M.E. (PART-TIME) **Prospectus No.111737**

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

अभ्यासक्रमिका

(FACULTY OF ENGINEERING & TECHNOLOGY)

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Prescribed for
Post Graduate Three Year Degree Course
Master of Engineering
(Part-Time)
Credit Grade System
I to III Year Examinations
2010 - 2011 & Onwards

Branches : 1) Electrical Power System
2) Digital Electronics
3) Environmental Engineering
4) Computer Science & Engineering
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2010

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SANT GADGE BABA AMRAVATI UNIVERSITY AMRAVATI

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinances Booklet the various conditions/ provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Inprovement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.
Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.

Ordinance No. 6/2008	:	For improvement of Division/Grade.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi
Registrar
Sant Gadge Baba Amravati University

SYLLABUS PRESCRIBED FOR

THREE YEAR P.G. DEGREE COURSE IN

MASTER OF ENGINEERING (PART TIME)
ELECTRICAL ENGINEERING
(ELECTRICAL POWER SYSTEM) EXAMINATION
SEMESTER : FIRST

1 SEPS 1 POWER SYSTEM OPTIMIZATION

SECTION-A

1) Introduction to optimization and classical optimization techniques
2) Linear Programming : Standard form, geometry of LPP, Simplex Method pf solving LPP, revised simplex method, duality, decomposition principle, and transportation problem.
3) Non-Linear Problem (NLP) : One dimensional methods, Elimination methods, Interpolation methods
4) Non-Linear Programming(NLP): Unconstrained optimization techniques-Direct search and Descent methods, constrained optimization techniques, direct and indirect methods

SECTION-B

5) Dynamic Programming: Multistage decision processes, concept of sub-optimization and principle of optimality, conversion of final value problem into an initial value problem.
6) CPM and PERT
7) Genetic Algorithm: Introduction to genetic Algorithm, working principle, coding of variables, fitness function. GA operators; Similarities and differences between Gas and traditional methods; Unconstrained and constrained optimization using Genetic Algorithm, real coded gas, Advanced Gas, global optimization using GA.
8) Applications to Power system: Economic Load Dispatch in thermal and Hudro-thermal system using GA and classical optimization techniques, Unit commitment problem, reactive power optimization. optimal power flow, LPP and NLP techniques to Optimal flow problems.

References:

1. "Optimization - Theory and Applications", S.S.Rao, Wiley-Eastern Limited
2. "Introduction of Linear and Non-Linear Programming ", David G. Luenberger, Wesley Publishing Company
3. "Computational methods in Optimization ", Polak, Academic Press
4. "Optimization Theory with Applications" Pierre D.A., Wiley Publications

5. "Optimization for Engineering Design: Algorithms and Examples", Kalyanmoy deb, PHI Publication
6. "Genetic Algorithm in Search Optimization and Machine Learning ", D.E. Goldberg, Addision-Wesley Publication, 1989
7. "Advanced Power System Analysis and Dynamics " L.P. Singh, Wiley Eastern Limited.
8. "Power System Analysis ", Hadi Saadat, TMH Publication.
9. " Electrical Energy System : An Introduction ". Olle I.Elewgerd, TMH Publication, New Delhi.

1 SEPS 2 GENERATION PLANNING AND LOAD DISPATCH

SECTION - A

Generation- Fossil fules, Hydropower and Nuclear power generation systems. Chronological Load Curves, Power duration curve, Integrated duration curve, Hydrography, Flow duration curve, Mass curve for Hydro Power generations. Co-ordination of steam, Hydro and Nuclear power stations. Optimum Generation allocation-Line losses neglected and including the effect of transmission losses for thermal power generations. Long range and short range Hydro generation scheduling. The short term and long term Hydro-thermal scheduling of generation.

Load Forecasting & Generation Planning - Classification of loads -Load forecasting methodology-Energy forecastingpeak demand forecasting-Weather sensitive and Non-weather sensitive forecasting - Total forcast - Annual and Monthly peak demand forecast.

SECTION-B

Generation system cost analysis:
Cost analysis -capacity cost, production cost. Production analysis-production costing, production analysis involving nuclear unit, production analysis involving hydro unit. Fuel inventories-energy transaction and off-peak energy utilization.
Generation System Reliability Analysis – probabilistic generating Unit-Model and Load model, effective load- Reliability analysis for isolated system-Interconnected system-Reliability analysis of interconnected system.
Load dispatch & System Communication – Consideration for centralized control of system operations. Requirements of the central load dispatch centre.
Telementry-Remote control and data transmission, etc. Power system reforms, deregulation of electric utilities, energy management & conservation.

REFERENCES:

1) Power System Planning - R.L. Sullivan, McGraw Hill.
2) Economic Control of Interconnected System -Kirchmayers, L.K.,John Wiley and Sons, New York.
3) Generation of Electrical Energy - B.R. Gupta, Euresia Publishing House Pvt., Ltd., New Delhi.
4) Power System Restructing and Deregulation - by Loi Lei Lai
5) Restructed Electrical Power Systems - by Mohammad Shahidehopur, Muwaffaq Alomoush.
6) Privatization, Restructing, and Regulation of Network Utilities (Walras-Pareto Lectures) : by David M. Newbery.
7) Power to the People : Electric Power Deregulation : An Expose : Jack Duckworth
8) Understanding Electric Utilities and De-Regulation, Power Engineering : Lorrin Philipson, et al
9) Power Generation, Opearion and Control : A.J. Wood and B.F. Wollenberg:, John Wiley 1996
10) Understanding Electric Utilities and De-Regulation (Power Engineering) : by Lorrin Philipson, H. Lee Willis, Lorrion Philipson
11) The End of a Natural Monopoly : Deregulation and Competition in the Electric Power Industry : by P.Z.Grossman, D.H. Cole, P.Z. Grossman, D.H. Cole

1SEPS 3 MICROPROCESSOR AND MICROCONTROLLER

SECTION – A

Overview of Intel 8085 microprocessor. 8086 : Architecture, instruction including I/O instructions, bus timing diagram, interrupt structure, ISR minimum and maximum mode, Assembly Language Programming. Hardware and Software debugging aids: 1 Pass and 2 Pass assemblers, cross assemplers, circuit emulators, simulators, linkers, loaders, compiler, cross compiler, logic analyzers.

Types of interfacing devices

SECTION B

8051 Architecture : 8051 Microcontroller Hardware, Input/Output. Pins, ports, and circuits, External Memory, Counter and Timers, Serial Data input/ output, Interrupts

Assembly language programming concepts : The mechanics of programming, The assembly language programming process, PAL instructions, Programming tools and techniques, Programming the 8051

Moving Data : Addressing modes, external data moves, code memory read only data moves, push and pop -op codes, data exchanges

Logical Operations : Byte level logical operations, bit level logical operations, rorate and swap operations

Arithmetic Opearions : Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic

Jumps and Call Instructions : The jump and call program range, jumps, calls and subroutines, interrupts and returns

8051 Microcontroller Design : Microcontroller specification, microcontroller design, testing the design, timing subroutines, look up tables for the 8051, serial data transmission

Applications : Keyboard, displays, pulse measurement, D/A and A/D conversion, multiple interrupts

Serial Data Communication : Network Configuration, 8051 Data Communication.

Books Recommended :

1. Kenneth J.Ayala, The 8051 Micro Controller : Architecture, Programming, Penram International, Mumbai.
2. Intel Embeded Micro Controller Data Book, Intel Corporation.
3. D.V.Hall, Microprocessor and Digital Systems, ELBS Publication, London.
4. B.P.Singh, Advance Microprocessors and Micro Controllers, New Age International, New Delhi.
5. D.V.Hall, Microprocessors and Interfacing, Tata McGraw Hill Publication, New Delhi.
6. Y.C.Liu, Gibson, Microcomputer Systems: the 8086/8088 Family, Architecture, Programming and Design, Prentice Hall of India Publications, New Delhi.
7. Lance A. Leventhal, Introduction to Microprocessor, Software, Hardware and Programming.
8. Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International, Mumbai.

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SECOND SEMESTER

1SEPS 4 POWER SYSTEM DYNAMICS

SECTION-A

INTRODUCTION

Reliable electrical power service, Stability of Synchronous machines, Tie-line oscillations, Method of simulation. Synchronous Machines: Review od synchronous machine equations, parameters, Equations in a-b-c phase co-ordinates and Park's co-ordinates, Representation of external system, Low and High orderstate models, Choice of state variables. Initial state equivalent circuit, Phasor diagram p.u. reactances. System Response to Large Disturbances: System of one machine against infinite bus, Classical Model, Mechanical and electrical torques, Critical clearing angle and time, Automatic reclosing, Precalculated Swing curves and their use.

SECTION-B

System Response to Small Disturbances: Two machine system with negligibe losses, Clarke diagram for two machine series reactance system, Extention of Clarke diagram to cover any reactance network, Equation for steady State Stability limit, Two- Machinesystem with losses, Effect of inertia. Effect of governor, action, Conservative criterion for stability, Effect of sallency, saturation and short circuit ratio on steady state power limits.

Regulated Synchronous Machines: Demagnetising effect of armature reaction and effect of small speed changes, Modes of oscillations of unregulated multimachine system. Voltage regulator and governor coach with delay Distribution of power impacts.

Effect of Excitation on Stability: Effect of excitation on generator power limits, transients and dynamic stability, Examination of dynamic stability by Routh's criterian, Root locus analysis of a regulated machine connected to an infinite bus. Approximate System representation, Supplementary Stabilising Signals, Linear analysis of stabillised generator.

REFERENCES:

1. Synchronous Machines by C.Concordia, John Wiley & Sons.
2. Power System Stability by E.W.Kimbark, Dover Publication, Vol.-3
3. Power System Control & Stability by Anderson, Galgotia Publ.
4. Power System Stability by S.B. Crary, John Wiley & Sons.

1SEPS 5 DIGITAL SIGNAL PROCESSING

SECTION-A

Digital Signal Processing

Characterization & Classification of Digital Signals. Digital Signal Processing of continuous signals. Discrete time signals - sequences, representation of signals on orthogonal basis, sampling, aliasing, quantization & reconstruction of signals.

Discrete systems-attributes, z-transform, analysis of LTI system.

Frequency analysis, inverse systems, Discrete Fourier transform, Fast Fourier implementation of discrete time system.

Digital filters - structures, sampling, recursive, non-recursive A to D & D to A conversion. FIR, IIR & lattice filter structures, Design of FIR digital filters. Window method, Park-McCellan's method. Design of IIR digital filters. Butterworth, Chebyshev.

SECTION-B

Elliptic approximations, low-pass, band-pass, band-stop & high-pass filters. Effect of finite register length in FIR filter design. Multirate signal processing-motivation-application, decimation & interpolation, sample rate

conversion, polyphase implementation of sampling rate conversion, Filter bank theory-DFT filter banks, Adaptive filtering theory.

DSP Processors and Applications - DSP Microprocessor architectures, fixed point, floating point precision, algorithm design, mathematical, structural and numerical constraints, DSP programming, filtering, data conversion; communication applications. Real time processing considerations including interrupts.

Refernce Books :

1. J.G.Proakis and D.G.Manolakis 'Digital Signal Processing Principles, Algorithm and Applications' Prentice Hall 1997
2. A.V.Oppenheim, R.W.Schafer, 'Discrete Time Signal Processing' John Wiley.
3. J.R. Johnson, ' Introduction to Digital Signal Processing Prentice Hall 1992
4. D.J.Defatta, J.G.Dulas. Hodgekiss, 'Digital Signal Processing' J. Wiley and Sons Singapore, 1988
5. L.R.Rabiner & B. Gold - 'Theory & Applications of Digital Signal Processing', Prentice Hall, 1992

1 SEPS 6 POWER SYSTEM LAB.-I

Indentify and perform minimum 16 (sixteen) experiments based on syllabus of subjects form Semester-I

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THIRD SEMESTER

2SEPS1 ADVANCED POWER SYSTEM PROTECTION

SECTION-A

Review of principles of power system equipments protection, configuration of various solid state protection scheme, evaluation of digital relays from electromechanical relays, performance & operational characteristics of digital protection, Basic elements of digital filtering, analog multiplexers, conversions of system: the sampling theorem, signal aliasing error, sample & hold circuit, multiplexers, analog to digital conversion, digital filtering concepts, A digital relay. Hardware & Software.

SECTION – B

Mathematical background to protectional algorithm, first derivative (Mann & Morrison) algorithm, Fourier algorithm- full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm, least square based algorithm, differential equation based algorithm, travelling wave based technique. Digital differential protection of transformer, digital line differential protection, recent advances in digital protection of power system.

Books Recommended :

1) Digital Protection for Power System : A.T.Johns and S.K.Salman, Peter, Published by Peter Peregrinus Ltd. on behalf of the IEE, London, U.K.
2) Power System Protection and Switchgear : Badri Ram and D.N.Vishvakarma, Tata McGraw Hill, New Delhi.
3) Transmission Network Protection : Theory and Practice, Y.G.Paithankar, Marcel Dekker, New York, U.S.A.
4) Fundamentals of Power System Protection : Y.G.Paithankar and S.R. Bhide, Prentice Hall of India, New Delhi.

2 SEPS 2 HIGH VOLTAGE TRANSMISSION

SECTION-A

Introduction of EHV-AC transmission, Tower configuration, Thermal ratings of lines & cables, circuit breakers, insulators for A.C. transmission, Voltage gradients of conductors, Cuona effects, power loss & audible noise, radio interferences, electrostatic field of transmission lines, Insulation characteristics of ling air gaps. Design of EHV lines based upon steady state limits, transient overvoltages & voltage stability, series shunt compensation, active & reactive power flow control, basics of static VAR compensators

SECTION-B

H.V.D.C. Transmission:

General aspects of comparison between HVDC & HVDC transmission schemes and terminal station layout. Operation of converters as rectifier and as an inverter. Equivalent circuit and operating chart of converter. Control of the converters (ccc & cca) Harmonics and its control, faults protection of line and terminal equipment.

Parallel operation of HVDC and AC, Multiterminal HVDC Systems

REFERENCE BOOKS :

1. Weedy, B.M. : Electric Power Systems, John Wiley & Sons.
2. EHV Transmission Line Refernce Book : Edison Electric Inst.
3. Adamson, C & Hingorani N.G. . HVDC Power Transmission, Garraway Publications.
4. Kimbark, E.W. : Direct Current Transmission, Vol.I, John Wiley & Sons.
5. Uhlman, E. : Transmission by D.C.
6. Rakosh Das Beganudre : Extra High Voltage AC Transmission Engineering.

2 SEPS 3 POWER SYSTEM MODELLING & CONTROL

SECTION-A

Transient response and concept of stability in Electrical Power System. Modelling of Power System. Control of voltage, frequency and tie-line

power flows, Q-v and P-f control loops, mechanism of real and reactive power control. Mathematical model of speed governing system. Turbine governor contrate as affecting the power system dynamics. Transion and steady state response in the interconnected power systems. (multimedia systems). Excitation systems. Transformation model of exciter system. Analysis using block diagrams. Power systems stabilizers. Dynamic stability (small disturbances), effect of excitation control and turbine dynamics, characteristic equation, method of analysis of the stability of power system. Multi machine systems, Flux decay effects. Multi machine systems with constant impedance loads, matrix representation of a passive network in the transient state, converting to a common reference frame. Converting machine co-ordinates to system reference, relation between machine current and voltages, system order, machine represented by classical methods, multi machines systems study.

SECTION-B

Net interchange tie-line bias control. Optimal, sub-optimal and decentralised controllers. Discrete mode AGC. Time - error and inadvertent interchange correction techniques. On-line computer control. Distributed digital control. Data acquisition systems. Emergency control, preventive control, system, system wide optimization, SCADA.

Self excited electro-mechanical oscillations in power system and the means for control.

REFERENCES :-

1) V.Venlkov : Transient Processes in Electrical Power System, Mir Publication, Moscow.
2) Olle I.Elgard : Electric Energy Systems Theory, Tata McGraw Hill Pub. Co., New Delhi.
3) Anderson P.M. & Foaud A.A. : Power System Control and Stability, Galgotia Pub.
4) Nagrath I.J., Kothari D.P. : Modern Power System Analysis, Tata McGraw Hill Pub. Co., New Delhi.

FOURTH SEMESTER

2SEPS 4 COMPUTER METHODS IN POWER SYSTEM ANALYSIS

SECTION - A

1. Representation of power systems for computerised analysis: Mathematical models of synchronous generator for steady state and transient analysis, Transformer with tap changer, transmission line, phase shifter and loads.
2. Topology of Electric Power System-Network Graphs, Incidence matrices, fundamental loop and cutest matrices, primitive impedance

and admittance matrices, equilibrium equations of networks. Singular and nonsingular transformation of network matrices.

3. Formation of bus impedance and admittance matrices by algorithm - Modification of bus impedance and admittance matrix to account for change in networks. Derivation of loop impedance matrix. Three phase network elements-transformation matrix -incidence and network matrices for three phase network. Algorithm for formulation of 3 - phase bus impedance matrix.

SECTION-B

4. Short Circuit Studies : Three phase network, Symmetrical components. Thevenin's theorem and short circuit analysis of multi node power systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced short circuits bus impedance and look impedance matrices.
5. Load flow studies : Sleek bus, loop buses, voltage control buses, Load flow equations, Power flow model using bus admittance matrix, Power flow solution through Gauss-Seidal and N-R methods - sensitivity analysis, Second order N-R method, fast mecouple load flow method - Sparsity of matrix. Multi area power flow analysis with the line control.
6. Stability studies of Power System - Development of mathematical model for multi machine system stability analysis-Formation of equations and method of solution. Transient stability analysis including synchronous machines, system network and loads. Solution of state equation by modified Eular method and solution of network equations by Gauss-Seidal interactive method.

