Introduction to the kernel: Architecture of the Unix, the buffer cache. Internal representation of files:-inode, accessing blocks, releasing blocks, structure of regular files, conversion of a path name to an inode, inode assignment to a new file, allocation of disk-block. System calls for the file systems: OPEN, READ,WRITE,CLOSE,PIPES : the pipe system call, opening a named pipes, reading and writing pipes,closing pipes DUP,Mounting and Un-Mounting file system, LINK, UNLINK. System call for TIME and CLOCK.
The structure of processes : process states and transitions, layout of system emory, the context of a process, saving the context of the process, manipulation of the process address space. Process Control : process creation, signals, process termination, awaiting process
termination, the user-id of a process, changing the size of the process, the system BOOT and
INIT process.


HUMAN COMPUTER INTERACTION
Interaction between computation and the physical world. Input and output devices in their various forms – devices such as keyboards and printer, robotic sensors and effectors. Interaction between computation and biological world – Sensor for biological substances and process and effectors that can intervene in them. Interaction between computation and people – traditional discipline of human computer interaction, authorization process that entitle people to access computational resources. Computer to Computer Interaction – Networking, Parallel / Distributed Computing/ Grid Computing / Utility Computing.

ADAPTIVE COMPUTING –
BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS FOR Ph.D ENTRANCE TEST
SUBJECT – MECHANICAL ENGINEERING

Max. Marks : 100

Note: There will be 100 objective type of questions minimum passing marks will be 40. No negative marking.

1. Linear Algebra, Differential equations: First order equations, higher order linear differential equations Initial and boundary value problems, Laplace transforms.
4. Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts, thermal stresses.
5. Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram;
   Principles of the design of machine elements -such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.
6. Thermodynamics and its applications: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. Irreversibility and availability; behavior of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles.
7. Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat;
   Refrigeration and air-conditioning: Refrigeration system, expansion devices, condensers and evaporators, psychometric, un-Conventional refrigeration and air Conditioning systems and new Trends in the field.
9. Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; Bernoullis equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes.
10. Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins;
dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

11. Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels; bearings; governors; static & dynamic balancing of rotors.


13. Production Engineering: Machining: Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and tool wear; economics of machining; Powder Metallurgy;
Metal Forming: basic principal of forging, drawing and extrusion;
Metal Casting: die casting, investment casting, centrifugal casting, gating & riser design, melting furnaces;
Fabrication Processes: weldability, metallurgy of welding, principal of gas, arc and resistance welding,
Principles of non-traditional machining processes,
Principles of work holding, principles of design of jigs and fixtures.


15. Production Planning and Control: Forecasting models, aggregate production, production planning and control, scheduling, materials requirement planning.

16. Optimization Techniques: Linear programming, simplex method, transportation, assignment, simple queuing models, PERT and CPM.
BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS FOR Ph.D ENTRANCE TEST
SUBJECT – APPLIED PHYSICS

Max. Marks : 100

Note: There will be 100 objective type of questions minimum passing marks will be 40. No negative marking.

**Mathematical Physics:**
Matrices; Inverse, Orthogonal and unitary matrices; independent elements of a matrix; Eigenvalues and eigenvectors; Diagnolization; Complete orthonormal sets of functions. Caley-Hamilton theorem. Basic idea about Legendre, Bessel, Hermite, and Laguerre equations. Fourier series, FS of arbitrary period; Half wave expansions, Fourier integral and transforms.

**Solid state Physics:**
Density of states, K-space, Bloch wave, Bloch theorem, Kronig-Penny model, origin of energy gap, Brillion zones, Number of possible wave functions per band, velocity of electrons according to periodic potential, Influence of electric field, effective mass, concept of hole, acceleration of electron moving in periodic lattice, Hall effect, Fermi Dirac distribution function. Meissner effect-Flux quantization, persistent current, phenomenological theory, London equation, Type I and type II superconductors, cooper pairs, BCS theory,

**Quantum Mechanics:**
Uncertainty principle, Energy and momentum operators, Schodinger wave equations, Analysis of particle in a box, linear harmonic oscillator, hydrogen atom. WKB method, validity & connection formula, application to alpha-decay. Time dependent perturbation method, harmonic perturbation and transition probabilities, absorption and emission of radiation
Electronics:
Essentials of transistor biasing circuits, various methods of transistor biasing, Classification of amplifiers, distortion in amplifiers, frequency response, R.C. coupled amplifier, transformer coupled amplifier, Criteria for Oscillation, phase shift, Wein bridge, Hartley & Colpitt oscillator. Frequency stability; Astable, Monostable and Bistable multibrators, Schmitt trigger. Operational amplifier and its application e.g. summation, subtraction, integration and differentiation, wave form generation, comparators, & voltage regulator, FET, MOSFET, UJT, SCR, tunnel diode and Zener Diode.

