School of Engineering & Technology,

Vikram University Ujjain

Master of Technology

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

First Semester- Master of Technology

Digital Communication

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assign ments/ Quiz	End Sem. Practical /Viva	Practical Record/ Assignme nt/Quiz /Present ation	
1.	MTDC-101	DSP Application	3	1	-	4	70	20	10	-	-	100
2.	MTDC-102	Embedded System & Micro controllers	3	1	-	4	70	20	10	-	-	100
3.	MTDC-103	Principles of Sensors & Signal Conditioning	3	1	-	4	70	20	10	-	-	100
4.	MTDC-104	Advance Computer Networks	3	1	-	4	70	20	10	-	-	100
5.	MTDC-105	Elective -I	3	1	-	4	70	20	10	-	-	100
6.	MTDC-106	Lab-I (102)	-	-	6	6	-	-	-	90	60	150
7.	MTDC-107	Lab-II (104)	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

Elective-I (Select any one from A/B/C/D)

(A) Software Engineering (B) Database Management System (C) Advance Distributed Systems (D) Mobile & Satellite Communication

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Second Semester- Master of Technology

(Digital Communication)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assign ments /Quiz	End Sem. Practical /Viva	Practical Record/ Assignment /Quiz/P resentati on	
1.	MTDC-201	IoT Architecture and Protocols	3	1	-	4	70	20	10	-	-	100
2.	MTDC-202	Wireless Sensor Networks	3	1	-	4	70	20	10	-	-	100
3.	MTDC-203	Network Design Technology	3	1	-	4	70	20	10	-	-	100
4.	MTDC-204	Optical Network	3	1	-	4	70	20	10	-	-	100
5.	MTDC-205	Elective- II	3	1	-	4	70	20	10	-	-	100
6.	MTDC-206	Lab-III (201)	-	-	6	6	-	-	-	90	60	150
7.	MTDC-207	Lab-IV (203)	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

Elective-II (Select any one from A/B/C)

(A) Mobile Application Development (B) Block chain Technology (C) Cloud and Fog Computing

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Third Semester- Master of Technology

(Digital Communication)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical /Viva	Practical Record Assignment/ Quiz /Presentation	
1.	**MTDC- 301**	Comprehensive Viva & Seminar	-	-	6	6	-	150	150
2.	**MTDC- 302**	Dissertation Part I	-	-	14	14	250	100	350
		Total	-	-	20	20	250	250	500

L:Lecture- T:Tutorial- P:Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Fourth Semester-Master of Technology

(Digital Communication)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical/Viva	Practical Record/ Assignment /Quiz /Presentation	
1.	MTDC 401	DissertationPart-II	-	-	20	20	300	200	500
		Total	-	-	20	20	300	200	500

L:Lecture- T:Tutorial- P:Practical

School of Engineering & Technology, Vikram University,Ujjain(M.P.)

Scheme of Examination

First Semester- Master of Technology

(Thermal Engineering)

S. No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Marks for End Sem. Examination		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical /Viva	Practical Record/ Assignment/ Quiz /Presentation	
1.	MMTP-101	Advanced Solar Energy System	3	1	-	4	70	20	10	-	-	100
2.	MMTP-102	Advanced Thermodynamics and Combustion	3	1	-	4	70	20	10	-	-	100
3.	MMTP-103	Advanced Heat Transfer	3	1	-	4	70	20	10	-	-	100
4.	MMTP-104	Advanced Fluid Mechanics	3	1	-	4	70	20	10	-	-	100
5.	MMTP-105	Steam and Gas Turbine	3	1	-	4	70	20	10	-	-	100
6.	MMTP-106	Lab-I	-	-	6	6	-	-	-	90	60	150
7.	MMTP-107	Lab-II	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

Lab I – Thermal Engineering Lab

Lab II – Heat Transfer Lab.

School of Engineering & Technology, Vikram University,Ujjain(M.P.)