REFERNCE BOOKS :

1) Computer Methods in Power System Analysis : G.W.Stage A.H.Elabiad, McGraw Hill Book Co.
2) Computer Techniques in Power System Analysis : M.A. Pai, Tata McGraw Hill Publication.
3) Electric Energy System Theory : O.I.Elgard, Tata McGraw Hill Publication.
4) Computer Aided Power System Operation and Analysis: R.N.Dhar, Tata McGraw Hill Publication.
5) Modern Power System Analysis : I.J.Nagrath, D.E.Kothar, Tata McGraw Hill, New Delhi.

2SEPS 5 FACTS AND POWER QUALITY

SECTION-A

Steady state and dynamic problems in AC systems, Flexible AC transmission systems (FACTS), principles of series shunt compensation, description of static var compensation (SAC), thyristor controlled series compensation

(TCSC) static phase shitters (SPS), static condenser (STATCON), static synchronous series compensator (SSSC) and unified power flow controller (UPFC), modelling and analysis of FACTS controllers, control strategies to improve system stability.

SECTION-B

Power quality problems in distribution systems, Harmonics, Harmonics creating loads, modelling, harmonic propagation,series and parallel resonance, harmonic power flow, mitigation of harmonics, filters,passive filters, active filters,shunt and series hybrid filters, voltage sag ans swells, voltage flicker, mitigation of power quality problems using power electronics conditioners, IEEE standards.

Books Recommended :

1) G.T.Heydt : Power Quality, Stars in a Circle Publication, Indiana, 1991.
2) E.J.E.Miller : Static Reactive Power Compensation, John Wiley & Sons, New York, 1982.
3) Recent Publications on Power Systems and Power Delivery.

2 SEPS 6 POWER SYSTEM LAB.-II

Identify and perform minimum 16 (sixteen) experiments based on syllabus of subjects form Semester-II.

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FIFTH SEMESTER

3 SEPS 1 SEMINAR AND DISSERTATION

(as per given scheme)

SIXTH SEMESTER

4 SEPS 1 SEMINAR AND DISSERTATION

(as per given scheme)

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SYLLABUS PRESCRIBED FOR

THREE YEAR P.G. DEGREE COURSE IN

MASTER OF ENGINEERING (PART TIME)
DIGITAL ELECTRONICS

1UMEP1 / 1UMEF1 DIGITAL INSTRUMENTATION
SECTION A

Unit-I **Digital time measurement techniques:**
Vernier technique for small time interval measurement, Measurement of periodic time, Measurement of phase, capacitance, quality factor, time constant & decibel .
Digital frequency measurement techniques:
Measurement of ratio, product & difference between two frequencies, High frequency measurement, Maxima & Minima frequency measurement , Peak Frequency measurement, Fast low frequency measurement.

Unit-II: **Electronic instrument for signal analysis:**
Signal Analyzer: Spectrum analyzer, Network analyzer, Wave analyzer, Distortion analyzer, Logic Analyzer, Protocol analyzer.
Automated Measurement Systems:
Need & requirement of Automatic test equipment (ATE), Computer based & computer controlled ATE, ATE for PCB, Component testing. IEEE-488 electronic instrument Bus standard, Field Bus application. Instrumentation in Hazardous area.

SECTION B

Unit-III: **Microcontroller & PC based Data acquisition system:**
Data acquisition system: Introduction to smart sensors, digital sensors, Case studies of real time PC based instrumentation system, Virtual instruments, Intelligent instrument & Role of software.
Computer control: Hierarchy of computer control for industry, Direct digital control, Distributed computer control: System architecture & implementation concepts, buses & communication networks of DCCS, SCADA system.

Unit-IV: **Advanced medical instrumentation systems:**
Microprocessor interfacing & computer based Medical instrumentation System, Real time digital conditioning of monitored bio-medical signals such as EEG, ECG, EMG, & VEP .
Intelligent controllers:
Discrete State Process control, Relay Sequencer & Ladder Diagram Programmable logic controllers, PLC programming techniques, Introduction to fuzzy logic & Neural network controllers.

Text Books:

1. Digital Measurement Techniques, 1996 by T.S.Rathore, Narosa publishers,New Delhi Second Edi.
2. Instrumentation & Process, Critis Johnson (PHI Publication)

Reference Books :

1. Electronic Instruments Handbook (3/e), 1997 by Clyde E. Coombs, McGraw Hill International
2. Applied Electronics Instrumentation & Measurement, 1992 by McLachlan & Buchala, Prentice Hall International
3. Khandpur R.S., Handbook of Bio-medical Instrumentation (3/e)
4. Computer Based Industrial Control by Krishnkant , PHI , 5TH Edition.
5. Digital Signal Processing by Cavicchi (John Willey Publication)

1UMEP2/1UMEF2 ADVANCED DIGITAL SIGNAL PROCESSING

SECTION - A

Unit I : Introduction : Overview of Discrete time signals and systems: Convolution, correlation, Time Bandwidth Relationships, Introduction to Random signal Processing and Statistical Signal Processing. Different transforms, use of DFT in linear filtering, filtering of long data sequences, Algorithm for convolution and DFT. FFT algorithms.

Unit II : Digital filter Design: FIR and IIR Filter Design techniques, Introduction to Multirate Digital Signal , Implementation of Sampling Rate Converter, Filter Bank Implementation, Sub-band Coding.

SECTION - B

Unit III : Adaptive Digital Signal Processing: Spectral Estimation using Least Square(LS), Least Mean Square (LMS), Recursive Least Square (RLS) Algorithms. Applications to Speech and Audio Signal Processing

Unit IV : Issues involved in DSP processor design, Architecture and programming of TMS 320 C67XX, Applications of DSP to Biomedical Signal Processing.

Text Books :

1) Digital Signal Processing: Principles , Algorithms and Applications by J G Proakis, D.G. Monalikis PHI (3rd Edition)
2) Discrete Time Signal Processing, A.V. Oppenheim and Schafer, PHI.

Reference Books :

1) Discrete Time Signal Processing A practical Approach, E.C. Ifeacher & B.W. Jarvis Pearson Education 3rd Edition.

2) A Course in Digital Signal Processing, Porat ,Boaz John Willey and Sons
3) Digital Signal Processing, S.K. Mitra, TMH(2nd Edition)
4) Digital Signal Processing, T. J. Cavicchi, John Willey and Sons
5) DSP Handbook Vijay Medisetti & D.B. Williams CRC Press
6) Adaptive Filter Theory, Simon Haylein Jhon Wiley
7) Fundamentals of Statistical signal Processing by Steven Key, Pearson Education.

1UMEP3 / 1UMEF3 ELECTIVE –I

1) Modern Electronics Design Technique

Unit – I : Amplifiers & Regulators System Design : Digital isolation techniques, high speed clamping amplifiers, programmable gain amplifiers, auto – zero amplifiers, lock – in amplifiers, switch mode regulator topologies like buck, boost, buck boost their control techniques and selection of passive, active (IGBT, GTO, MOSFET, Diode) and magnetic components for these regulators, simulation of these systems using PSIM and related software.

Unit – II : Communication and control system design : Electronic navigation systems, underwater sound systems, phase lock loop design, direct digital synthesis, radio systems and auto pilot systems in aircraft, digital engine control and motion control systems for automobiles, simulation of these systems using related software's.

Unit – III : Portable Electronics system design : Types and characteristics of modern batteries, smart battery management systems, portable devices like mobile TV, VolP phones, glucose meter, pulse oximetry, cardio pulmonary resuscitation systems , ultrasound systems, Barcode readers, payment terminals.

Unit–IV : Electronic system design for production : Layout and grounding for analog & digital systems, safety, testablility, reliability and thermal management in electronic systems, quality, reliability, testing and environmental aspects in printed circuit board design, design of enclosures for electronic products, EMC of electronic products.

Text Books :

1. Linear Circuit Design Handbook by Zumbahlen Elsevier, Analog Devices Corp.
2. Circuit Design, Knowit All by Ashby, Baker Elsevier

Reference Books :

1. Demystifying switching power supplies by Mach., Elsevier 2.Standard handbook of Electronic Engg. (5th Ed) by Chritiansen & Alexander MGH
3. Digital Frequency synthesis Demystified by Goldberg LLH Pub.
4. Aircraft Digital Electronic & Comp. System by Tooley Elsevier
5. Aircraft Electricity and Electronics by Bent.
6. Battery operated devices and systems by Pitoia, Elsevier
7. Understanding Automotive electronics (6th Ed) by Ribbens Elesevier
8. Grounding & Shielding Ckt & interfacing (5th Ed) by Morrison Wiley
9. Printed Ckt. Boards by Khandpur MGH

1UMEP3 / 1UMEF3 ELECTIVE –I

2) RF SYSTEM DESIGN

UNIT-I ACTIVE RF COMPONENTS AND THEIR MODELING

Active RF Components: Semiconductor Basics: Physical properties of semiconductors, PN-Junction, Schottky contact. **Bipolar-Junction Transistors:** Construction, Functionality, Temperature behavior, Limiting values. **RF Field Effect Transistors:** Construction, Functionality, Frequency response, Limiting values. **High Electron Mobility Transistors:** Construction, Functionality, Frequency response. **Active RF Component Modeling:** Transistor Models: Large-signal BJT Models, Small-signal BJT Models, Large-signal FET Models, Small-signal FET Models.

UNIT-II FILTER and AMPLIFIER DESIGN

RF filter Design methods: Image Parameter Method, Insertion Loss Method, Microstrip Filter Design **Filter Implementation:** Unit Elements, Richard's Transformation, Kuroda's Identities and Examples of Microstrip. **High frequency amplifier design:** Bandwidth enhancement, neutralization and unilateralisation, cascaded amplifiers. **RF power amplifier design:** Class A to Class F amplifiers and modulation characteristics.

UNIT-III LNA, Mixers and oscillators design

LNA topologies and their design, linearity and large signal performances, multipliers and sub sampling mixers, High Frequency Oscillator Configuration: Fixed Frequency Oscillator, Voltage Controller Oscillator and Dielectric Resonator Oscillator

UNIT-IV PLL design

Linearized PLL models, Noise properties of PLLs, Phase detectors, Sequential phase detectors, Loop filters and charge pumps, design examples

Text Books :

1. Microwave Transistor Amplifiers, Analysis and Design by G. Gonzalez; Prentice Hall
2. RF Circuit Design-Theory and Applications by Reinhold Ludwig and Pavel Bretchko; Pearson Education

Reference Books :

1. Thomas Lee, " The Design of CMOS RF ICs", Cambridge second edition
2. Microwave Engineering by David M. Pozar; Wiley & Sons (ASIA) Pvt. Ltd.
3. Radio Frequency and Microwave Electronics by Matthew M Radmanesh
4. Microwave Circuit analysis and Amplifier Design by S. Y. Liao; Prentice Hall

1UMEP3 / 1UMEF3 ELECTIVE –I

3) COMPUTER COMMUNICATION NETWORKS

Section - A

Unit I **Review of computer networking concepts:** *(Introductory portion removed)* OSI/ISO Reference Model, TCP/IP reference models, Point to point protocols.

ARQ: Retransmission strategies.

Functional elements : Multiplexing, Switching , Networks Management & traffic controls. Delay models in Data Networks Switching techniques: Performance measures & architectural issues.

Unit II **Internetworking :** TCP/IP Internet architecture, IPV4, IPV6, IP addressing & related issues, IP address resolution techniques (ARP). IP datagram & forwarding, *Queuing Models*, *Routers*, routing algorithms.

Section - B

Unit III **Multiple access techniques:** CSMA/CD, CSMA/CA, CDMA, OFDM, Delay throughput characteristics, WLAN-Protocols**, multiple access Protocols**, Ad-hoc networks, WAP, Bluetooth Specifications, *3G Evolution and Architecture.*

Unit IV **Network security issues :** Ciphers, DES, Public key cryptography, RAS algorithm, Digital Watermarking, Attacks and Counter Measures , Service Authentication Proforma.

Text Books :

1. Communication Networks – Leon Garcia & Wadeja, Tata McGraw Hill Publication.
2. "Computer Networks and Internetworking"D.E.Comer, Pearson Education

Reference Books :

1) "Data Networks" Dimitri Bertisekas & Robert Gallager, PHI
2) "Local Area Networks", Gerd E Kieser – Mc-Graw-Hill
3) "Cryptography and Network Security: Principles and Practice", William Stallings, Pearson Education
4) "GSM, CDMA and 3G Systems" , Steele,, Wiely Students Edition

SECOND SEMESTER

2UMEP1/1UMEF4 DIGITAL COMMUNICATION TECHNIQUES

Section : - A

Unit -I Characterization of communication signal and optimum receiver for AWGN Channel :

Signal space representation, Memory less modulation methods, Linear Modulation with memory, Non linear modulation methods with memory,-CPFSK & CPM, Power spectral of linear modulated signal, CPFSK & CPM Signals, Correlation demodulator, Match filter demodulator, Optimum detector, Probability of error for binary & M-array signals.

Unit – II Source & channel coding: Discrete stationary sources, Lampel Ziv algorithm, Coding of analog sources, Rate distortion functions, Scalar quantization & vector quantization, Temporal & spectral waveform coding, BCH codes, Reed – Solomon codes, Reed Muller codes, convolution codes, transfer function of convolution codes, Viterbi decoding algorithm, stack algorithm (no problems expected) trellis coded modulation.

Section : B

Unit – III Signal Design for band limited channel & equalization.: Design of banc limited signal for zero ISI, Nyquist criterion, design of band limited signal for controlled ISI, partial response signal. Data detection for controlled ISI, Linear Equalization – peak distortion criteria, mean square error (MSE) criteria, decision feedback equalization, coefficient optimization, adaptive linear equalization, zero forcing algorithm

Unit - IV Spread Spectrum techniques : Generation of PN sequence, direct sequence spread spectrum system , processing gain, jamming margin, application of direct sequence spread spectrum signal, frequency hopped spread spectrum signal, time hopping spread spectrum signal, synchronization of spread spectrum signal - acquisition & tracking.

Text Books :

1. J G Proakis, " Digital Communication" Fourth Edi. MGH
2. Shu Lin & Costell , " Error Control Coding – Fundamentals & applications," Addison Wessley Pub.

Reference Books :

1. Bernard Sklar, " Digital Communication" Fundamental & application, Second Edi. Pearson education, Asia.
2. Simon Haykins ; Digital Communication" John Wiley & Sons.
3. J P Proakis, M Salehi, " Communication System Engineering" Second Edi. Pearson Edition (LPE)
4. Salvatore Gravano, " Introduction to Error Control Codes", 1st Edition, Oxford Press.
5. Stephen Wicker, " Theory of Error Correcting Codes", PHI
6. K S Shanmugan; " Digital & Analog Communication System" John Wiley & Sons.

2UMEP2 / 1UMEF5 EMBEDDED SYSTEM DESIGN

Section - A

Unit I : Embedded System hardware : Embedded systems overview, Hardware components like microcontroller, GPP,ASSP,AISP, SOC, Details of 32 bit ARM SoC architecture, Organisation, analog, digital & high speed I/O for embedded systems, interfacing SRAM, DRAM, flash memories with microcontroller, memory management, allocation of memory to program segments and blocks, memory maps.

Unit II : Embedded System Software : Techniques of writing efficient C code for microcontroller C data types for ARM, Signed & unsigned data types, limitation of char & char & data types, storage class – static & extern, volatile keyword, operation on bits, functions, ARM / Thumb procedural call standard, pointers & arrays, conditional statements – of-else, switch, structure, conditional loops – for & while, preprocessing, compiling, cross compiling, compiler driver, startup code and board support packages, program segments calling assembly routines in C, interrupt handling in C, interrupt latency.

Section - B

Unit III : Uniprocessor Real Time Scheduling: Real time systems, tasks and its states, task assignment & scheduling, scheduling algorithms – rate monotonic and earliest deadline first, inter-task communication, semaphore, priority inheritance protocol, priority ceiling protocol, real time operating system features, features of micro C OS – II RTOS.

Unit IV : Embedded System Architecture & Design : Embedded system implementation aspects & estimation modeling, embedded system architecture, validation and debugging of embedded systems, hardware – software co-design in an embedded system, ARM Philips NXP LPC 2148 programming on – chip components like ADC and interfacing external peripherals like keyboard, LCD, Stepper motor.

Text Books :

01) Embedded Systems (2nd Edi) by Rajkamal (Tata McGraw Hill)
02) Embedded Real-time Systems Programming by Lyer & Gupta (Tata McGraw Hill

Reference Books :

01) ARM System on chip architecture (2nd Ed) by Furber (Pearson India)
02) Intro. To Embedded systems by K.V. Shibu (MGH)
03) Philips NXP LPC 2148 user manual
04) Scheduling in Real time systems by Cottet, Delacroix & Mammeri (John Wiley & Sons)

2UMEP3/1UMEF6
DIGITAL COMMUNICATION TECHNIQUES-LAB.

2UMEP4 / 1UMEF7
EMBEDDED SYSTEM DESIGN-LAB.