Electrodynamics:
Maxwell’s equations, boundary conditions, electromagnetic waves and their propagation, reflection and transmission of electromagnetic waves, parallel plate waveguide, rectangular waveguide and cylindrical waveguides, dipoles. Plasma oscillations, Debye shielding, Plasma parameters.

Digital electronics:
Number systems and codes:- Binary, Octal, Hexadecimal, floating point number system and their conversion method BCD code, excess three code, ASCII code. Logic gates, De Morgan’s theorems, Multiplexer, demultiplexer, signed and unsigned numbers, 1’s and 2’s compliments, half adder, full adder 2’s compliment adder and substractor, Combinatinal logic, minimization technique using karnugh’s map, SOP and POS forms.Counters :- Synchronous, asynchronous counters, ring counter, programmable and presettable, up/down counter, Johnson counter/ twisted counter. Designing counters using flip flops.Memories :- ROM, RAM, EPROM, EEPROM, PAL, PAL Programming static and dynamic RAMs, charged coupled device.

Lasers and fiber optics:

**Applied electronics:**

Basic idea about Klystrons, Magnetrons and Travelling wave tubes, velocity modulation two cavity Klystrons and Reflex Klystrons, Tunnel diode, Gunn effect, IMPATT diode, TRAPATT diode. Optoelectronics device: Photovoltaic effect, Solar cell.
PHYSICAL CHEMISTRY


INORGANIC CHEMISTRY

ORGANIC CHEMISTRY


INTERDISCIPLINARY TOPICS

Note: There will be 100 objective type of questions minimum passing marks will be 40.
No negative marking.

Integral Transform:
Laplace Transform and Inverse Laplace Transform, Fourier Transform, Fourier Sine and
Cosine Transform, Complex Fourier transform, Inversion formulae, linearity property,
Change of scale property and shifting property, Fourier transform of derivatives, Parseval’s
identity. Application of Laplace and Fourier Transform, Definitions of Hankel transform,
Mellin Transform, and their elementary properties.

Fourier Series & Vector Calculus:
Fourier Series: Euler’s Formulae, Dirichlet’s Conditions, Fourier Series for Continuous and
Discontinuous Functions, Half-Range Fourier Series.
Vector Calculus: Gradient, Divergence & Curl, Vector Differentiation, Vector Integration
(Line, Surface & Volume), Gauss-Divergence, Stoke’s & Green Theorem.

Differential Equations:
Ordinary Differential Equations: Differential Equation of First Order and First Degree,
first order and Higher degree, Linear Higher order Differential Equation with Constant
Coefficient, Homogeneous Linear Differential Equations, Simultaneous Differential
Equations.

Partial Differential Equation: Linear Partial Differential Equation of First Order, Non-
Linear Partial Differential Equation of First Order, Homogeneous Linear PDE with Constant
Coefficients, Application of Partial Differential Equations. Boundary value problems (wave,
Laplace and heat equations).
Numerical Analysis:

Operations Research:
Introduction to Linear Programming, Solution by Graphical and Simplex Method, Concept of Degeneracy and Duality, Optimal Solution of Transportation Problems, Assignment Problems, Job Sequencing Problems.

Functions of Complex Variable:
Complex Function, Continuity, Differentiability, Analytic Function, Cauchy’s Integral Theorem, Taylor’s and Laurent Series. Residue (Definition), Residue Theorem, Evaluation of Real Integral, Conformal Mapping.