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THIRD SEMESTER

3UMEP1/2UMEF1 DIGITAL IMAGE PROCESSING

Section A

UNIT I Image processing fundamental: Basic image processing Steps, Digital image representation,Image acquisition for grey scale and color, ,Human visual system Image types . Image Transforms: 2D DFT, Walsh transform ,Hadamard transform,Slant transform, Discrete transform ,KL transform, Radon transform and Multiresolution wavelet transform.

UNIT II Image Enhancement: Image enhancement in spatial domain ,Enhancement through point operation,Types of point operation, Histrogram Manipulation, linear/nonlinear grey-level transformation,Local or neighbourhood operation, median filter,spatial domain high-pass filtering,bit-plane slicing,Image enhancement in the frequency domain,homomorphic filter,zooming operation ,image arithmetic.

Section B

UNIT III Image Restoration and Denoising : Image degradation models, Types of image blur, image restoration model, linear image restoration,nonlinear image restoration techniques, blind deconvolution and classification technique ,image denoising, noise in image, median filtering, trimmed metrices in image restoration, Application of biomedical imaging

UNIT IV Image segmentation: , region approach to image segmentation, clustering technique, image segmentation based on

thresholding, edge-based segmentation , edge detection ,edge linking, Hough transform ,active contour, watershed transformation, shape representation and classification. Morphological techniques, Object & pattern recognition & interpretation method.

Image Compression : Lossy block truncation & vector quantization , lossless Huffmon coding, runlength coding & block coding , transform coding.

Text Books :

1) "Digital Image Processing By R.C Gonzales & Woods –Addison Wesley IIIrd Ed
2) "Digital Image Processing" by S Jayaraman, S Esakkirajan,T Veerakumar- Tata Mc Graw Hill.

Reference Books :

1) "Fundamental Digital Image Processing "by A.K.Jain –Prentics Hall Inc.
2) "Digital Image Processing" By W.K Pratt IIIrd ed John Wiley
3) "Digital Image Processing and Analysis" by B Chanda and D. Mujumdar-PHI new Delhi

3UMEP2 / 2UMEF2 CMOS VLSI DESIGN

Unit I: CMOS design methods, CMOS Testing, CMOS subsystem design, CMOS system case studies. Fault tolerant VLSI architectures.

Unit II: ASIC Construction: Physical design, CAD tools, system partitioning, ASIC size estimation, Power dissipation issues, FPGA partitioning methods

Unit III: Floor planning, Placement, physical design flow, information formats, global routing, detailed routing, special routing, circuit extraction and DRC

Unit IV: CMOS Analog and RF Integrated Circuits: High speed comparators, Switch capacitor filters, RF power amplifier, Mixer, PLL.

Text Books :

1) "Application Specific IC" Michael John Sebastin, Smith Addison – Wesley Publication
2) "The Design of CMOS Radio-Frequency Integrated Circuits" Thomas H. Lee – Cambridge University press

Reference Books :

1) "Principles of CMOS VLSI Design" Neil Weste and Eshraghian – Person Education

2) "CMOS Analog Circuit Design" Phillip F. Allen, Douglas R. Holberg – Oxford University Press
3) "VLSI Design" M. Michael Vai – CRC press

3UMEP3/2UMEF6 DIGITAL IMAGE PROCESSING-LAB.

3UMEP4 / 2UMEF7 CMOS VLSI DESIGN-LAB.

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FOURTH SEMESTER

4UMEP1 / 2UMEF3 PARALLEL COMPUTING

Section A

Unit I : **Introduction**

Parallel Computer Models, Flynn's classification, system attributes, multiprocessors and multicomputers, condition of parallelism, program partitioning and scheduling, program flow mechanism, performance metrics and measures, parallel processing applications, speed up performance laws.

Unit II : **Pipelining and superscalar Techniques**

Linear and non linear pipeline processors, reservation and latency analysis, collision free scheduling, instruction pipeline design, arithmetic pipeline design, superscalar and superpipeline design.

Section B

Unit III : **Parallel and scalable architectures**

Multiprocessor, Multicomputers, multivector and SIMD computers, scalable, multithread and dataflow architecture.

Unit IV : **Parallel Program Development and Environment**

Programming Parallel Computers, Parallel Programming environments, Synchronization and multiprocessing modes, multitasking,. Microtasking, autotasking, shared variable program structure, semaphores and applications, message passing program development, control decomposition techniques, heterogeneous processing.

Text Books :

1) "Advanced Computer Architecture", Kai Hwang, Parallelism, Scalability, Programmability", McGraw Hill Inc. Ed. 1993.
2) "Computer Architecture and Parallel Processing", Kai Hwang, F. A. Briggs, McGraw Hill, 1985

Reference Books :

1) "Elements of Parallel Computing", V. Rajaraman, PHI, 1990
2) "Computer organization & Architecture", William Stallings, PHI, New Delhi, 6th edition.

3) "Kalsuk' Advanced computer Architectures", Dezso'Sima, Terence Fountain & Peter Pearson's Edation. (2nd Edition)
4) "Parallel Processing for Supercomputers and AI", Hwang and Degroot (Eds) McGraw Hill.

4UMEP2 /2UMEF4 ARTIFICIAL INTELLIGENT SYSTEM

Unit I : Fuzzy set Theory, Introduction to Fuzzy sets, Fuzzy relation,Membership functions, fuzzification, defuzzification, fuzzy logic, fuzzy rule based system, fuzzy inference system.

Unit II : Fuzzy Decision Making, Fuzzy modeling, Adaptive neuro fuzzy inferencesystem, cognitive neurofuzzy modelling, Neuro fuzzy control, Application of neuro fuzzy control.

Unit III : Artificial neuron model, single and multilayer perceptron neural network (MLP), Learning process: training by backpropagation, swarm particle optimization, genetic algorithm, simulated annealing, basic concept of bidirectional associative memory (BAM), self organization feature map, optical neural network.

Unit IV: Recurrent networks, Hamming network, support vector machine**,** counter propagation networks, cluster discovery network (ART), Applications of neural network in characters recognition, forecasting, robot kinematics, biomedical signals.

Text Books :

1) "Neural Networks", S. Hykin ,Pearson Education.
2) "Fuzzy sets and Fuzzy logic Theory and Applications", George J. Klir, Bo Yuan, PHI

Reference Books :

1) "Artificial Neural Networks", Zurada
2) "Neuro Fuzzy and Soft computing", Jang, Sun, Mezutani
3) " Introduction to Neural networks using MATLAB 6.0", S.N.Sivanandan, S. Sumathi, S.N. Deepa, McGraw Hill.
4) "Neural networks, Fuzzy logic and genetic algorithms synthesis and applications", S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI
5) Intelligent Systems & controls , Laxmidhar Behera, Indrani kar (Oxford)

4UMEP3 / 2UMEF5 ELECTIVE - II

1) BIOINFORMATICS

Unit I : Intro. To bioinformatics, databases in bioinformatics, characterization in bioinformatics databases, categories of bioinformatics databases & navigating databases.

Unit II : **Biological sequence database :** Nucleotide database, literature database, protein database, Gene expressing database.

Unit III : **Tools :** Data submission tools, PDB, MMDB, CATH, FSSP, DALI & SCOp.

Unit IV : **Data Analysis Algorithms :** Sequence comparison algorithms, substitution matrics, sequence alignment algorithms.
Prediction Algorithms : Gene prediction algorithms, phyrogenetic prediction algorithms, protein structure prediction.

Text Books :

1. Bioinformatics databases, tools and algorithm by Orpita Bosu & Simminder Kaur Thukral, Oxford Uni. Press
2. Bioinformatics principles & application by Zhumur Ghosh & Bikekanand Mallick, Oxford Uni. Press.

Reference Book:

1. Intro. To Bioinformatics by Artur M. Lesk, Oxford Uni. Press.

4UMEP3 / 2UMEF5 ELECTIVE - II

2) Micro Electro Mechanical Systems

UnitI : Development of MEMS technology, present and future, challenges, Starting Materials-substrates, etching processes & patterning, material doping, bulk micromachining processes-SCREAM, PennSOIL, integration of Electronics and MEMS technology, technology characterization.

Unit II: Scaling issues of MEMS, Scaling of physical systems, computational & fabrication issues of scale. Design realization tools for MEMS : SUMMiT technology layout, design rules.

Unit III: Electro Mechanics: structural mechanics, damping, electrical system dynamics.

Unit IV: MEMS sensors: Capacitive, piezo-resistive, sensor noise. Actuators : Electrostatic, thermal, Lorentz force actuation, MEMS reliability theory & terminology.

Text Book :

1) "Micro Electro Mechanical System Design" James J. Allen - CRC Press

Reference Books:

1) "MEMS and nanotechnology based sensors and devices for communications medical and Aerospace applications", Jha A. R. - CRC Publications.
2) "MEMS Design and fabrication" Mohamed Gad-El-Hak – CRC Press
3) "MEMS : A Practical Guide to Design, Analysis and Applications" Jan G Korvink, Oliver Paul – Springer-Verlag

4UMEP3 / 2UMEF5 ELECTIVE - II

3) HIGH SPEED DIGITAL SYSTEM DESIGN

Unit I: The Importance of Interconnect Design, Ideal Transmission Line Fundamentals, Crosstalk

Unit II: Non ideal Interconnect Issues, Connectors, Packages, and Vias, Nonideal Return Paths, Simultaneous Switching Noise, Power Delivery

Unit III: Buffer Modeling, Digital Timing Analysis, Design Methodologies

Unit IV: Radiated Emissions Compliance and System Noise Minimization, High-Speed Measurement Techniques

Text Books :

1) "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices" Stephen H. Hall Garrett W. Hall, James A. McCall - John Wiley & Sons, Inc.
2) "High-Speed Digital Design: A Handbook of Black Magic" Howard Johnson – Prentice Hall publication

Reference Books:

1) "High Speed Signal Propagation: Advanced Black Magic" Howard W. Johnson
2) " Signal Integrity Issues and Printed Circuit Board Design" Douglas Brooks – Prentice Hall
3) "Signal Integrity – Simplified" Eric Bogatin – Prentice Hall
4) " Noise Reduction Techniques in Electronic Systems" Henry Ott - John Wiley & Sons.

5UMEP1 / 3UMEF1 FIFTH SEMESTER

SEMINAR AND DISSERTATION
AND TECHNICAL PAPER WRITING

6UMEP1 / 4UMEF1 SIXTH SEMESTER

SEMINAR AND DISSERTATION
AND TECHNICAL PAPER WRITING

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SYLLABUS PRESCRIBED FOR
THREE YEAR P.G. DEGREE COURSE IN
MASTER OF ENGINEERING (PART TIME)
CIVIL ENGINEERING
(ENVIRONMENTAL ENGINEERING)
SEMESTER : FIRST

1 SCEE 1 ENVIRONMENTAL SCIENCES AND CHEMISTRY

SECTION – A

The Nature and scope of Environmental Problems :- Interaction of systems, Environmental disturbances, public awareness and action, Quantification of Environmental problems.

Climatology and Meteorology:- Introduction, Basic atmospheric properties, Energy outputs and inputs, wind stability and turbulence, water in the atmosphere, climate.

Ecology :- Introduction, Energy flow in Ecosystems, food chain and trophic level, elements of limnology, Eutrophication.

Global Atmospheric change :- The green house effect and stratosphere ozone depletion, Global temperature, the green house effect, carbon dioxide, chlorofluorocarbons, the green house gases, changes in stratospheric ozone.

General Chemistry: - Law of mass action, Stoichiometry, Gas Laws.

Physical Chemistry: - Types of solution, electrical conductivity and aqueous solution, ionic theory, electrical dissociation, Buffer solutions, Indicators, Solubility products, Common ion effect, Amphoteric hydroxides, chemical equilibrium and ways of shifting it.

SECTION- B

Organic Chemistry and Biochemistry : Organic compounds of interest to environmental engineers (Details of preparation and chemical reactions involved are not required)

General preparation of the functional groups of organic compounds.

Enzymes, classification, Enzyme carbolysed reactions.

Break down and synthesis of carbohydrates, fats, protein under aerobic and anaerobic reactions.

CNP cycle under aerobic and anaerobic reactions.

Concept of B.O.D., C.O.D., T.O.C.

Colloids, Dispersion of Colloids, General and electro kinetic properties of colloids, colloidal solutions and mixtures.

Environmental Chemistry :- Water structure and anomalous behavior of water, Chemistry involved in water treatment processes like coagulation, disinfection, softening, fluoridation, defluoridation, Iron and its control

Composition and characterization of sewage, sewage sludge and gas analysis.

Chromatography :- Principles and uses in Environmental Engg.

Reference Books:

1) Introduction to Environmental Engg. and Science By Gilbert M Masters.
2) Environmental Science By Alam Singh, Vol-I, II, III.
3) Environmental Science & Engg. By Henry.
4) Fair G M, Geyr J C, Okun D A, Water and Wastewater Engineering, Vol, I & II, John Wiley & Sons, New York.
4) Chemistry for Environmental Engg. By Sawyer & McCarty.

1SCEE 2 ENVIRONMENTAL MICROBIOLOGY

SECTION A

1. Introduction to microbiology : Classification of microorganisms, prokaryotic cells, eukaryotic cells. Characterization of microorganism, microorganism of importance. Distribution of biological forms, interrelationship application in the field of Environmental Engineering.

2 Bacteria : Distribution, cytology, forms size, morphology and file structure of bacteria, nutritional requirements, metabolism, growth of bacteria, growth patterns, food microorganism relationship, Aerobic, Anaerobic growth. Factor affecting growth, generation time.

3 Bacteriology of water : Pathogens and indicator of pollution, method of isolation, enumeration and differentiation. Presumptive, confirmative and completed test for E-coli, most probable number, Membrane filter technique, indicators of pollution, sampling method, frequency, precautions.

Microbiology of food : Microorganisms associated with milk and food, diseases transmitted, food poisoning,

4 Enzymes : Nature of enzymes, mode of actions, effect of temperature, pH, salts and heavy metal, extra cellular and intracellular enzymes classification, source of enzymes, enzymes formation.

5. Fresh water biology : Flora and fauna in rivers, distribution, limnology, biological cycles, oxygen concentration, nutrient concentration, oxygen depletion, oxygen sag reaeration, Lake eutrophication and its prevention.

SECTION B

6. Algae, Fungi Protozoa and viruses : General, introduction to these groups, their role in environmental Engineering and their classification, identification, observation nutrition, reproductions, their control.

Viruses : Occurrence, special features, diseases caused by them, culturing, control of viruses.

7 Bacterial culture : Isolation of microorganisms, staining procedures, pure and mix cultures, culture characteristics, different medias, selective methods, interference, gram positive and negative bacteria laboratory culturing techniques, equipments used, microscope, autoclave, incubator, test chamber.

8 Microbiology of waste water treatment : Microorganisms, fundamental theory, theory of operations, oxygen requirements and environmental factors associated with following waste treatment methods.

- Activated sludge process
- Trickling filter
- Oxidation pond
- Sludge digestion
- Cesspools, septic tank and imhoff tank

9. Air microbiology : Types of microorganisms, Air borne diseases, sampling of air, microbial content of air, control of airborne diseases.

10. Control of microorganisms : Death of bacteria, Pattern of death, effect of temp pH, toxic substances on growth of bacteria, Antagonism and synergism. Control of microorganisms by physical agents, Control of microorganisms by chemical agents.

1 SCEE 3 ENVIRONMENTAL SCIENCES AND CHEMISTRY - LAB

Determination of :-

1) Conductivity 2) pH (indicators and pH meter) 3) Turbidity 4) Hardness (Calcium and total by EDTA method) 5) Sulphate 6) Chlorides 7)Chlorine demand and Chlorine residual (Available, Break point dose) 8) Nitrogen all types 9) DO, BOD 10) COD, TOC 11) Iron and Manganese 12)Acidity and Alkalinity 13) Fluorides 14) Solids (Fixed, suspended and Volatile) **(ANY TEN)**

1 SCEE 4 ENVIRONMENTAL MICROBIOLOGY - LAB

Study of instruments, Heterotrophic plate count, preparation of differential media isolation of bacteria by various methods, staining of bacteria, enumeration of bacteria by various methods,

M.F. technique, Control of microorganisms.

SECOND SEMESTER

2 SCEE 1 WATERSHED MANAGEMENT

SECTION A

1. INTRODUCTION : The hydrological cycle, storage, concept of storage, the watershed

2. WATER AND ENERGY : Energy movement, quality of energy, the geometry of energy, the energy budget, Instruments and limitations, the role of water in energy sphere.

3 WATER IN VEGETATION : Processes, interception, Transpiration, Evapotranspiration, calculations by using water budget, Evapotranspiration, models, storage.

4 Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams, Estimate of storage requirements.

SECTION B

5. HYDROLOGY OF GROUND WATER : Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flow nets and their constructions, Boundary conditions – Unconfined and Confined, steady and unsteady flow into wells and infiltration galleries – Evaluation of formulation constant interference, Method of images – Types, design, construction and maintenance of wells and infiltration galleries, Development of wells – well strainer – functions and selections, field tests – Hydraulics of salt water intrusions and their prevention , Ground water recharge.

6 WATERSHED DEVELOPMENT AND MANAGEMENT : Definition, Need and scope, characterization of watershed criteria survey, Basic data collection and interpretation, Establishment of watershed research stations. Watershed resource evaluation and management. Irrigation technology. Integrated farming system. Project formulation and economic analysis.

PERSPECTIVE ON WATERSHED MANAGEMENT: Methodologies for modifying the water resource environment, watershed management and large scale changes.

7 PRACTICE OF WATERSHED MANAGEMENT: Rehabilitation, Protection and Enhancement

NON POINT SOURCES OF POLLUTION : The legal basis, the process of non point source pollution control, Best management practices principles, Best management practices on wet lands.

8 RAIN WATER HARVESTING : Necessity, Methods of rain water harvesting, Requirements for design of project, community participation, Role of NGO's, Government and Municipal Corporation, Limitations, quality assurance of stored water.

Reference Books: :-

1. Watershed Hydrology by Peter E. Black.

2. Water Resources Systems, Planning and Management by R. N. Chaturvedi.

2SCEE2 ADVANCED WATER TRETMENT

SECTION A

Standards for treated waters. Surface waters. Effects of storage on water quality. Limnology. Water ecology, Thermal stratification. Seasonal Change, lake overturns. Algae, Control measures, quality of underground Waters. Nature and source of impurities. Examination of waters.

Requirements of water treatment facilities. Unit operations, Gravity systems, pumping systems. Period of design, Fluctuations in demand. Intake structures.

Principles of sedimentation and floatation. General equations for settling or discrete particulates. Hindred settling, efficiency of an ideal basin, short-circuiting. Sludge moisture content – specific gravity relationship. Up flow and sludge blanket tanks – mathematical model of the unit processes.

Theories of chemical coagulation. Nature of colloids. Zeta potential. Coagulant and their specificity. Design of mechanical flocculators. Mean velocity gradient "G", "Gt" effect of temperature and other variables. Power consumption. Mathematical Modeling.

SECTION B

Theory of filtration. System Parameter and mathematical modeling, size and shape characteristics of granular filtering materials. Preparations of filter sand, Hydraulics of filtration through homogeneous and stratified beds. Performance of slow, rapid, high-rate multiplayer and composite filters. Up flow, two way filter, dual media filter.

Pressure filters. Diatomaceous earth filters. Mico-strainers. Filterability Index.

Principles of disinfection. Factors affecting disinfection. Halogens: Chlorine, Iodine and Bromine.

Principles of aeration, System parameters and mathematical model. Methods of aeration. Theories of adsorption. Freudlich equation. Removal of taste and odor by adsorption. Removal of colour. Effects of fluorides. Fluoridation. Removal of fluorides.

Industrial water treatment: Boiler feed water. Softening of water. Reuse of water and conservation of water in industry.

Methods of Iron and Manganese removal. Use of aeration, oxidation, ion-exchange and other methods and their control.

Theory of corrosion, and corrosion control.

Reference Books:

1. Water and Waste water Engineering by Fair Geyer and Okun, John Willy and Sons
2. Water and Waste water Technology by Mark J. Hammer, John Willy and Sons
3. Water Supply and Sewerage by E. W. Steel and McGhee, McGraw Hill Company.
4. Manual on Water Supply & Treatment, CPHEEO, New Delhi.
5. Physico-Chemical Processes for Water Quality Control by Weber, John Wiley & Sons, 1972.

2SCEE3 ADVANCED WASTEWATER TREATMENT

SECTION-A

1. INTRODUCTION: Objectives of waste water treatment, Purpose of advanced wastewater treatment, Wastewater quantity and transport and waste water characteristics. Alternative flowcharts, function and basic principles involved in different units of conventional wastewater treatment plant.
2. PROCESS ANALYSIS: Reaction and reaction kinetics, Mass balance, Reactors and their hydraulic characteristics, Practical aspects of reactor design.
3. PHYSICAL AND CHEMIXCAL TREATMENT: Screening, Grit removal, flow equalizations and mixing. Flocculation, sedimentation, flotation. Detailed principles and design aspects of Screening, Grit chamber and Sedimentation tank.

SECTION-B

4. PRINCIPLES OF BIOLOGICAL TREATMENT: Kinetics of biological growth, introduction to suspended and fixed film reactors. Concepts of gas transfer and solids separation, Nitrogen and Phosphorus removal from waste water. Concepts of aerobic and anaerobic

treatment of waste water. Design of Activated Sludge system using biological process dynamics. Complete design details of Activated Sludge Process. Modifications of ASP. Process concepts and design aspects of Trickling Filters, Rotating Biological Contactors (RBC), Fluidized bed reactor/treatment.

5. SLUDGE TREATMENT AND DISPOSAL: Aerobic and Anaerobic digestion of sludge, sludge stabilization, dewatering, conditioning and disposal.
6. TERTIARY TREATMENT: Principles of tertiary treatment, theory of adsorption and factors affecting adsorption. Concepts and different methods of dissolved solids removal. Basic principles of Reverse Osmosis, Ultra-filtration, Electro dialysis, Desalination.

REFERENCE BOOKS:

1. Wastewater Engineering: Treatment, Disposal & Reuse, By Metcalf & Eddy Inc. Sixth Ed. 2002, McGraw Hill.
2. Introduction to Environmental Engg., By. P.A. Veslind, PWS, Publishing Company, Boston, 1997.
3. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
4. Wastewater Treatment Plant Planning, Design and Operation, By S.R. Quasim, Holt, Rinehart & Winston N.Y.
5. Activated Sludge Process: Theory and Practices, By N.F Grey, Oxford University Press, 1990.

THIRD SEMESTER

3 SCEE1 ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

SECTION A

1. Development and Environment, need for EIA, concept of EIA, elements of EIA, nature of impacts – primary, secondary, tertiary, short-term, long-term, local and regional, reversible & irreversible impacts
2. Overview of impacts – directly & indirectly measurable impacts w.r. to air, noise & water,
3. Screening and scoping in EIA, terms of reference for conducting EIA, methodologies of EIA-checklists, matrices, overlays, cost benefit analysis, & networks
4. Framework of EIA – scope of EIA, baseline data collection, prediction of impacts, evaluation of impacts, battelle environmental evaluation system, environmental quality monitoring.

SECTION B

1. Environmental legislation – basic concepts, critical issues, civil liability, various enactment and their provisions – Water Act (1974, 1988), Air Act (1981, 1988), Environmental Protection Act 1986, Role of State & Central boards of pollution control, local Govt., social action groups.
2. Environmental Audit – definition, concept of EA, types of environmental audit, benefits of environmental audit, scope & objectives, environmental statement, procedural aspects of conducting environmental audit, pre-audit phase, on-site audit phase & post-audit phase.
3. Sustainable development & environmental management, carrying capacity based developmental planning process, concept of carrying capacity, assimilative and supportive capacity, Environmental Management in India.
4. Resource Management

   Types of resources - terrestrial (soil) resources, minerals, plants & animals (biotic) resources, marine, fresh water, air & bioenergy resources, resource utilization-renewable and non-renewable resources, optimal use of resources, depletion of resources – causes & effects.

Reference Books:

1) Environmental Impact Assessment : Rau & Woofes.
2) Environmental Impact Assessment : W.F. Canter, McGraw Hill.
3) Proceedings of Indo-British Workshop on EIA of Petrochemical Industries and Environmental Audit, Jan. 1994, IAEM, Nagpur.
4) Handbook on Pollution Control Acts, Central Pollution Control Board, New Delhi.
5) The New Environmental Age by R. K. Sapra, S. Bhardwaj, Ashish Pub. House, New Delhi.

3 SCEE 2 AIR POLLUTION AND CONTROL

SECTION A

I Elements of air pollution: History of air pollution, Natural versus polluted atmosphere, Air quality, Sources of air pollution,.

II Effects of air pollution: Effect on human health, on vegetation and animals, on material,

III Measurement and monitoring of air pollution: Atmospheric Chemistry, Ambient air sampling, Ambient air pollutants, air pollution-monitoring & surveillance.

SECTION B

IV Meteorology of Pollution : Physics of atmosphere, . Meteorological bases of Atmospheric pollution, Transport & dispersion of air pollutants, air pollution modeling & prediction, Wind rose

V Regulatory Control of air pollution: Air quality criteria & standards Elements of Regulatory Control

VI Engg. Control of air pollution: Engg. Control concept, control device & systems ,Control of stationery sources, ,Control of mobile sources, source sampling & monitoring.

Reference Books:

1) Air Pollution, Vol. I To IV – A. C. Stern.
2) Fundamentals Of Air Pollution – Stern, Wohlers, Bouble, Lower.
3) Air Pollution & Control – P. P. Mowli & N. Venkata Subbayya.
4) Air Pollution – Rao & Rao.
5) Air Pollution Sienfeld J. H.
6) Air Pollution – Perkins.
7) Air Quality Monitoring – A Course Manual By NEERI, 19981.
8) Mechanical handbook
9) Mechanical Handling - Jolley, F. Raby, & H. Walder.
10) Fundamentals of Air pollution – R. W. Boubel, D. L. Fox, A. C. Stern

3 SCEE 3 AIR POLLUTION AND CONTROL - LAB

1) To measure CO % & NO % of the exhaust gases from vehicles or gasoline engine.
2) Determination of SPM, RSPM, SO2
3) Statistical Calculations of observed air pollution data.
4) Design of Bag filter for controlling dust pollution in particular industry – case study.
5) Design of cyclone separator.
6) Study of Air Quality Monitoring Instruments & Equipments.
7) Determination of wind velocity, wind direction, temperature, cloud cover, humidity & preparation of wind rose diagram.

3 SCEE 4 DESIGN PROBLEM - LAB

A project report on Design of Complete Water Treatment Plant or Sewage Treatment Plant or Industrial Waste Water Treatment Plant including detailed drawing and cost economics will be prepared by a group of not more than 3 Students.

Examination will be based on Viva-Voce on report submitted.

FOURTH SEMESTER

4SCEE1 INDUSTRIAL WASTEWATER TREATMENT

SECTION A

Problem of Industrial Waste Water:

Variation in quality and quantity of industrial waste water. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Indian standards for discharge of treated waste water on land, into municipal sewer and natural water courses.

Sampling procedure. Experimental evaluation of physico-chemical or biological treatment methods for treatment of the wastewater.

Approaches to minimization of problem of industrial waste water, Good house-keeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal. Cleaner Technologies of production for waste minimization.

SECTION B

Different aspects and choices of various alternatives such as:

1) Treating different effluent streams separately.
2) Treating different streams jointly after mixing them partly or fully.
3) Including/excluding domestic waste along with the industrial waste.

General approach for handling and treatment of industrial waste water with following special characteristics.

Shock loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Experimental evaluation of physico-chemical or biological treatment processes for treatment of the waste water.

Process line diagrams, characteristics and treatment of industrial waste of: -

Pulp and paper, textile, tannery, food, Canings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries.

Reference Books:

1) Waste Water Treatment, Disposal and Reuse-Mctcalf and Eddy.
2) Pollution Control in Process Industries – S. P. Mahajan.

3) Liquid Waste of Industry – Theory, Practices and Treatment Nemcrow.
4) Industrial Water Pollution Control- W. W. Eekenfelder.
5) Natural Systems for Waste Management and Treatment – S.C. Reed, E.J. Middlebrooks, R. W. Crites.
6) The Treatment of Industrial Waste – Purse Lievre E.B.
7) Water Quality Management by W.W. Eckenfelder
8) Biological Treatment of Waste Waters : W.W. Enkenfelder

4 SCEE 2 ENVIRONMENTAL SANITATION & SOLID WASTE MANAGEMENT

SECTION – A

1. Concept of environment and scope of sanitation in rural areas. Principles involved in the protection of public health by engineering measures to control the environment Rural water supply.
2. Swimming Pool sanitation – quality standards, algae control Fly and Mosquito Control – destruction of adult flies and prevention of fly breeding.
3. Food Sanitation – Public consideration, Causes of food poisoning, food storage,
4. Restaurant sanitation, Slaughter house sanitation, Milk plant sanitation, Sanitation of Hospital.

SECTION – B

5. Problems and impacts of solid waste in developing countries; Sources, types and composition of Municipal solid waste, quantity estimation and forecast, Management systems and planning.
6. Characteristis of solid waste – Sampling – physical , chemical and biological analysis. .
7. Collection of solid waste: On site handling and processing; Collection systems and service; Analysis of collection systems, collection routes; Management issues and concerns.

   Transfer and transport, design requirements.
8. Composting – Process microbiology, Aerobic and anaerobic composting, parameters affecting, Design considerations, compost control, engineering design and operations.
9. Sanitary Landfill – Process mechanism, Classification, types, siting considerations, engineering design and operations.

Reference Books:

1) Ehlens and Steel; Municipal and Rural Sanitation.
2) Wagner E. G. & Lanoik J. N.; Water Supply for Rural Areas and Small Communities, Geneva WHO.

3) Manual for Rural Water Supply, Helvetas Swiss Corporation, Divyajyoti Prakashan, Jodhpur.
4) G. Techbanoglous, Elliasen; Solid Waste Engineering, Principles and Management Issues, Mc-Graw Hill Book Co.
5) Bhide A. D. and Sudaresan B. B.; Solid Waste Management in Developing Countries, INSDOC, New Delhi.
6) D. Joseph Hagerty, Joseph L. Pavoni & John E. Heer Jr.; Solid Waste Management, Van Norstrand Reinhold Environmental Engineering Science.
7) Frank Kreith; Handbook of Solid Waste Management, Mc-Graw Hill Inc.
8) Frank Flintoff; Management of Solid Waste in Developing Countries, WHO publication.

4 SCEE 3 ELECTIVE

(1) HAZARDOUS WASTE MANAGEMENT
SECTION – A

1. Introduction to Hazardous Waste :-
Definition, Problems, general awareness, Industry and Government's perspective. Risk Assessments, Environmental legislation.
2. Hazardous waste characterization and site Treatment.
Introduction, study of characterization, Assessment of Hazardous sites, waste minimization and Resource Recovery, chemical , physical and biological treatment to Hazardous waste. Thermal process.
3. Transportation of Hazardous wastes :-
Introduction of Hazardous wastes :-
Hazardous Wastes (Handling, Storage & Management) Rules, 1989 of MoEF.
Introduction, container for Hazardous waste, bulk transport, Non bulk transport.
4. Groundwater contamination :-
Effect on human health, Historical uses and abuses, hydrology, Detection , Control and Mitigation of groundwater contamination.
5. Process Techniques and Disposal :-
Selecting the process, siting the facility, integrated land fill system as Disposal sites, Developing a new facility, operating a landfill.

SECTION – B

6. Basic Disaster Management Aspects.:-
The significance of Disaster, the Disaster threat, National Disaster Management policy, major requirement for coping with Dissester Management cycle, Disaster and National Development, Disaster legislation, counter disaster resources. International Disaster Organization, utilization of Resources.

7. Long-Term Measures :- Prevention, Mitigation.
8. Major factors for occurrence of Disaster impact
9. Response to Disaster impact
10. Major post impact factors, Disaster management support requirements.

Reference Books:

1. Hazardous Waste Management : Charles A. Wentz.
2. Hazardous Waste Minimization : Harry M. Preeman.
3. Hazardous Waste Chemistry, Toxicology and Treatment : Stanly E. Manahan.
4. Disaster Management : W. Nick Carter.

4 SCEE 3 ELECTIVE

(2) NOISE POLLUTION CONTROL
SECTION A

I Introduction, Noise pollution, Nature of noise, Characteristics of noise, NEI, Sound pressure levels, and propagation of noise.

II Source of noise, Types of sources of noise, (mobile and non mobile) comparison of noise and Air pollution standards. Assessment and measurement of sound control facilities, Monitoring procedures.

III Effects of noise on people and various protective equipments Like earplugs, earmuffs, etc. Basic principles of noise control, general noise control factors sources of vibrations.

SECTION B

IV Noise in Home & its control, control of Existing noise outside the home, Noise from construction and Civil Engineering works and its control. Noise from industry and its control.

V Road traffic noise and its control subjective rating of Automotive vehicles noise characteristics of vehicle guidelines for vehicular noise, relation between noise and engine combustion system Aircraft and Airport noise.

VI Legal Aspects of noise pollution, prediction and Assessment of Impacts on the noise Environment due to stationery and mobile noise sources. Existing legal provisions for controlling noise, International noise level standards.

Reference Books:

1) Noise Pollution - P. R. Trivedi, Gurdeep Raj
2) Environmental Noise Pollution and its Controls - G. R. Chatwal, M. C. Mehra, M. Satake

4SCEE3 ELECTIVE

(3) ENVIRONMENTAL BIOTECHNOLOGY

Basic concepts of Microbial Biochemistry of carbohydrates, proteins and lipids; structure of nucleic acids.

Biodegradation, biotransformation, microbial associations, significance of monitoring bacterial, viral and protozoan pathogens, gene probes, biosensors, immunoassay.

Basic concepts of genetic engineering, chromosomal DNA, plasmid DNA, replication of DNA, genetic code.

Transformation, transduction, conjugation, mutation, recombinant DNA techniques, biotransformation of biomass/organic waste into value added chemicals and energy.

Single cell proteins, microorganisms involved and biochemical changes of different pollutants present in liquid wastes. Types of reactors.

Reference Books:

1. Concepts in Biotechnology- Edited by Balsubramanian et al.
2. Text book of Biotechnology- Dubey.

4SCEE3 ELECTIVE

(4) REMOTE SENSING AND GIS IN ENV. ENGG.

Fundamental principles of Remote Sensing; Electromagnetic energy and its atmospheric interactions ; Remote sensing systems.

Elements of Remote sensing systems; Indian remote sensing program.

Data products and types; Interpretation techniques; Digital image processing; Image rectification, enhancement and classification.

Geographical information system, concept and characteristics.

Raster and Vector data, attribute generation and analysis.