Probability & Statistics:
Probability, Distributions (Binomial, Poisson, Normal), Random variables, Distribution function, Probability density function, Expectation, Moments, Moment generating function, Test of Hypotheses, Level of significance, Small and Large sampling, Chi- Square test. Coefficient of variance, standard error, standard deviation, and correlation and regression analysis. Student t-test, F-test,

Linear Algebra:
Graph Theory:
Definitions, Sub Graph, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, Null Graph, Isomorphism, Sub graphs, Walks, Path and Circuits, Connected & Disconnected Graph, Components, Euler Graph, Operation of Graphs, Hamiltonian Path and Circuit. Tree, Decision, Rooted, Binary, Spanning Trees, Properties of trees.

Special functions:
Legendre and Bessel functions, Hyper geometric function, Legendre polynomial, Properties of Bessel functions, Simple transformations, Rodrigue’s formula,
DOCTOR OF PHILOSOPHY
(Ph. D. in Technical Education)

Affiliated to

BARKATULLAH UNIVERSITY
Bhopal – 462 026
(Madhya Pradesh), India

CURRICULUM FOR
Ph.D ENTRANCE EXAMINATION

National Institute of Technical Teachers’ Training & Research
Shamla Hills, Bhopal – 462 002
(Madhya Pradesh), India
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1. **Rationale:**

   The teachers in technical institutions are required to keep abreast with latest technologies and development in the area to help their students acquire requisite knowledge and skills and more importantly inculcation of desirable attitudes and values, professional ethics contributing towards the development of professionalism among the prospective engineers and technicians.

   To satisfy the growing need of competent educational manager, National Institute of Technical Teachers’ Training & Research, Bhopal (India) has launched a unique Post-graduate full-time program “Master of technical Education” (M. Tech. Ed.) A number of students from India and abroad have undergone this program and occupy very important positions as Principals, Educational Administrators and Managers in their respective state systems.

   There is strong need to undertake research initiatives to break new grounds, to assess the impact of the innovations tried out in the past years, to enhance the quality of technical education and find solutions to various problems affecting the whole gamut of technical education system. Research in technical education has to address the needs of the modern industrial world, community and march towards self-reliance. Conducting Research in technical education can be an enlightening process to realize just how much we are able to discover through the application of rigorous and appropriate research methods.

   In view of all this, a research program at a Doctorate level leading to Ph. D. Degree in Technical Education has been conceived, designed, developed and offered by N.I.T.T.T.R. Bhopal to develop competent professionals with problem solving attitude, critical thinking and effective decision-making skills based on objective data. This program is offered under the Faculty of Technical Education of Barkatullah University, Bhopal (India). The program has been designed adopting inter-disciplinary approach integrating the contents of engineering degree / diploma courses with various pedagogical aspects of technical education system such as curriculum development, implementation of curriculum using variety of methods and media, students assessment, Information and communication technology, consolidating the effect of various innovations experimented in the system, technology forecasting, status of demand and supply of technically trained manpower in the country.
2. About NITTTR Bhopal

National Institute of Technical Teachers' Training & Research (NITTTR) Bhopal is a premier national institute established in 1966, by the Government of India under the Ministry of Human Resources Development for the improvement of the quality of technical education systems. The institute holds expertise in the various areas of technical education like curriculum development, educational management, policy formulation, continuing education, student assessment, multimedia development, human resource development, community networking, industrial liaison, designing learning resources and education research it offers Ph.D, PG Programmes as well. It is a resource centre dedicated for the improvement of the quality of entire gamut of technical education system including engineering colleges, management institutions, polytechnics, vocational education system and other professional institutions. The institute along with its extension centres at Ahmedabad, Pune, Alto-Pvorim–Goa and Raipur has an excellent working synergic partnership with industries and field agencies besides several technical institutions of repute at the national and international level, and as a consequence has enhanced its capabilities in providing a variety of yeoman services under one umbrella.

NITTTR Bhopal is internationally recognised for its HRD services and its innovative approaches in developing professionally competent manpower.

3. The Research Program Leading to Ph. D. Degree (under Faculty of Technical Education, B.U. BHOPAL)

3.1 Aims of the Doctoral Program:
A Doctoral degree awardee of NITTTR, Bhopal should have demonstrated the capacity to:

- Design and implement at a high level of originality and quality, either in original research project(s), of significant to technical education discipline or cross disciplinary field(s) or projects addressing an important problem or question concerning policy and / or practice in technical education as profession or its applied aspects in industry: and
• Present, using one or more media, a substantial and intellectually coherent product(s) such as a thesis, dissertation and artifacts or exegesis and portfolio of creative works and/or performance for submission to external examination.

3.2 Thrust Areas For Research In Technical Education:

Normally an aspirant for Ph. D. in technical education may think of the following areas for the selection of topic for his/her research work:

• Approaches / models for curriculum design and development
• Curricular reforms in technical subjects
• Management and Governance of technical education
• Media design and development
• Innovations in teaching/learning process
• Autonomy and flexibility
• Examination and admission reforms
• Guidance and Counseling
• Entrepreneurship development and self employment
• Manpower planning
• Impact studies/outcome studies for various Innovations
• Tracer studies of pass-outs
• Systemic researches
• ICT and Computer enabled learning
• Feasibility of different modes/approaches – modular, credit based, distance, online
• Content specific researches

The above list is highly suggestive and may include many more areas relevant to technical education.
4. **Course Work for Entrance Examination:**

The successful completion of entrance examination will help them in acquiring necessary cognitive skills to enable them to undertake research work, using appropriate statistical tools and research methodology in technical education and allied areas.

The following courses are suggested for the entrance examination leading to admission in Ph. D. program of BU, Bhopal.

**Table 4.1 – Course Work**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Courses</th>
<th>% Weight-age for Entrance Exam</th>
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<tr>
<td>1</td>
<td>Educational Technology</td>
<td>20 %</td>
</tr>
<tr>
<td>2</td>
<td>Curriculum Development</td>
<td>15 %</td>
</tr>
<tr>
<td>3</td>
<td>Technical Education Research and Statistics</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>Technical Education Management</td>
<td>20%</td>
</tr>
<tr>
<td>5</td>
<td>Educational Evaluation</td>
<td>15%</td>
</tr>
</tbody>
</table>
5. Curricula of Proposed Course Work

Name of Course: Educational Technology

Rationale:

Education, the act or process of acquiring and imparting knowledge is crucial to the development of a learner with a view to his participation in the transformation of the world for a better tomorrow. Learning and understanding are the basic to the definition of education. Teaching/ Instruction plays an important role in education. To make the teaching – learning process effective, it is imperative to think of different inputs that may influence this process. Educational Technology is one such input. It covers Technology in education as well as Technology of education. It is necessitates the inclusion of Educational Technology as a course.

Contents:

Unit 1 - Basic concepts:

Education Technology functions, systems approach and feedback mechanism.

Unit 2 - Basic processes in learning and instruction:

Principles of learning, varieties of learning (intellectual skills, cognitive strategies, information, motor skills, attitudes), events of instruction, conceptual structure and learning hierarchy.

Unit 3 - Instructional objectives:

Educational Aims, Concept of Abilities, competency statement and it’s components, behavioral objectives in different domains Cognitive domain, affective domain, Psychomotor domain and interactive domain. Different taxonomies. (Blooms, Kranthwal and Dave), Rules for formulating objectives. Recent trends in objective writing.

Unit 4 – Communication:

Basic Concepts, models, verbal and non-verbal, written communication, importance of interaction and feedback, barriers of communication. Concept of left brain and right brain function. Application of principles of communication to improve instructional process and for effective professional interaction with peers, superiors and sub ordinates.

Unit 5 - Overview of Instructional Strategies:

Inductive and deductive types, Group Learning, Laboratory based approaches, Workshop based Skill training methods, Field and Industry based methods, Individualized and Self Learning using Computer aided and Computer assisted Learning packages.
Unit 6 - An Overview of Instructional Media:

Types of instructional media, characteristics, and selection criteria

Unit 7 - Design and Use of Instructional Resources:

Print Instructional resources, MS-Power Point, principles of media design, 2D and 3D Animations

Unit 8 - Use of ICT:

Information and Communication Technology (ICT) in Teaching Learning Process, Web/Internet based learning, E-learning, Collaborative learning,

References

i) Romizowski A.J., Designing Instructional Systems, Kogan Page Publishers
vi) Competency based module on teaching methods - NITTTR Bhopal
Name of Course: Curriculum Development

Rationale:

Curriculum is a key element in the education process, its scope is extremely broad, and it touches virtually everyone who is involved with teaching and learning. The technical education curriculum focuses not only on education process but also on the tangible results of that process. Hence, greater emphasis has to be placed on the development of curriculum that is relevant in terms of the employer, learner and societal needs. Teachers of technical institutions have to appreciate the basic philosophy of curriculum and its developmental procedure. Student assessment and evaluation is an integral part of curriculum. Every teacher therefore requires a thorough understanding of the purposes of evaluation and various instrument and strategies associated with it.