Integrated applications of Remote Sensing and GIS in Environmental engineering, Viz. Resources management, monitoring and evaluation, modeling.

Reference Books:

1. Sabnis F.- Remote Sensing, Principles and interpretation -WH & Freeman & Co. NY.
2. Gupta R. P.- Remote Sensing
3. Jensen J. R.- Introductory Digital Image Processing -Pentice Hall NZ.

FIFTH & SIXTH SEMESTERS

5 SCEE 1 & 6 SCEE 1 SEMINAR AND DISSERTATION

A Dissertation on Recent Trends in Environmental Engineering to be submitted.

Seminar shall be delivered on the dissertation submitted.

Marks shall be based on Seminar and Viva-Voce on dissertation.

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SYLLABUS PRESCRIBED FOR

THREE YEAR P.G. DEGREE COURSE IN

MASTER OF ENGINEERING (PART TIME)

COMPUTER SCIENCE & ENGINEERING

FIRST SEMESTER

1RME1/1RMEF1 ADVANCED COMPUTER ARCHITECTURE

Unit I: Fundamentals: Technology & Computer usage trends, costs, Performance measurements. Quantitative principles of Computer design. Concepts of memory hierarchy. Instruction set architectures. Memory addressing. Operations in the instruction set. Encoding. Role of compilers. DLX architecture.

Unit II: Pipelining: Basic principles & DLX. Various hazards: Pipelines, data, control hazards. Implementation issues. Multicycle operations. Crosscutting issues. Instruction set design and piplelining. MIPS R4000 pipeline architecture.

Unit III: Advanced pipeline and instruction - level parallelism: concepts & challenges. Data hazards & dynamic scheduling. Dynamic Hardware prediction. Compiler support for ILP. Hardware support for parallelism. Studies of ILP. Power PC620.

Unit IV: Memory- hierarchy design : Basics of caches, Reducing cache miss & hit time. Main memory. Virtual memory. Protections Examples of virtual memory. Issues in the design of memory hierarchies. Alpha APX 21064 Memory hierarchy.

Unit V: Storage Systems: Types of storage devices, Buses & their types, performance I/O performance measures. Reliability, Availability and RAID. Interfacing to an Operating system. Designing an I/O system. Unix file system performance.

Unit VI: Interconnection networks: Introduction & basic concepts, Computer connection to interconnection network. Interconnection network media. Practical issues. Examples of interconnection networks. Issues for interconnection networks. Internet working. An ATM network of workstation.

Text Book:

Hennessy J.L. & Patterson D.A."Computer Architecture : A Quantitative Approach" 2/e (Harcourt Asia).

Reference Books:

1. Hayes J.P., "Introduction to Computer Architecture", (McGraw Hill)).
2. Tenanbaum A. S., "Computer Organisation and Architecture", (PHI).
3. Hwang K., "Advanced Computer Architecture", (McGraw Hill).
4. Hamacher V.C, "Computer Organization", (McGraw Hill).

1RME2/1RMEF2 ALGORITHMICS

Unit I: Introduction: Mathematical Notations, Proof techniques, Elementary algorithmics, Efficiency of algorithms : Examples. Asymptomatic notations: conditional asymptomatic notations. Notation with several parameters. Operations on asymptomatic notations.

Unit II: Algorithm analysis: Analysing control structures. Examples. Average-case analysis. Amortized analysis. Solving recurrences. Review of data structures: Arrays, Stacks, Queries, Records & Pointers, Lists, Graphs, Trees, Associative tables, Heaps.

Unit III: Greedy Algorithms: Some characteristics, Graphs: Minimum spanning trees, Shortest paths. The knapsack problem, Scheduling, Divide & Conques : Introduction - general template, Binary search, sorting, median finding & matrix multiplication. Exponentiation. Cryptograph.

Unit IV: Dynamic programming: Examples, Principle of optimality, Knapsack problem & shortest paths. Chained matrix multiplication, Recursion, Memory function. Graphs: Travarsing trees. Depth-first-search : Directed & undirected graphs : Breadth-first-search. Back tracking. Branch-and-Bound. Minimax principle.

Unit V: Probability algorithms: Introduction, pseudorandom generation. Numerical probabilistic algorithms. Monte Carlo algorithms. Las Vegas algorithms. Parallel algorithms: Basic techniques. Work & efficiency. Examples. Parallel evaluations of expressions. Parallel sorting networks & parallel sorting.

Unit VI: Computational complexity. Introduction. Information-theoretic arguments. Adversary arguments. Linear reduction, Introduction to NP-completeness. Heuristic algorithms. Approximate algorithms. NP-hard approximation problems. Approximation schemes.

Text Book:

G. Brassard, P.Bratley, "Fundamentals of Algorithmics", (PHI).

Reference Books:

1. Horowitz & Sahni, "Fundamentals of Algorithms", (Galgotia).
2. Aho, Ullman, "Analysis & Design of Computer Algorithms", (Addison-Wesley).
3. Donald E.Knuth, "The Art of Computer Programming", Vol.I, Vol.II, Vol.III, (Addison-Wesley).

1RME3/1RMEF3 OPERATING SYSTEM DESIGN

Unit-I: Introduction to OS Internals. Overview of OS and Kernel, Linux and classic UNIX kernels. Kernel Source tree. Process management in Linux: Process descriptor and task structure, process creation, implementation of threads, process termination, process scheduling.

Unit-II: Process Scheduling in Linux: The Linux Scheduling Algorithm, Preemption and Context Switching, Real-Time, Scheduler-Related System Calls, System Calls: Handler, Implementation and Context. Interrupts and Interrupt Handlers.

Unit-III: Kernel Synchronization in Linux: Critical Regions and Race Conditions, Locking, Deadlocks, Contention and Scalability. Kernel Synchronization Methods: Spin Locks, Semaphores, Completion Variables. Preemption Disabling.

Unit-IV: Time Management in Linux: Kernel Notion of Time, Hardware Clocks and Timers, The Timer Interrupt Handler, Delaying Execution. Memory Management in Linux: pages, zones, kmalloc, vmalloc, slab layer allocator, statically allocating on the stack, high memory mapping. Per-CPU Allocations.

Unit-V: The Virtual File System in Linux: common file system interface, file abstraction layer, UNIX file system, VFS, dentry object, Super block object, file object, data structure associated with file systems and with a process. The Block I/O Layer and I/O Scheduler in Linux.

Unit-VI: The Process Address Space, the Memory Descriptor, Memory Areas, Page Tables. The Page Cache and Page Write back: Page Cache, Radix Tree, Buffer Cache. Linux Kernel Modules: Building, installing, Loading and managing. Portability in Linux.

Text Book:

Robert Love, "Linux Kernel Development" Pearson Education, (2/e).

Reference Books:

i. Daniel Bovet, "Understanding the Linux Kernel" O'Reilly Publications 2/e.
ii. Rubini and J. Corbet . "Linux Device Drivers." O'Reilly and Associates, 2001.
iii. Mosberger & Eranian. "IA-64 Linux Kernel: Design & Implementation" PHI.
iv. McKusick & Neil . "The FreeBSD Operating System" Addison-Wesley, 2004.

SECOND SEMESTER

2RME1/2RMEF1 COMPUTER COMMUNICATION NETWORKS

Unit I: The need for speed and quality of service. Advanced TCP/IP and ATM Networks. The need for a protocol architecture. The TCP/IP protocol architecture. The OSI model. Internetworking, TCP, UDP, Ipv6.

Unit II: Pacekt-switching networks. Frame relay networks. ATM protocol architecture. ATM logical connections. ATM cells. ATM service categories. ATM Adaptation Layer (AAL). The emergence of high-speed LANs. Ethernet. Fibre channel. Wireless LANs.

Unit III: Overview of probability and Stochastic processes. Probability. Random variables. Stochastic processes. Queuing analysis. Why queuing analysis. Queuing models. Single-server queus. Multiserver queues. Queues with priorities. Networks of queues. Other queuing models. Estimating model parameters. Self-similarity. Self-similar data traffic. Examples of self-similar data traffic. Performance implications of self-similarity.

Unit IV: Congestion control in data networks and internets. Effects of congestion. Congestion and control. Traffic management. Congestion control in Packet-Switching networks. Frame relay congestion control. The need for flow and error control. Link control mechanisms. ARQ performance. TCP flow control. TCP congestion control performance of TCP over ATM.

Unit V: Overview of graph theory and least-cost paths. Elementary concepts of graph theory. Shortest path length determination. Internet routing principles. Distance-Vector protocol. RIP. Link-State protocol. OSPF. Path-Vector protocols. BGP and IDRP. Multicasting.

Unit VI: Integrated Services Architecture (ISA). Queuing discipline. Random early detection. Differentiatedservices. Real-Time traffic. Resource Reservation : RSVP. Multiprotocol label switching. Real-Time Transport Protocol (RTP).

Text Books:

Willam Stallings - High Speed Networks and Internets - Performance and Quality of Service, 2nd Ed., (Pearson Education).

Reference Books:

1. Andrew S. Tanenbaum - Computer Networks, 4th Ed., Pearson Education.
2. James F. Kurose, Keith W. Ross - Computer Networking: A Top-Down Approach Featuring the Internet.

3. William Stallings - Data and Computer Communications, 7th Ed., Pearson Education.
4. Andrew S. Tanenbaum - Computer Networks, 4th Ed., Pearson Education.

2RME2/2RMEF2 ADVANCED COMPILING TECHNIQUES

Unit I: Symbol-Table Structure: Storage Classes, Visibility, and Lifetimes, Symbol Attributes and Symbol-Table Entries, Local Symbol-Table Management, Global Symbol-Table Structure, Storage Binding and Symbolic Registers, Approaches to Generating Loads and Stores.

Unit II: Intermediate Representations: Issues in Designing an Intermediate Language, High-Level, Medium-Level and Low-Level Intermediate Languages, Multi-Level Intermediate Languages, Sample Intermediate Languages: MIR, HIR, and LIR, Representing MIR, HIR and LIR. ICAN Naming of Data Structures, Routines to Manipulate Intermediate Code.

Unit III: Run-Time Support: Data Representations and Instructions, Register Usage, The Local Stack Frame, The Run-Time Stack, Parameter-Passing Disciplines, Procedure Prologues, Epilogues, Calls, and Returns, Code Sharing and Position-Independent Code, Symbolic and Polymorphic Language Support.

Unit IV: Producing Code Generators Automatically: Introduction, need and applications to Automatic production of Code Generators, a Syntax-Directed Technique. Introduction to Semantics-Directed Parsing, Tree Pattern Matching and Dynamic Programming.

Unit V: Control-Flow Analysis: Various Approaches, Depth-First Search, Preorder Traversal, Post order Traversal, Breadth-Firs Search, Dominators and Post dominators, Loops, Strongly Connected Components, Reducibility, Interval Analysis, Control Trees, Structural Analysis.

Unit VI: Data-Flow Analysis: Basic Concepts, Taxonomy of Data-Flow Problems, Solution Methods: Iterative, Lattices of Flow Functions and Control-Tree-Eased. Structural Analysis, Interval Analysis, Du-Chains, Ud-Chains, Webs, SSA Form. Dealing with Arrays, Structures, and Pointers. Automating Construction of Data-Flow Analyzers.

Text Book:

Steven S. Muchnick, “Advanced Compiler Design Implementation” (Hartcourt Asia- Morgan Kaufman).

Reference Books:

1. Aho, Sethi, Ullman, “Compilers: Principles Techniques and Tools” (Pearson).
2. D. M. Dhamdhere, “Compiler Construction” (2/e), Macmillan.

3. Cooper & Torczon, "Engineering a Compiler" Elsevier.
4. K C. Louden, "Compiler Construction: Principles and Practice" Cengage.

2RME3/2RMEF6 SEMINAR

2RME4/2 RMEF7 ADVANCED COMPILING TECHNIQUES-LAB.

At least eight experiments must be performed which will include at least one experiments on each Unit.

THIRD SEMESTER

3RME1/1RMEF4 EXPERT SYSTEM DESIGN

Unit I: Introduction to Expert Systems, An Overview of Artificial Intelligence, Knowledge Representation: Principles and techniques, STRIPS planner, Subgoaling in MYCIN, Evaluating and comparing expert Systems.

Unit II: Rule Based Systems: Canonical systems, Production systems for problem solving, Conflict resolution. Associative Nets and Frame Systems: Graphs, trees and networks, The rise of associative networks, Representing typical objects and situations. Object-oriented analysis and design for expert systems.

Unit III: Representing Uncertainty: Sources of uncertainty, Expert systems and probability theory, Vagueness and possibility, The uncertain state of uncertainty. Knowledge Acquisition: Theoretical analyses of knowledge acquisition, Expert system shells, Knowledge acquisition methods, Knowledge-based knowledge acquisition.

Unit IV: Heuristic Classification (I): Classifications of expert system tasks, Classification problem solving, Classification versus construction. Heuristic Classification (II): Mapping tools to tasks, Heuristic classification in MUD and MORE, Making strategy more explicit.

Unit V: Hierarchical Hypothesize and Test: Managing complexity, Structured objects in CENTAUR, Model-based reasoning in INTERNIST, TDE as knowledge engineering workbench. Constructive Problem Solving (I): Motivation and overview, A case study: R1/XCON, Elicitation, evaluation and extensibility.

Unit VI: Tools for Building Expert Systems: Overview of expert systems tools, Expert System Shells, High-level programming languages, potential implementation problems, More maxims on expert system development. Truth Maintenance Systems: Keeping track of dependencies, Revising propositional theories, Nonmonotonic justifications, Maintaining multiple contexts.

Text Book:

Peter Jackson, "Introduction to Expert systems", Pearson Education, 3rd Edition, 2003.

Reference Books:

1. J. L. Ermine, "Expert Systems: Theory and Practice", Prentice Hall, 2003.
2. Hayes Roth, "Handbook of Expert System Design" (Addison-Wesley).
3. D. W. Patterson, "Artificial Intelligence & Expert Systems" (PHI).
4. Donal A. Waterman, "A Guide to Expert systems", Pearson Education, 2001.
5. E. Turban, "Expert Systems and Applied Artificial Intelligence", Macmillan, 2004.

3RME2/1RMEF5 DATABASE PROCESSING

Unit I: Introduction to Database Processing, File Processing Systems, Definition of Database. The Entity-Relationship (E-R) Model: Element of the E-R Model, E-R Diagrams, Examples, Database as Models of Models. The Semantic Object Model: Semantic Objects, Creating Data Models with Semantic Objects, Types of Objects, Comparison of the Semantic Object and the E-R Model.

Unit II: The Relational Model and Normalization: The Relational Model, normalization, First through Fifth Normal Forms, Domain Key Normal Forms, The Synthesis of Relations, Multi-Value Dependencies, Iteration, Optimization.

Unit III: Database Design using Entity-Relationship Models: Transformation of Entity Relationship Models into Relational Database Designs, Example Design. Trees, Networks. Database Design with Semantic Object Models: Transformation of Semantic Objects into Relational Database Design, Sample Objects.

Unit IV: Defining Relational Data, Relational Data manipulation, Relational Algebra. SQL: Querying a Single Table, Querying Multiple Tables, Exist and Not Exists, Changing Data. Database Application Design: Creating, Reading, Updating and Deleting

View Instances, Form Design, Report Design, Enforcing Constraints, Security and Control, Application Logic.

Unit V: Managing Multi-User Databases: Database Administration, Concurrency Control, Database Security, and Database Recovery. Managing Database with Oracle: Creating an Oracle Database, Application Logic, Data Dictionary, Concurrency Control, Oracle Security, Backup and Recovery.

Unit VI: Networks, Multi-Tier Architecture, and XML: Network Environments, Multi-Tier Architecture, XML-Extensible Markup Language. ODBC, OLE DB, ADO. The Web Server Data Environment, Open Database Connectivity (ODBC) Standard, JDBC, JSP with reference to databases.

Text Book:

David M. Kroenke: Database Processing- Fundamentals, Design and Implementation, 8th Edition (PHI).

Reference Books:

1. C.J. Date: Database Processing, (Addison Wesley).
2. R. Ramakrishnan: Database Management Systems, (McGraw Hill).
3. R Elmasri and S B. Navathe: Fundamentals of Database Systems, 2nd Edition.(Wiley)
4. Korth and Silberschatz " Database Processing Concepts" (McGraw Hill).

At least eight experiments must be performed which will include at least one experiments on each Unit.

3RME3/1RMEF6 EXPERT SYSTEM DESIGN-LAB.

At least eight experiments must be performed which will include at least one experiments on each Unit.

3RME4/1RMEF7 DATABASE PROCESSING

At least eight experiments must be performed which will include at least one experiments on each Unit.

FOURTH SEMESTER

4RME1/2RMEF3 REAL-TIME SYSTEMS

Unit-I: Typical Real-time applications, Hard versus Soft Real-time systems: Jobs and Processors, Release Times, Deadlines and Timing Constraints, Hard and Soft Timing Constraints, Hard Real-time systems, Soft Real-time systems. A Reference Model of Real-time system: Processors and Resources, Temporal Parameters of Real-time Workload, Periodic Task Model,

Precedence Constraints and Data Dependency, Other types of Dependencies, Functional Parameters, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy.

Unit II: Commonly used approaches to Real-time Scheduling: Clock driven Approach, Weighted Round-Robin Approach, Priority Driven Approach, Dynamic versus Static Systems, Effective Release Times and Deadlines, Optimality of the EDF and LST Algorithms, Non optimality of the EDF and LST Algorithms, Challenging in Validating Timing Constraints in Priority-Driven Systems, Off-Line versus On-Line Scheduling.

Unit III: Clock-Driven Scheduling: Notation and Assumptions, Static, Timer Driven Scheduler, General Structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of Aperiodic Jobs, Scheduling Sporadic Jobs, Practical Consideration and Generalizations, Algorithms for Constructing Static Schedules, Pros and Cons of Clock-Driven Scheduling.

Unit IV: Priority-Driven Scheduling of Periodic Tasks: Static Assumption, Fixed-Priority versus Dynamic-Priority Algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM Algorithms, A Schedulability Test for Fixed-Priority Tasks with Short Response Times, Schedulability Test for Fixed-Priority Tasks with Arbitrary Response Times, Sufficient Schedulability Conditions for the RM and DM Algorithms.

Unit V: Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumption and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth, and Weighted Fair Queuing Servers, Scheduling of Sporadic Jobs, Real-time Performance for Jobs with Soft Timing Constraints.

Unit VI: Resources and Resource Access Control: Effects of Resource Contention and Resource Access Control, Nonpreemptive Critical Sections, Basic Priority-Inheritance Protocol, Basic Priority-Ceiling Protocol, Stack-Based Priority-Ceiling (Ceiling-Priority) Protocol, Use of Priority-Ceiling Protocol in Dynamic-Priority Systems, Preemption-Ceiling Protocol, Controlling Accesses to Multiple-Unit Resources.

Text Book:

Jane W.S. Liu: Real-Time Systems, (Pearson Education).

Reference Books:

1. R Buhr and D Bailey "Introduction to Real-Time Systems" (Addison Wesley).

2. C. M. Krishna and K. G. Shin: Real-Time Systems, (McGraw-Hill), 1997.
3. Phillip A. Laplante: "Real-Time Systems Design and Analysis" (Wiley India).
4. K.V.K. Prasad "Embedded Real –Time Systems" (Wiley- India/ Dreamtech).

4RME2/2RMEF4 ELECTIVE

(1) MOBILE COMPUTING

Unit I: Characteristics, Fundamentals and Infrastructure of cellular system, Satellite system, Network protocol, Ad Hoc and sensor network, Wireless MAN's, LAN's and PAN's.
Mobile Ratio Propagation: Types of Radio waves, Propagation mechanism, Free space propagation, Land propagation, Path loss, Slow fading, Fast fading, Doppler effect, Delay spread, Coherence Bandwidth ,Inter symbol and Co-channel Interferences.

Unit II: Cellular Concept: Cell area, Signal strength and cell parameter, Capacity of a cell, Frequency reuse, Cluster, Co-channel Interference, Cell Splitting, Cell sectoring. Channel allocation: Static allocation verses Dynamic allocation, fixed channel allocation (FCA), Dynamic channel allocation, Hybrid channel allocation (HCA), Allocation in specialized system structure, System Modeling.

Unit III: Mobile communication systems: Cellular system infrastructure, Registration, Handoff parameter and underlying support Roaming support, Multicasting, Security and privacy, Firewall and system security. Exiting wireless system: AMPS, IS-41, GSM, IMT-2000.

Unit IV: Ad hoc And sensor network: Characteristic of MANET, Applications, Routing, Table – driven routing protocol, Source initiated On- demand Routing, Hybrid protocol, Wireless sensor network, Fixed wireless sensor networks.

Unit V: Wireless MANs, LANs and PAN's**:** Wireless metropolitan area networks (WMANs), Wireless Local Area networks (WLANs), and Wireless Personal Area networks (WPANs), Recent Advances, Introduction, and Ultra –wideband technology.

Unit VI: Multimedia services requirement, Push –to-talk (PTT) technology, Mobility and resources management for Integrated system, Multicast in Wireless networks, Directional and smart

antennas, Design issue in sensor networks, Bluetooth network, Low - power design, XML, Threat and security issue..

Text Book:

Agrawal D P and Zeng Q A, "Introduction to Wireless and Mobile Systems", (CENGAGE) (2/e).

Reference Books:

1. Jochen Schiller, "Mobile Communication", (Pearson Education) Second Edition.
2. C.K. Toh, "Ad Hoc Mobile Wireless Networks: Protocols & Systems", (Pearson Edu.)
3. Rajkamal, "Mobile Computing" (Oxford University Press).
4. George A, "Mobile Ad Hoc Networks: From Wireless LANs to 4G Networks" (TMH).

4RME2 /2RMEF4 ELECTIVE

(2) NETWORK SECURITY

UNIT-I **Introduction:** Security, Attacks, Computer criminals, Method of Defense
Cryptography: Substitution ciphers, Transpositions, Symmetric and asymmetric systems, cryptanalysis ,data encryption standard (DES) AES Encryption algorithms Public Key Cryptography, RSA Algorithms , Uses of Encryptions.

UNIT-II **Program Security**: Secure programs, Non-malicious program errors, Computer Viruses and Other malicious code, Targeted malicious code, controls against program threats.

UNIT-III **Operating System** Security: Protected Objects and methods of protection, Memory address protection, Control of access to general objects, File protection Mechanism, User Authentication**:**
Authentication basics, Password, Biometrics,

UNIT-IV Trusted Operating System, Security Policies, models of Security, Trusted Operating System, Design, Design elements , security features of ordinary and Trusted Operating System, Kernalised design , separation , virtualizations , Layered design , typical OS Flows assurance method , Open Source Evolutions

UNIT-V **Database Security**: Security requirements for Database , Reliability and integrity, sensitive data, interface, multilevel database, Proposals for multilevel security : separations , design of Multilevel secure databases , Trusted Front-end Practical issues

UNIT-VI **Networks Security**: Threats in networks, Network security controls, Firewalls Intrusion detection systems, Secure E-mail. **Administrating Security**: Planning, Risk Analysis, Organization security policies, Physical security

Text Book:

C.P. Pfleeger and S.L.Pfleeger, "Security in Computing", Pearson Education (LPE)

Reference Books:

1. Stallings, "Cryptography and Network Security:" Pearson Education (LPE)
2. Matt Bishop, "Computer Security: Art and Science", Pearson Education
3. Kaufman, Perlman, Speciner, "Network Security" PHI.
4. Eric Malwald, "Network Security: A Beginner's Guide", TMH.

4RME2/2RMEF4 ELECTIVE

(3) COMPUTER VISION & IMAGE PROCESSING

Unit-I: Introduction to image processing, computer vision. Digitized images: basic concepts, image digitization, sampling, and quantization, digital image properties. Data structures for image analysis: traditional data structures and hierarchical data structures.

Unit-II: Image pre-processing: pixel brightness transformation, geometrical transformation, local pre-processing, image smoothing, edge detection, scaling, parametric edge models, multi-spectral images, adaptive neighborhood pre-processing, image restoration.

Unit-III: Image Segmentation: Thresholding, threshold detection methods, optimal thresholding, Edge-based segmentation, edge image thresholding, edge relaxation, border tracing and detection, Hough transforms, region-based segmentation and matching.

Unit-IV: Shape: Region identification, contour-based shape representation and description, region-based shape representation and description, shape classes. Object recognition: knowledge representation, statistical pattern recognition, syntactic pattern recognition.

Unit-V: Image Understanding: parallel, serial processing and hierarchical control, bottom-up, model-based and combined control

strategies, point distribution models, contextual image classification, scene labeling & constraint propagation, semantic region growing.

Unit-VI: Linear discrete image transforms: Fourier, Hadamard, Discrete Cosine and Wavelets. Applications of these transforms. Image data compression: predictive methods, vector quantization, Hierarchical, progressive compression. JPEG & MPEG image compression.

Text Book:

Sonka M, Hlavac H, Boyle R, "Image Processing, Analysis, and Machine Vision", (2/e) Brooks/Cole Thomson Learning.

Reference Books:

1. Gonzalez and Woods, "Digital Image Processing" (2/e) Pearson Education.
2. Forsyth, "Computer Vision" Pearson Education.
3. Chanda and Majumdar, "Digital Image Processing and Analysis" PHI.
4. Horn B K P, "Robot Vision" MIT Press, Cambridge, MA.

4 RME 3/2RMEF5 TECHNICAL PAPER WRITING

4 RME 4/2RMEF8 REAL TIME SYSTEMS-Lab.

At least eight experiments must be performed which will include at least one experiments on each Unit.

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FIFTH /SIXTH SEMESTER

5 RME 1/6 RME 1 SEMINAR-I AND DISSERTATION

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SYLLABUS PRESCRIBED FOR

THREE YEAR P.G. DEGREE COURSE IN

MASTER OF ENGINEERING (PART TIME)

PRODUCTION TECHNOLOGY & MANAGEMENT

FIRST SEMESTER

1SPTM1 ADVANCED METAL CUTTING AND WELDING TECH.

Metal cutting theory, nomenclature system, Developments in tool mat Composites.

Design of metal cutting tools, single and multiple point cutting tools.

Tooling for NC/CNC M/c -consideration and requirements.

Non traditional metal shaping processes.

Design of drills jigs and fixtures for milling, broaching, turning, welding and assembly.

JOINING OF METALS

Welding-weldability of metals, pre and post treatments of joints, welding defects

Advance welding tech., soldering and brazing.

BOOKS RECOMMENDED:

1. Metal cutting theory and cutting tool design-Arshinov(MIR Publications)
2. Mat. and Process in manufacturing-8e, Degarmo E. Paul, J.T. Black (PHI)
3. Processes and mat. of manufacture-ROY A.Lindberg, 4e (PHI)
4. Fundamentals of metal cutting and m/c tools-Juneja (WEL)
5. Metal cutting theory and practice-A.Battacharya (Central book publisher)
6. Tool design - Donaldson, Cyrll Donaldson, G.H.Lecain, Tata Mc Graw Hill.
7. Jigs and fixtures - Kemptser
8. Jigs and fixtures - Grantt
9. Welding Tech. - Little
10. Welding Tech. - O.P.Khanna, S.Chand & Co.

1SPTM2 ADVANCED METAL FORMING & CASTING TECHNOLOGY

Sheet metal working-Shear action in die cutting, Different die cutting operation, die types & applications. Metal flow in forming & drawing dies, Different forming, bending & drawing operations die types & applications

Design of press working tools

Roll pass design, roll forming, process & design of forging dies, high velocity rate forming, High energy forming, Powder metallurgical technique & powder forming, selection of metal forming process with reference to products & their desired properties

Casting processes, classification & comparison based on different criteria, study of recent developments. Solidification of metal in casting, Metallurgical changes, study & analysis as a heat transfer problem . Feeding of casting under gravitational & external forces, design of feeding system.

Defects & testing of castings

BOOKS RECOMMENDED:

1) Technique of Press Working Sheet Metal- Eary & Reed(PHI)
2) Tool Design Donaldson(TMH)
3) Tool Design Astmf(PHI)
4) Principles of Rolling Burtsev(MIR)
5) Forging Die Design Sharan
6) Fundamentals of Casting R.A.Flymn
7) Principals of Metal Casting Heine Resenthal
8) Die Casting Deohler
9) Solidification of Casting
10) Process & Materials of Manufacture Roy A. Lindberg, 4e (PHI)

1SPTM3 ADVANCED METAL CUTTING AND WELDING TECH.-LAB.

Practicals based on above syllabus.

1SPTM4 ADVANCED METAL FORMING & CASTING TECHNOLOGY-LAB.

Practicals based on above syllabus.

SECOND SEMESTER

2SPTM1 PRODUCTION MANAGEMENT

Generalised model of prod. System, design optimisation and control of prod. System Forecasting types, demand pattern, qualitalive and quantitative forecasting models and applications Aggregate prod. And capacity planning. Master planning scheduling and Rough cut capacity planning Prod. Control functions, loading charts sequensing and scheduling models,expediting functions and short term capacity control.

High volume prod. systems-analysis of automated flow lines, assembly systems and line balancing. Mat. Management functions-standardization, simplification and diversification, purchasing functions, inventory control-static and dynamic models, objective control, inventory control under

constraints, stores functions and records, spare parts and in-process inventory.

BOOKS RECOMMENDED

1. Prod. and operations management-Dilworth
2. Prod. and operations management-Adam and Ebert
3. Prod. and operations management-Buffa
4. Automation prod. system and CIM-M.P. Groover, (PHI)
5. Hand book of mat. management-Gopalkrishnan
6. Mat. Management.-procedures, text and cases-A.K.Dutta
7. Prod./Operations management. Roger W.Schmenner
8. P.P.C.-Samuel Eilon

2SPTM2 PRODUCTIVITY AND QUALITY MANAGEMENT

Industrial Inspection I-Design considerations for gauges and measuring instruments. Tolerances for linear dimensions and dimensional chains. Limits Fits and tolerances as per I.S., inspection of threads and gears. Measurement of surface texture etc.

Industrial inspection II-Pneumatic gauging, in-process gauging, geometrical and positional tolerances, geometrical and physical limitations in metrology, automated inspection principle and methods, sensor technologies for automated inspections, CMM, flexible inspection systems, inspection probs, machine vision etc.

Quality management-Quality of products: meaning of quality, evaluation of total quality control, fundamental factors affecting quality, modern quality problems, total quality systems, quality information feedback, quality training, orientation and work force

Development Quality costs: introduction, identifying quality cost items, analysis of quality costs S.Q.C., ISO 9000.

Modern approach to productivity improvement: Quality management. Tech, QFD, Taguchi method, Poka Yoke tech., quality philosophies of quality Gurus; Deming Juran, Ishikawa, Croshy, Cmway, total quality management. Self assessment (QMS/A), Kaizen and innovation, Kanban, TPM, SMED,5S.

Total factor and partial factor productivity, measurement of productivity, qualitative tech. For improving productivity.

BOOKS RECOMMENDED:

1. Engineering M.Q.C.-I.C. Gupta
2. Quality planning and analysis-Juran, Tata Mc Graw Hill.
3. S.Q.C.-Grant
4. S.Q.C.-Juran

5. Introduction to total quality-David Goetsch and Stanley Devis
6. Automation prod. Systems-Mikell P.Groover, (PHI)
7. Total quality control-A.V.Feigenbann, Mc Graw Hill, 3e
8. Productivity Engineering and Management.-D.J.Sumanth
9. KAIZEN-M.Imai
10. Prod. and operation management-Dilworth
11. Managing for total quality-N.Logothetis
12. Profile of ISO 9000-Bureau of business practice.

2SPTM3 OPERATIONS RESEARCH TECHNIQUES

Linear programming: Formulation of O.R. problems. Simplex method, duality on linear programming, sensitivity analysis, revised simplex method.1 Integer programming, goal programming.

Dynamic programming: Characteristics of dynamic programming, stagecoach Problem, capital budgeting problem, salevman problem, production smoothing problem, forward & backward recursion

Decision theory: Decision making under uncertainty, Decision making under risk, decision trees, utility theory.

Game theory: two person Zero sum games, pure & mixed strategies, dominance, algebraic & graphical methods of solution, linear programming methods to solve mixed strategy games.

Simulation: Introduction, formulating & implementing a simulation model, role of random number in simulation, application of simulation to inventory control problems, quening problems, investment problems, & projecting network problems, role of computers in simulation.

Waiting line models Multiple server models (M/M/S)

BOOKS RECOMMENDED:

1) Askhedkar R.D. & Kulkarni R.V. : OperationsResearch, Dhanpat Rai & Sons.
2) Shenoy G.V. : Linear Programming Methods and Applications, Wiley Eastern Ltd.
3) Sharma J.K. : Operations Research Theory & Applications, Macmillan India Ltd.
4) Shenoy G.V., Srivastava U.K., Sharma S.C.: Opeartions Research & management, Wiley Eastern.
5) Hamdy A. Taha : Operations Research, An Introduction, Prentics Hall of India Pvt. Ltd., New Delhi.
6) Wagner Harvey M. : Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd.,

New Delhi. 110 001.

7. Hiller and Liberman : Opearions Research.
8) Budnick Frank S., Dennis McLeavey, Richard Mojena : Principles of Opearions Research for Management, Richard D. Irwin Inc., Homewood Illinois 60430, All India Traveller Bookseller, Delhi. 110 051
9) Ravindran, Phillips, Solberg: Oprations Research Principles and Practice, John Wiley & Sons Inc.
10) Nair N.G. : Opearions Research, Dhanpat Rai & Sons.
11) Verma A.P. : Operations Research with Numeric Analysis & Statistical Methods., S.K.Katariya & Sons, Delhi. 110 006
12) Gupta Premkumar, Hira D.S. : Operations Research, S.Chand & Co. Ltd., Ram Nagar, New Delhi. 55
13) Goel B.S., Mithal S.K. : Operations Research, Pragati Prakashan, Meerut, U.P. (India)

THIRD SEMESTER

3SPTM 1 ERGONOMICS

Introduction : ergonomics and man machine systems. Basic ergonomics, Work phycology and method of measurement of work, Paced & Unpaced performance. Design & selection of displays and controls. Application of anthropometric data and design of work place.

Laytouts, Environmental studies, industrial safety & training, case studies.

BOOKS RECOMMENDED :

1) Ergonomics Design for People at Work, Vol.I & II : Eastman Kodak Co.
2) A Guide to the Ergonomics of Manufacturing : Martin Heylander, East West Press, Teylor & Fransis.
3) Ergonomics : Man in his Working Environment : K.F.H. Murrel, Chhapman & Hall Ltd., U.S.A.
4) Ergonomics at Work : David J.Oborn, John Wiley &Sons, New York.
5) Motion & Time Studies : Ralph M.Barnes, John Wiley & Sons.
6) Motion & Time Studies : Martin E. Muldel, PHI.
7) Hand Book of Industrial Engg. : Gavriel Salvendy, John Wiley & Sons.