Content:

Unit 1 - Curriculum development:


Unit 2 - Curriculum Planning:

Systems view of Curriculum Development, Manpower Needs Assessment Conventional techniques such as Job Analysis and Task Analysis. Special techniques such as NGT (Normal Group Technique), Delphi Technique, Search Conference.

Unit 3 - Curriculum Design:

Models of Curriculum Development related to technician education, Programme aims, deriving programme structure from Training Need Analysis (TNA), Determine Curriculum content, Teaching and Assessment Scheme.

Unit 4 - Curriculum Implementation:


Unit 5 - Organizing Learning Experience:

Curriculum Analysis, Design of instructional strategies, Selection of methods and media, Planning for learning experience, Assessment of learning experiences.
Unit 6 - Curriculum Evaluation:

Concept and purposes, Models/Approaches to Curriculum Evaluation, Planning for Evaluation, Utilizing results of evaluation for curriculum improvement, Review and revision of curriculum.

References:


**Name of Course:** Technical Education Research and Statistics  
**Rationale:**

Technical education system has been growing in magnitude and complexity due to rapid changes in society and technology and as a consequence faces a variety of problems. One can no longer cope with this situation by making decisions, solely based on tradition, authority and personal interest. The need to obtain information through systematic and scientific enquiry processes and make decisions based on sound reasoning has been appreciated and realized. This would greatly help objective decision-making leading to more effective solutions to problems.

Further, the technical education a number of in system in India has gone through a number of innovations. Yet there have been little systematic efforts in understanding the processes and outcomes of such innovations. Educational research is invaluable as an instrument for evaluating and strengthening innovations during the different stages of their development. Also, research is highly useful in identifying priority areas, problems and needs requiring innovative efforts.

Analysis of data and interpretation of results requires a researcher to acquire knowledge and skills of appropriate statistical methods. It is in this context that this course on Research methods and statistics in Technical Education is offered. Only those types of research designs which would most commonly be required and the relevant statistical methods will be dealt with in this course.

**Content:**

**Unit 1 - Introduction and Types of Technical Education Research:**
Concept of educational research, Areas of research in Technical Education, Types of research-Basic, Applied and Action researches, Qualitative and Quantitative researches

**Unit 2 - Steps of conducting education researches:**
Problem identification, Research Questions and Objectives of the study, Formulating hypotheses, Literature review –Sources and procedure
Unit 3 - Action Researches in Technical Education:
Action Researches for system’s development, Procedure of conducting Action Researches, Implementing the results of Action researches

Unit 4 - Research Designs:
Historical Researches, Descriptive – Survey, Case study, Co relational Researches, Ex-post Facto Researches and Experimental Researches

Unit 5 - Sampling and instrumentation:
Concept of population and sample, Different types of sampling – simple random sampling, stratified random sampling, systematic sampling, area or cluster sampling purposive, Researcher Made Instruments: Questionnaires, Opinionnaire, Interview Schedule and Observation Schedule

Unit 6 - Statistical Applications in Technical Education Research:
Descriptive and Inferential Statistics, Scales of measurement, Frequency Distribution Tables, Graphical representation of data, Measures of central tendency, measures of dispersion, Concept of correlation, Scatter plots, Spearman’s rank difference correlation, Pearson’s product moment correlation

References:
i) Best J.W. “Research in Education”, Prentice Hall of India Pvt. Ltd., New Delhi,
iii) Eagelhart, M.D., “Methods of Educational Research”, Rand McNally and Company, Chicago,
iv) Sax, Gilbert, “Foundations of Educational Research”, Prentice Hall inc., New Jersey,
v) Sukhia and Mehrotra, Elements of Educational Research, New Delhi, Allied Publisher.
vi) Moley, George J. The Science of Educatioinal Research, Eurasia Publishing House, New Delhi,
vii) Sharma R.D. ”Research Methods in Social Sciences” National Book Organization, New Delhi
ix) Garret Henry E. “Statistics in Psychology and Education”, Gokils Heaafter and Simsons, Pvt.Ltd.,
x) F. Falik B.Brown, “Statistics of Behavioral Science”, The Dorskey Press,
Name of Course: Technical Education Management

Rationale
Technical Education System has expanded significantly in the country. It has faced many crisis, challenges and recession in terms of intake, course delivery, employment, financial crisis etc. Now a day’s management of the technical institution is not that easy as it used to be in past because of number of reasons. Stakeholders are putting tremendous pressure on the system to produce desired number of educational leaders, who possess skills to vision and prepare strategic plans and implement them to achieve excellence.

Content

Unit – 1 Overview of Education Management:
Management of Technical Education in India, Various management approaches and models followed by sub systems, Role of Technical Education System and Technical Institutions, Systems approach in management

Unit – 2 Influencing skills and Leadership:
Leadership, Motivation, Communication, Peoples Skill

Unit – 3 Teamwork and team building:
Need & Importance, Characteristics, Team Building models, Team effectiveness evaluation

Unit – 4 Problem Solving and Decision Making:
Concept of Problem Solving and Decision Makin, Models of Problem Solving and Decision Making, Conflict Resolution

Unit – 5 Project Management:
Diagnosis of Problem, Concept of Project, Models of project design and planning, Proposal design, Monitoring and evaluation

Unit – 6 Resources Management:
Strategies to Enhance Resources Utilization, Human, Physical, Finance, Information, Time

Unit – 7 Management of Change:
Concept & Models of change, Strategies to implement the change, Resistance to change
Unit – 8 Innovations in Education Management:


References

i) David N. Griffiths Management in a Quality Environment, Tata McGRAW-HILL Publishing Company Limited, N. Delhi
Name of Course: Educational Evaluation

Rationale

With the growth of cognitive and psychometric theories and the advent of computer in recent years, the technology of test design, data analysis and interpretation has undergone a sea change. Testing and evaluation process cannot be considered in isolation, but it has become an integral part of the teaching and learning process and therefore. Though students’ assessment is designed to assist learning, it is noticed that it influences the learning to a great extent and hence quality of learning is greatly influenced by the quality of assessment Quality of assessment is therefore a key issue to be addressed.

The course will be extremely useful to the technical teachers in general. It will be particularly useful to those who would be required to undertake leadership role in the area of educational measurement and evaluation.

Content

Unit – 1 Educational Evaluation-


Unit – 2 Student Evaluation:

Basic Purposes Placement/selection, Formative, Diagnostic, Summative, Testing of achievement, aptitude, skill, personality, Comprehensive and Continuous Evaluation: Concept and Purpose, Relationship with Teaching and Learning Progressive and term work assessment: Purpose and Utility

Unit – 3 Test Characteristics and its estimation

Basic Characteristics- Validity, reliability, objectivity, usability, practicability- their meaning and concepts.

Unit – 4 Evaluation in Cognitive Domain:

 Different Types of Items/Questions:
Selected - Response Type Item- True- False, Multiple Choice, Matching, Assertion Reason.
Supply Type Question- Completion Type, Short Answer, Structured Question, Improved essay and Essay type questions.
Unit – 5 Evaluation in psychomotor and Affective Domain:

Assessment of performance and behaviour in laboratory work, project work, and workshop: tools to be used, need and scope, objectives to be assessed, Use of checklists and rating scales in assessing performance and behavior

Unit – 6 Competency Based/Skill Based Assessment

Concept, Issues and Techniques, Models of Competency Based Assessment

References

v) Ebel, R. L. Essentials of Educational Measurement, (New Delhi, Prentice Hall, Inc.)
Barkatullah University, Bhopal  
Subject: Pharmacy  
Faculty - Technology  
Doctoral Entrance Test (DET) syllabus 2012 -13  

Total Marks: 100  

Unit I: 20 Marks  
All topics will include in Instrumentation methodologies, techniques and applications to structural and quantitative analysis of drug and their methodologies.  
Gas chromatography, High pressure liquid chromatography, Ion-Pair Chromatography, HPTLC. Ultra violet, Infra-red (including FTIR), Nuclear Magnetic Resonance (including C-13NMR), Mass spectroscopy, Atomic spectroscopy, Electron microscopy, Radio assaying, Radio immuno assaying and autoradiography.  