3SPTM2 COMPUTER INTEGRATED DESIGN & MANUFACTURING

Evaluation of CAD/CAM, integrated CAD/CAM concept, CAD applications, scope of CIM, geometric modeling, CAD process, concept of concurrent engineering.

Numerical control: introduction to NC, CNC, DNC, adaptive control

system, constructional and operational features, CNC part programming, and economics of CNC.

Introduction to GT,FMS, scope and applications, types and elements of FMS, FMS Layouts.

Robotics:Robot characteristics, motions, work space description, Robot applications in CIM.

Manufacturing system integration requirements for integrating manufacturing. Systems, CAPP, CAQC and automated mat. Handling systems.

BOOKS RECOMMENDED:

1. Computer integrated design and Manufacturing- David D. Bedworth, M.R. Henderson, Mc Graw Hill International Edition.
2. CAD/CAM Mickell P. Groover, (PHI)
3. Automation prod. Systems and CIM-Mickell P. Groover, (PHI)
4. CAD/CAM-Ibrahim Zeid
5. Computer control and management. Systems-Yoren Koren.

3SPTM 3 ERGONOMICS - LAB.

Practicals/ case studies based on above syllabus.

3SPTM 4 COMPUTER INTEGRATED DESIGN & MANUFACTURING

Practicals/ case studies based on above syllabus.

FOURTH SEMESTER

4SPTM 1 PROCESS ENGINEERING

Process planning/engineering functions, preliminary part print analysis, approaches to process planning, Dimensional analysis, " Theory of dimension chains" Tolerances analysis, Tolerance chart, purpose utilisation.

Workpiece control-Equilibrium theories, gauging, classifying operations

Selecting and planning manufacturing process; determining manufacturing sequence

Selection of equipments, standard and special equipments, classification of tooling

Process picture, operation routing, computer aided process planning, structure of CAPP, limitations, process planning system and their selection criteria.

Computer aided process planning-structure of CAPP system, limitations of cad based process planning, forward and backward

planning, implementation, criteria consideration, process planning system and their selection criteria.

BOOKS RECOMMENDED

1. Process Engineering. for Manufacturing - Eary and Johnson (PHI)
2. Computer Integrated Design and Manufacturing - David D. Bedworth (TMH)
3. Dimensional Control in Precision Manufacturing - Gadzala I.L.
4. Tolerance Control in Design and Manufacturing - Wade O.R.

4 SPTM 2 RESEARCH METHODOLOGY

1) Research concept : process of growth of knowledge, generation/ realization of new facts, establishing logic for the generated facts, scope of quantification of cause effect relationship, evolution of hypothesis.
2) Approach of formulation of the research task : literature review, sources discussions, field studies; critical analysis of generated facts, hypothetical proposals for future development, constraints for proposal selection, prioritization.
3) Research approaches : conceptual reserach, theoretical research, applied research,

   Experimental research : experimental validation of proposed logic, experimentation to generate design data.
4) Modeling & Simulation : concept of modeling, concept of simulation, types of simulation (quantitative, experimental,computer, fuzzy based, statistical), process of formulation of models based on selected type of simulation.
5) Model Optimization.
6) Formulation of hypothesis.

REFERENCES :

1) T.S.Wilkinson & P.L.Bhandarkar : Methods & Techniques of Social Research, Himalaya Pub., Mumbai.
2) Averill M. Law & W.David Kelton : Simulation, Modeling & Analysis.
3) H.Schenck Jr. : Theories of Engg. Experimentation, McGraw Hill.
4) Montgomery : Design of Experiments.
5) Bart Kasko & Klir : Nural Network & Fuzzy Systems, Prentice Hall.
6) T.J.Roff : Fuzzy Logic with Engg. Application, Tata McGraw Hill.
7) Fuzzy Sets, Uncertainties & Information, Prentice Hall.
8) S.S.Rao : Optimization Theory & Applications, Wiley Eastern.
9) Back Volumes of Journal : Modeling & Simulation, AMSE Press, France.

4SPTM3 ELECTIVE

(1) FACILITY PLANNING

Plant location-major factor influencing the location of an industry choice of site. The big city and small town plant location. Localisation of industries, social and governmental factors in plant location. Decentralisation of industries and self-sufficiency. Industrial housing, discussion on the location of some major plants in India.

Plant layout-factors influencing plant layout, balance in departments and operations, production or centers and the work places layout, product or line layout, layout by process or functions, work in progress bank, service centers, tools and techniques used in making layouts, flow diagram, process charts, machine layout, data cards, visual aids such as templates and three dimensional models, layout drawings and lot plans or model of plant, illustrative examples of representative plants in selected industries, factors indicating poor layout, means of securing more floor space. Computer aided layout-planning.

Plant building and services sizes and types of factory building and their construction, latest trends in factory building and industrial architecture, building costs of alternate types, scope for expansion lighting, poor ventilation, air-conditioning, dust removal, water, steam,compressed air, industrial waste disposal.

Industrial safety engineering-accident prevention, machinery safe guards (mechanical and electrical)- precautions against fire, explosions and health hazards-ventilation and personal protective gear, factories and allied Acts.

Material Handling:- importance of proper materials handling in increasing productivity and affecting saving, factors determine the nature of material handling equipment's, the material and its container building characteristics, equipment operating costs, volume of handling activity and annual cost analysis equipment decision, types of handling equipment, maintenance of handling equipment, illustrative examples, design of conveyors,their uses and typical applications, internal and external transportation.

REFERENCES:-

1 Materials Handling- Therodore H.Allegri Sr.
2 Material Handling System Design-James M.Apple
3 Plant Layout & Mat.Handling-Eastman
4 Plant Layout- J.M.Maore
5 Accident Prevention-Henrich
6 Industrial Safety-Black

4SPTM3 ELECTIVE

(2) MAINTENANCE & RELIABILITY ENGINEERING

Elements of pneumatic, hydraulic, electrical & electronic control systems.

Maintenance of electrical, mechanical drives & systems, std. Maintenance practice & procedures, machine diagnostics, machine condition monitoring and signature analysis.

System reliability, availability and maintainability, reliability testing, prediction & improvement, maintenance cost, evaluation of maintenance performance, FMEA, economics of replacement.

Maintenance types, work standards, logistic support, organisation for maintenance.

BOOKS RECOMMENDED :

1. Maintenance Engineering. Handbook-Higgins
2. Maintenance planning and control-Anthony Kelly
3. Industrial maintenance -H.P.Garg
4. Reliability Engineering - L.S.Srinath
5. Reliability of Engineering Systems -L.Ryabinin
6. Practical Reliability Engineering -Patric D.T. O'Connor
7. The Assurance Science -Halpern.

4SPTM3 ELECTIVE

(3) COMPUTERS IN PRODUCTION MANAGEMENT

Basic concept of data base system, Relational DBMS data structures, normalization, SQL, SQL forms, reports and loader, DBTG, subschema and schemas

Concept of DSS, architechure and application.

Expert systems development in design and manufacturing, expert system tools.

Industrial applications of AI and expert systems

BOOKS RECOMMENDED:

1. Database System Concepts, H.F.Korth, S. Sudarshan, McGraw Hill International Edition.
2. Principles of Data Base Management - Martin, (PHI)
3. Expert system - Shashikumar
4. An Introduction to Database Systems, C.J.Date, Pearson Education.
5. Introduction to Expert System - James P. Nizio
6. Artificial Intelligence - Enaine Rich & Kevin Knight

7. DSS - Spragne (Prentice Hall)
8. DSS - Jayshankar

4SPTM3 ELECTIVE

(4) PLASTIC TECHNOLOGY

New tech. for alloying of polymers, speciality FRP's & composites, Introduction to some advanced plastic alloys & speciality plastics, standard test procedures, testing devices & set-ups for plastics, Recent development in mould processes & equipments.

Parameter setting in processing of plastics, achieving quality & productivity in moulding process using techniques such as QMC, Intelligent process control etc.

Defect cause analysis & trouble shooting in plastic processing. Computer applications in moulding process.

Plastic part design: Part design for various moulding processes. Mat selection, Ribs & undercut design, parting line location, design for service requirements, aesthetics, part design for Thermoforming.

Mould design & building: mould/ die design in view of polymer melt flow behavior, mat. Shrinkage property, cooling/heating system design, gutes & flow channel design, parting line layout for split mould collapsible cores, ejector system design, design for QMC/SMED, stack mould design.

Computer aided mould design: Introduction to mould design software packages, electronic catalogues.

Mould materials, mould building methods, requirements of tool room & shop facilities for in house mould making.

Plastic packaging:unit & bulk packaging, outstanding features of plastic packaging, Globally & Nationally major emerging areas of use of plastics-medical, automobile, agriculture, Information tech. etc.

Joining of plastics: Various welding techniques for plastics, Boss, weld & seal design, adhesive selection for joining plastic parts.

Recycling of plastics:various tech., biodegradable plastics, environment protection through plastics, guidelines for processing & use of plastics.

BOOKS RECOMMENDED :

1. Plastic mat. Hand book - Brydson
2. Plastic mat. Hand book, Vol. I & II -A.S.Athaley
3. Plastics-Harry Duboise
4. Simple methods for identification of plastics-Beann(Hanser)
5. Polymer science-Birley/Haworth (Hanser)
6. Designing with plastics-Ethrenstein/Erhard (Hanser)

7. Plastic failure guide-Myer Ezrin (Hanser)
8. Injection moulding-A.S.Athley
9. How To Make Injection Moulds-Menges/Mohren (Hanser)
10. Extrusion dies for plastic & rubber-Michaeli (Hanser)
11. Technology of Thermoforming-James L.Throne (Hanser)
12. Plastics Recyling - Ebric (Henser)

4SPTM3 ELECTIVE

(5) PRODUCT DESIGN

Finite element analysis (FEA)- Introduction, physical problems, mathematical models & use of finite element solution. Finite element analysis an integral part of computer aided design.

Rapid prototyping tech- Stereo- lithography, solid grounded curing, selective laser sintering, fused deposition modeling, 3-dimensional printing, laminated object manufacturing Virtual prototyping physical prototyping v/s. virtual prototyping.

Taguchi's concept of product design & quality-Robust design testing, design and analysis of experiments using statistical techniques.

An integrated approach for product and process design-Concurrent engineering.Strategies, cost impact of design decision, concurrent engineering. Tools and methods, application of new tools, CIM & concurrent engineering.

Quality function deployment(QFD) approach for product design.

Virtual manufacturing Introduction to latest product design packages viz Pro-engineer, mechanical desktop, solid works etc.

BOOKS RECOMMENDED

1. Maynards Industrial engineering. Handbook 4th edition-William K Hodson (McGraw Hill)
2. Finite element producers-Klaus-Jurgen Bathe (PHI)
3. Managing for total quality-N. Logothesis (PHI)
4. Product design for manufacturing-A.K.Chitale & R.C.Gupta (PHI)
5. Product design and manufacture-John R Lindbeck
6. Stereo Lithography & other rapid prototyping & manufacturing technologies-Paul F Jacobs (PHI)
7. Assembly automation:The Virtual & Physical manufacturing engineering-Charles J. Cohrad
8. Quality engineering. Using robust design - M.S.Phadake (Prentice Hall)

9. Taguchi system of experiment design-Ed Don Clansing (UNIPUB-KRAUS int.pub.)

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FIFTH SEMESTER

5 SPTM 1 SEMINAR AND DISSERTATION

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SIXTH SEMESTER

6 SPTM 1 SEMINAR AND DISSERTATION

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DIRECTION

No. 32/2010 Date : 24/6/2010

Subject : Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time) (Semester Pattern .... Credit Grade System)

Whereas the schemes of teaching & examinations of Master of Engineering (Part-Time) courses has been accepted by the Academic Council vide Item No. 49 in its meeting held on 28-05-2010 as per the Credit Grade System for its implementation from the Academic Session 2010-2011,

AND

Whereas admissions to the First Year of Master of Engineering (Part-Time) courses are to be made in the Academic Session 2010-2011,

AND

Whereas the matter for admission of the students at the examinations is required to be regulated by an Ordinance,

AND

Whereas the schemes of teaching & examinations of I and II Semesters of Master of Engineering (Part-Time) courses are to be implemented from the academic session 2010-2011,

AND

Whereas the schemes of teaching & examinations are required to be regulated by the Regulation,

AND

Whereas the process of making an Ordinance and the Regulation is likely to take some time,

AND

Whereas syllabus for I and II Semesters of Master of Engineering (Part-Time) courses are to be sent for printing.

Now, therefore, I, Dr.Ku.Kamal Singh, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :

1. This Direction may be called "Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time) (Semester Pattern .... Credit Grade System) Direction, 2010.

2. This Direction shall come into force w.e.f. the sessions :
   - i) 2010-2011 for First Year,
   - ii) 2011-2012 for Second Year, and
   - iii) 2012-2013 for Third Year

3. Following shall be the Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time)
   - (i) M.E. Semester-I Examination,
   - (ii) M.E. Semester-II Examination,

   - (iii) M.E. Semester-III Examination,
   - (iv) M.E. Semester-IV Examination,
   - (v) M.E. Semester-V Examination } Exam. of V & VI Semesters shall be taken together
   - (vi) M.E. Semester-VI Examination } at the end of VI Sem.

4. Subject to compliance with the provisions of this Direction and of other Ordinances in force from time to time an applicant for admission to the Degree of Master of Engineering (M.E.) (Part-Time) shall have; Passed the Degree Examination with atleast 55 % marks Bachelor of Engineering in a branch as given below of the University or any other examination recognised by the University equivalent thereto for the part time M.E. course they must have a full time work experience of minimum 2 years in a registered firm/ company/industry/ education and research institution/ govt. deptts./ govt. autonomous organization in the relevant field in which admission is being sought.

Entry level qualification for various subject of Part Time M.E.

	M.E. Branch	Entry Level Qualification B.E. / B.Tech. of any statutory University in following branches
a)	M.E. Electrical Power System	Electrical / E.P.S.
b)	M.E. Digital Electronics	Electronics Engineering, Electronics & Power System, Electronics & Telecommunication, Industrial Electronics, Instrumentation, Electronics & Communications
c)	M.E. Environmental Engineering	Graduate of any Engg./Tech. branch
d)	M.E. Computer Science & Engineering	Computer Science & Engg., Computer Technology Computer Engineering, Electronics Engg., Electronics & Telecommunication, Information Technology
e)	M.E. Production Tech. & Management	Production, Mechanical, Industrial Engineering, Automobile

5. The Degree of Master of Engineering (Part-Time) shall be awarded to an examinee who in accordance with the provisions of this Ordinance qualifies in any one of the following subjects :-

(1) M.E. Electrical Power System (2) M.E. Digital Electronics (3) M.E. Environmental Engg. (4) M.E. Computer Science & Engineering (5) M.E. Production Technology & Management.

6. i) University shall hold Main examinations of the Part Time course for Semester-I & III in Winter every year at the end of First & Third Semesters and Supplementary examinations in Summer every year at the end of Second & Fourth Semesters.

ii) University shall hold Main examinations of the Part Time course for Semester-II, IV, V & VI in Summer every year at the end of Seond, Fourth & Sixth Semesters and Supplementary examinations in Winter every year at the end of First, Third & Fifth Semesters.

(iii) Period of Academic Term shall be such as may be notified by the University.

(iv) The examinations will be held at such places and on such dates as may be notified by the University.

7. For purposes of Instruction and Examinations students shall study sequentially.

8. Subject to his/her compliance with the provisions of this Direction and other Ordinances (Pertaining to Examinations in General) in force from time to time the applicant for admission to an examination at the end of the course of study of a particular part shall be eligible to appear at it, if;

(i) He/She satisfies the condition in the table and the provisions thereunder.

TABLE

Sr. No.	Name of Exam.	The student should have completed the term satisfactorily	The student should have passed the subjects of examination of
1.	M.E. Semester-I	M.E. Semester-I	----
2.	M.E. Semester-II	M.E. Semester-II	----
3.	M.E. Semester-III	M.E. Semester-III & M.E. Semester-I	2/3 heads of passing of & II taken together
4.	M.E. Semester-IV	M.E. Semester-IV	----
5.	M.E. Semester-V	M.E. Semester-V	M.E. Sem. I & II and 2/3 heads of passing of M.E. Sem. III & IV taken together
6.	M.E. Semester-VI	M.E. Semester-VI	----

(Note:- Subjects prescribed and numbered in the scheme of Examination shall be treated as separate subjects, however, the Theory, and Practical, if any, of the subject shall be treated as separate head of Passing.)

(ii) He/She has complied with the provisions of Ordinance pertaining to Examinations in general.

(iii) He/She has prosecuted a regular course of study in college affiliated to the university.

(iv) He/She hasin the opinion of the Principal, shown satisfactory progress in his/her studies.

9. The schemes of teaching & examinations shall be as provided under "Appendices A, B, C, D, and E" appended with this Direction.

10. The fees for each M.E. (Part Time) Examination (Theory & Practical) shall be as prescribed by University from time to time.

11. The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of an examinee shall be as given below :-

The marks will be given in all examinations which will include college assessment marks and the total marks for each Theory / Practical shall be converted into Grades as per Table II.

SGPA shall be calculated based on Grade Points corresponding to Grade as given in Table II and the Credits allotted to respective Theory / Practical shown in the scheme for respective semester.

SGPA shall be computed for I, II, III, IV and VI Semester (**V & VI Semester together**) and CGPA shall be computed in VI semester based on SGPAs of I, II, III, IV and VI Semester. :-

$$\text{SGPA} = \frac{C_1 \times G_1 + C_2 \times G_2 + \ldots\ldots + C_n G_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

Where C_1 = Credit of individual Theory / Practial

G_1 = Corresponding Grade Point obtained in the respective Theory / Practical

$$\text{CGPA} = \frac{(\text{SGPA})_I \text{ X } (\text{Cr})_I + \ldots\ldots + (\text{SGPA})_{VI} \text{ X } (\text{Cr})_{VI}}{(\text{Cr})_I + \ldots\ldots + (\text{Cr})_{VI}}$$

Where $(\text{SGPA})_{\text{I to VI}}$ = SGPA of I to VI Semester

$(\text{Cr})_{\text{I to VI}}$ = Total Credits for I to VI Semester

CGPA equal to 6.00 and above shall be considered as equivalent to First Class which shall be mentioned on Grade Card of VI Semester as a foot note.

TABLE II

THEORY & PRACTICALS:

Grade	Percentage of Marks	Grade Points
AA	85 ≤ Marks ≤ 100	10
AB	75 ≤ Marks < 85	9
BB	70 ≤ Marks < 75	8
BC	65 ≤ Marks < 70	7
CC	60 ≤ Marks < 65	6
CD	55 ≤ Marks < 60	5
DD	50 ≤ Marks < 55	4
FF	00 ≤ Marks < 50	0
ZZ	Absent in Examination	–

12. (i) The scope of the subject shall be as indicated in the syllabus.
(ii) The medium of instructions and examination shall be English.

13. Provisions of Ordinance No.18 of 2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and improvement of Division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance, 2001 shall apply to each examination under this Direction.

14. An examinee, who does not pass or who fails to present himself/ herself for the examination shall be eligible for readmission to the same examination on payment of fresh fees, and such other fees as may be prescribed.

15. As soon as possible after the examinations, the Board of Examinations shall publish a result of the examinees. The result of all examinations shall be classified as above and subjectwise merit list shall be notified as per Ordinance No.6.

16. Notwithstanding anything to the contrary in this Direction no one shall be admitted to an examination under this Direction, if he/she has already passed the same examination or an equivalent examination of any Statutory University.

17. i) Examinees who have passed in all the subjects prescribed for all the examinations of the particular subject shall be eligible for award of the Degree of Master of Engineering (Part-Time) in that subject concerned.

(ii) The Degree Certificate in the prescribed form shall be signed by the Vice-Chancellor.

Sd/-
Dr. Kamal Singh
Vice-Chancellor

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APPENDIX-A

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

ELECTRICAL ENGINEERING (ELECTRICAL POWER SYSTEM)

CREDIT GRADE SYSTEM

FIRST SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours/ Week	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assess-ment	Total	Min.Passing Marks Theory Paper	Subject	Practical Max.Marks External	Internal	Total	Min. Passing Marks
1	1SEPS1	Power System Optimization	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1SEPS2	Generation Planning & Load Dispatch	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1SEPS3	Microcomputer and Microcontroller	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12							300			
														TOTAL			300

SECOND SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours/ Week	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assess-ment	Total	Min.Passing Marks Theory Paper	Subject	Practical Max.Marks External	Internal	Total	Min. Passing Marks
1	1SEPS4	Power System Dynamics	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1SEPS5	Digital Signal Processing	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1SEPS6	Power System Lab.-I	0	0	4	4	2	-	-	-	-	-	-	50	50	100	50
			8	0	4	12	10				200					100	
														TOTAL			300

APPENDIX-A

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

ELECTRICAL ENGINEERING (ELECTRICAL POWER SYSTEM)

CREDIT GRADE SYSTEM

THIRD SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours/ Week	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assess-ment	Total	Min. Passing Marks Theory Paper	Subject	Practical Max. Marks External	Internal	Total	Min. Passing Marks
1	2SEPS1	Advanced Power System Protection	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2SEPS2	High Voltage Transmission	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2SEPS3	Power System Modeling & Control	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12							300			
															TOTAL		300

FOURTH SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours/ Week	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assess-ment	Total	Min. Passing Marks Theory Paper	Subject	Practical Max. Marks External	Internal	Total	Min. Passing Marks
1	2SEPS4	Computer Methods in Power System Analysis	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2SEPS5	Facts & Power Quality	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2SEPS6	Power System Lab.-II	0	0	4	4	2	-	-	-	-	-	-	50	50	100	50
			8	0	4	12	10				200					100	
															TOTAL		300

APPENDIX-A

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

ELECTRICAL ENGINEERING (ELECTRICAL POWER SYSTEM)

CREDIT GRADE SYSTEM

FIFTH SEMESTER

Sr.	Subject code	Subject	Lecture	Tutorial	Practical	Total	**Credits**	Internal Marks	Total	Min.Passing Marks
1	3SEPS1	Seminar and Dissertation	-	-	6	6	15	100	100	50
	Total		-	-	6	6	15		100	50
										Total : 100

SIXTH SEMESTER

Sr.	Subject	Subject	Lecture	Tutorial	Pract-ical	Total	**Credits**	External Marks	Internal Marks	Total	Min. Passing Marks
1	4SEPS1	Seminar And Dissertation	-	-	12	12	30	200	100	300	150
		TOTAL	-	-	12	12	30			300	
									GRAND TOTAL		1600

Semester V

Seminar : Seminar to be delivered on work completed during fifth semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester VI

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination

Notes : 1. Student should fill the examination form in the begining of V semester jointly for V & VI semester.

2. Single marksheet for V & VI semester together will be given to the student.

APPENDIX-B

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

DIGITAL ELECTRONICS

CREDIT GRADE SYSTEM

FIRST SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	**Credits**	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	1UMEP1	Digital Electronics	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1UMEP2	Advanced Digital Signal Processing	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1UMEP3	Elective-I	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
															TOTAL		300

Elective - I : 1) Modern Electronic Design Techniques 2) RF System Design 3) Computer Communication Network

SECOND SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	**Credits**	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	2UMEP1	Digital Communication Techniques	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2UMEP2	Embeded System Design	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2UMEP3	Digital Communication Techniques-Lab.	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
4.	2UMEP4	Embeded System Design-Lab.	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
			8	0	4	12	10				200					100	
															TOTAL		300

APPENDIX-B

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

DIGITAL ELECTRONICS

CREDIT GRADE SYSTEM

THIRD SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	3UMEP1	Digital Image Processing	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	3UMEP2	CMOS VLSI Design	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	3UMEP3	Digital Image Processing-Lab.	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
4	3UMEP4	CMOS VLSI Design-Lab.	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
			8	0	4	12	10				200					100	
															TOTAL		300

FOURTH SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	4UMEP1	Parallel Computing	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	4UMEP2	ArtificialL Intelligent Systems	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	4UMEP3	Elective-II	4	0	4	4	4	3	80	20	100	40	20	-	-	-	-
			12	0	0	12	12				300						
															TOTAL		300

Elective - II : 1) Bio-Informatics 2) Micro Electro Mechanical System 3) High Speed Digital System Design

APPENDIX-B

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

DIGITAL ELECTRONICS

CREDIT GRADE SYSTEM

FIFTH SEMESTER

Sr.	Subject code	Subject	Lecture	Tutorial	Practical	Total	**Credits**	Internal Marks	Total	Min.Passing Marks
1	5UMEP1	Seminar and Dissertation	-	-	6	6	15	100	100	50
		Total	-	-	6	6	15		100	
										Total : 100

SIXTH SEMESTER

Sr.	Subject	Subject	Lecture	Tutorial	Pract-ical	Total	**Credits**	External Marks	Internal Marks	Total	Min. Passing Marks
1	5UMEP1	Seminar and Dissertation	-	-	12	12	30	200	100	300	150
		TOTAL	-	-	12	12	30			300	
									GRAND TOTAL		1600

Semester V

Seminar : Seminar to be delivered on work completed during fifth semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester VI

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination

Notes : 1. Student should fill the examination form in the begining of V semester jointly for V & VI semester.

2. Single marksheet for V & VI semester together will be given to the student.

APPENDIX-C

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

ENVIRONMENTAL ENGINEERING

CREDIT GRADE SYSTEM

FIRST SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	1SCEE1	Environmetnal Sciences and Chemistry	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1SCEE2	Environmetnal Microbiology	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1SCEE3	Environmetnal Sciences and Chemistry -Lab	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
4	1SCEE4	Environmental Microbiology -Lab	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
			8	0	4	12	10				200					100	
														TOTAL			300

SECOND SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	2SCEE1	Watershed Management	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2SCEE2	Advanced Water Treatment	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2SCEE3	Advanced Wastewater Treatment	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
														TOTAL			300

APPENDIX-A

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

CIVIL ENGINEERING (ENVIRONMENTAL ENGINEERING)

CREDIT GRADE SYSTEM

THIRD SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	3SCEE1	Enviornmental Impact Assessment & Management	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	3SCEE2	Air Pollution and Control	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	3SCEE3	Air Pollution and Control-Lab	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
4	3SCEE4	Design Problem– Lab	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
			8	0	4	12	10				200					100	
														TOTAL			300

FOURTH SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	4SCEE4	Industrial Waste Water Treatment	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	4SCEE4	Environmental Sanitation & Solid Waste Management	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	4SCEE4	Elective	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
														TOTAL			300

Elective : 1) Hazardous Waste Management, 2) Noise Pollution Control, 3) Environmental Biotechnology, 4) Remote Sensing and GIS in Env. Engg.

APPENDIX-C

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART TIME)

ENVIRONMENTAL ENGINEERING

CREDIT GRADE SYSTEM

FIFTH SEMESTER

Sr.	Subject code	Subject	Lecture	Tutorial	Practical	Total	**Credits**	Internal Marks	Total	Min.Passing Marks
1	5 SCEE 1	Seminar and Dissertation	-	-	6	6	15	100	100	50
		Total	-	-	6	6	15		100	
										Total : 100

SIXTH SEMESTER

Sr.	Subject	Subject	Lecture	Tutorial	Pract-ical	Total	**Credits**	External Marks	Internal Marks	Total	Min. Passing Marks
1	6 SCEE 1	Seminar and Dissertation	-	-	12	12	30	200	100	300	150
		TOTAL	-	-	12	12	30			300	
									GRAND TOTAL		1600

Semester V

Seminar : Seminar to be delivered on work completed during fifth semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester VI

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination

Notes : 1. Student should fill the examination form in the begining of V semester jointly for V & VI semester.

2. Single marksheet for V & VI semester together will be given to the student.

APPENDIX-D

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

COMPUTER SCIENCE & ENGINEERING

CREDIT GRADE SYSTEM

FIRST SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	1RME1/ 1RMEF1	Advanced Computer Architecture	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1RME2/ 1RMEF2	Algorithmic	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1RME3/ 1RMEF3	Operating System Design	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
															TOTAL		300

SECOND SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	2RME1/ 2RMEF1	Computer Communication Networks	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2RME2/ 2RMEF2	Advanced Compiling Techniques	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2RME3/ 2RMEF6	Seminar	0	1	0	1	1	-	-	-	-	-	-	-	50	50	25
4	2RME4/ 2RMEF7	Advance Compiling Techniques-Lab.	0	0	2	2	1	-	-	-	-	-	-	25	25	50	25
			8	1	2	11	10				200					100	
															TOTAL		300

APPENDIX-D

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

COMPUTER SCIENCE & ENGINEERING

CREDIT GRADE SYSTEM

THIRD SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Subject	Practical Max. Marks External	Internal	Total	Min. Passing Marks
1	3RME1/ 1RMEF4	Expert System Design	4	0	0	4	4	3	80	20	100	40 50	-	-	-	-
2	3RME2/ 1RMEF5	Data Base Processing	4	0	0	4	4	3	80	20	100	40 50	-	-	-	-
3	3RME3/ 1RMEF6	Expert System Design-Lab.	0	0	2	2	1	-	-	-	-	- -	25	25	50	25
4	3RME4/ 1RMEF7	Data Base Processing-Lab.	0	0	2	2	1	-	-	-	-	- -	25	25	50	25
			8	0	4	12	10				200				100	
													TOTAL			300

FOURTH SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Subject	Practical Max. Marks External	Internal	Total	Min. Passing Marks
1	4RME1/ 2RMEF3	Real Time Systems	4	0	0	4	4	3	80	20	100	40 50	-	-	-	-
2	4RME2/ 2RMEF4	Elective	4	0	0	4	4	3	80	20	100	40 50	-	-	-	-
3	4RME3/ 2RMEF5	Technical Paper Writing	0	1	0	1	1	-	-	-	-	- -	-	50	50	25
4	4RME4/ 2RMEF8	Real Time Systems-Lab.	0	0	2	2	1	-	-	-	-	- -	25	25	50	25
			8	1	2	11	10				200				100	
													TOTAL			300

APPENDIX-D

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

COMPUTER SCIENCE & ENGINEERING

CREDIT GRADE SYSTEM

FIFTH SEMESTER

Sr.	Subject code	Subject	Lecture	Tutorial	Practical	Total	**Credits**	Internal Marks	Total	Min.Passing Marks
1	5 RME 1	Seminar and Dissertation	-	-	6	6	15	100	100	50
		Total	-	-	6	6	15		100	
										Total : 100

SIXTH SEMESTER

Sr.	Subject	Subject	Lecture	Tutorial	Pract-ical	Total	**Credits**	External Marks	Internal Marks	Total	Min. Passing Marks
1	6 RME 1	Seminar and Dissertation	-	-	12	12	30	200	100	300	150
		TOTAL	-	-	12	12	30			300	
									GRAND TOTAL		1600

Semester V

Seminar : Seminar to be delivered on work completed during fifth semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester VI

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination

Notes : 1. Student should fill the examination form in the begining of V semester jointly for V & VI semester.

2. Single marksheet for V & VI semester together will be given to the student.

APPENDIX-E

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

PRODUCTION TECHNOLOGY AND MANAGEMENT

CREDIT GRADE SYSTEM

FIRST SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	1SPTM1	Advance Metal Cutting and Welding Technology	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	1SPTM2	Advance Metal Forming and Casting Technology	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	1SPTM3	Advance Metal Cutting and Welding Technology-Lab.	0	0	2	2	1	--	--	--	--	--	--	25	25	50	25
4	1SPTM4	Advance Metal Forming and Casting Technology-Lab.	0	0	2	2	1	--	--	--	--	--	--	25	25	50	25
			8	0	4	12	10				200					100	
																TOTAL	300

SECOND SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Practical Max. Marks Internal	Practical Total	Practical Min. Passing Marks
1	2SPTM1	Production Management	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	2SPTM2	Productivity and Quality Management	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	2SPTM3	Operation Research Techniques	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
																TOTAL	300

APPENDIX-E

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

PRODUCTION TECHNOLOGY AND MANAGEMENT

CREDIT GRADE SYSTEM

THIRD SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	3SPTM1	Ergonomics	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	3SPTM2	Computer Integrated Design and Manufacturing	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	3SPTM3	Ergonomics-LAB.	0	0	2	2	1	--	--	--	--	--	--	25	25	50	25
4	3SPTM4	Computer Integrated Design and Manufacturing-Lab.	0	0	2	2	1	--	--	--	--	--	--	25	25	50	25
			8	0	4	12	10				200					100	
														TOTAL			300

FOURTH SEMESTER

Sr. No.	Subject Code	Subject	Teaching Scheme Hours/Week Lecture	Tutorial	Practical	Total Hours	Credits	Examination Scheme Theory Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks Theory Paper	Min. Passing Marks Subject	Practical Max. Marks External	Max. Marks Internal	Total	Min. Passing Marks
1	4SPTM1	Process Engineering	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
2	4SPTM2	Research Methodology	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
3	4SPTM3	Elective	4	0	0	4	4	3	80	20	100	40	50	-	-	-	-
			12	0	0	12	12				300						
														TOTAL			300

ELECTIVE: 1) FACILITY PLANNING 2) MAINTENANCE & RELIABILITY ENGINEERING
3) COMPUTERS IN PRODUCTION MANAGEMENT 4) PLASTIC TECHNOLOGY 5) PRODUCT DESIGN

APPENDIX-E

THREE YEAR POST GRADUATE DEGREE COURSE IN MASTER OF ENGINEERING (PART-TIME)

PRODUCTION TECHNOLOGY AND MANAGEMENT

CREDIT GRADE SYSTEM

FIFTH SEMESTER

Sr.	Subject code	Subject	Lecture	Tutorial	Practical	Total	**Credits**	Internal Marks	Total	Min.Passing Marks
1	5 SPTM 1	Seminar and Dissertation	-	-	6	6	15	100	100	50
	Total		-	-	6	6	15		100	
										Total : 100

SIXTH SEMESTER

Sr.	Subject	Subject	Lecture	Tutorial	Pract-ical	Total	**Credits**	External Marks	Internal Marks	Total	Min. Passing Marks
1	6 SPTM 1	Seminar and Dissertation	-	-	12	12	30	200	100	300	150
		TOTAL	-	-	12	12	30			300	
									GRAND TOTAL		1600

Semester V

Seminar : Seminar to be delivered on work completed during fifth semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester VI

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination

Notes : 1. Student should fill the examination form in the begining of V semester jointly for V & VI semester.

2. Single marksheet for V & VI semester together will be given to the student.