Unit II: 20 Marks  
i. Stability, solubility, pka, dissolution rate, partition coefficient. In vitro and In–Vivo evaluation techniques and product formulation  
ii. Designing of Pharmaceuticals:  
A. Tablet formulation, Special tablets, preparation of components for compression, characterization of granulation, coating of tablets, Evaluation of tablets  
B. Topical and rectal absorption of drugs, formulations and evaluation.  
C. Formulation considerations of oral liquids, Suspensions, emulsions, development of various products.  
D. Formulation consideration of parenteral, ophthalmic, depot products, Large volume and Small volume parenterals,  
E. Environmental control and quality assurance in parenteral drug manufacturing.  
iii. Stability in Pharmaceuticals and study of stability kinetics.

Unit III: 20 Marks

A. BIOTECHNOLOGY:

i. Techniques of enzyme immobilization factor affecting enzyme kinetics and application of immobilized enzyme in different field.


iii. Formation and selection of hybrid cell. Production advantages, limitation, characterization, Storage and applications of Monoclonal antibodies.

B. BIOCHEMISTRY:

i. Nomenclature of enzymes, enzyme kinetics and its mechanism of action, mechanism of enzyme inhibition,

ii. Oxidation of fatty acids, Biosynthesis of Fats, Ketosis and Ketogenesis. Metabolism of cholesterol, Control of lipid metabolism.

iii. The respiratory chain, Oxidative phosphorylation, enzymes and coenzymes involved in oxidation reduction.

C. PHARMACOLOGY:

congestive heart failure and cardiac arrhythmias and different 
drugs used in above mentioned cardiovascular disease.

ii. Pharmacology of Autonomic nervous system.
   (a) Parasympathomimetics and parasympatholytics.
   (b) Sympathomimetics and sympatholytics.
   (c) Ganglionic stimulant and ganglionic blockers.

iii. Pharmacology of Central nervous system
   General Synaptic transmission in CNS, Antiepileptic drugs,
   Antiparkinsonian drugs.

Unit IV: 20 Marks

i. Quality control of crude drugs. Adulteration of crude drugs and 
   their detection by organoleptic, microscopic, physical, chemical and 
   biological methods of evaluation.

ii. Study of fibers used in pharmacy such as Cotton, Cellulose and their 
   derivatives, Silk, Wool, Nylon, Glass wool, Polyester, Asbestos, 
   Hemp & Jute.

iii. Introduction to methods of preparation of plant extract - Infusion, 
    decoction, digestion, maceration & percolation. Soxhlet extraction 
    and expression.

iv. Systematic study of source, cultivation, collection, processing, commercial 
    varieties, chemical constituents, substitutes, adulterants, uses, diagnostic 
    macroscopic and microscopic features and specific chemical tests of 
    following categories drugs.

A. Alkaloids: Tropane (Belladonna, Hyoscyamus, Datura, Duboisia, Coca 
    and Withania), Quinoline and isoquinoline (chinchona, ipecac, opium) and 
    indole (ergot, rauwolfia, Vinca, nux-vomica and physostigma)

B. Glycosides: Saponins (Glycyrrhiza, Ginseng, Dioscorea, 
    Sarsaparilla and Senega), Cardioactive steroids (Digitalis, Squill,
Strophanthus, Thevatia) and Anthraquinone cathartics (Aloe, Senna, Rhubarb, Cascara and Cochineal).

v. Steroidal drug precursors from plant.


viii. Introduction to Ayurvedic dosage forms. Preparation and standardization of Ayurvedic dosage forms.

**Unit V:**

20 Marks

i. A study of method of preparation and uses of the following reagent and solution: Nesslers, Fehlings, Molish, Mayer, Barford, Benedict, Dragendorff, Schulzes, Liberman and Burchard, Millon, Wagner, Ammonium molybdate, Chlorosulphonic acid, Ferric chloride solution.

ii. Nomenclature of organic compounds and stereochemistry: IUPAC system of nomenclature, name based on function, substitute, additive, replacement, conjugative and radiofunctional, concept of Isomerism, optical activity stereoisomerism.

iii. Nucleophilic substitution reactions (SN$_1$-SN$_2$), elimination reactions (E$_1$ & E$_2$), substitution V/S Elimination.

iv. Physiochemical and physiological properties in relation to biological action: solubility and partition coefficient, selected physico-chemical properties, Ionization, hydrogen bonding, chelation.