Scheme of Examination

Second Semester- Master of Technology

(Thermal Engineering)

S. No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical /Viva	Practical Record/Assignment/ Quiz/Presentation	
1.	MMTP-201	Design of Thermal Power Plant	3	1	-	4	70	20	10	-	-	100
2.	MMTP-202	Design of Heat Exchangers	3	1	-	4	70	20	10	-	-	100
3.	MMTP-203	Advance Refrigeration & Air Conditioning Systems	3	1	-	4	70	20	10	-	-	100
4.	MMTP-204	Computational Fluid Dynamics	3	1	-	4	70	20	10	-	-	100
5.	MMTP-205	Elective	3	1	-	4	70	20	10	-	-	100
6.	MMTP-206	Lab-III	-	-	6	6	-	-	-	90	60	150
7.	MMTP-207	Lab-IV	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L:Lecture- T:Tutorial- P:Practical

Elective:

(A) Energy Conservation and Management
(B) Advanced I.C. Engines
(C) Computer Aided Design of Thermal System

Lab-III - Advance Refrigeration and Air conditioning Systems
Lab-IV- Computational Fluid Dynamics

School of Engineering & Technology, Vikram University, Ujjain (M.P.)

Scheme of Examination

Third Semester- Master of Technology

(Thermal Engineering)

S. No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz/Presentation	
1.	MMTP-301	Comprehensive Viva & Seminar	-	-	6	6	-	150	150
2.	MMTP-302	Dissertation Part-I (Literature Review/Problem Formulation/ Synopsis)	-	-	14	14	250	100	350
		Total	-	-	20	20	250	250	500

L:Lecture- T:Tutorial- P:Practical

School of Engineering & Technology, Vikram University,Ujjain(M.P.)

Scheme of Examination

Fourth Semester-Master of Technology

(Thermal Engineering)

S. No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical/ Viva	Practical Record/ Assignment/ Quiz/ Presentation	
1.	MMTP-401	DissertationPart-II	-	-	20	20	300	200	500
		Total	-	-	20	20	300	200	500

L:Lecture- T:Tutorial- P:Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

First Semester-Master of Technology

(Structural Engg.)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz /Presentation	
1.	MVSE-101	Design of Earthquake Resistant Structures	3	1	-	4	70	20	10	-	-	100
2.	MVSE-102	Strength of material and theory of elasticity	3	1	-	4	70	20	10	-	-	100
3.	MVSE-103	Advance Structural Analysis	3	1	-	4	70	20	10	-	-	100
4.	MVSE-104	Design of Concrete Structures	3	1	-	4	70	20	10	-	-	100
5.	MVSE-105	Computer Aided Design	3	1	-	4	70	20	10	-	-	100
6.	MVSE-106	Lab-I Concrete	-	-	6	6	-	-	-	90	60	150
7.	MVSE-107	Lab-II Cad	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L: Lecture - T: Tutorial - P: Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Second Semester- Master of Technology

(Structural Engg)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical /Viva	Practical Record/ assignment/ Quiz / presentation	
1.	MVSE 201	Structural Dynamics	3	1	-	4	70	20	10	-	-	100
2.	MVSE 202	FEM in Structural Engineering	3	1	-	4	70	20	10	-	-	100
3.	MVSE 203	Advance Concrete Technology	3	1	-	4	70	20	10	-	-	100
4.	MVSE 204	Analysis and Design of Multistoried Buildings	3	1	-	4	70	20	10	-	-	100
5.	MVSE 205	Theory of Plates and Shells	3	1	-	4	70	20	10	-	-	100
6.	MVSE 206	Lab-III Instrumentation	-	-	6	6	-	-	-	90	60	150
7.	MVSE 207	Lab-IV Structural Software Engg.	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L: Lecture - T: Tutorial - P: Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Third Semester- Master of Technology

(Structural Engineering)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical /Viva	Practical Record Assignment/ Quiz /Presentation	
1.	**MVSE- 301**	Comprehensive Viva & Seminar	-	-	6	6	-	150	150
2.	**MVSE- 302**	Dissertation Part I	-	-	14	14	250	100	350
		Total	-	-	20	20	250	250	500

L:Lecture- T:Tutorial- P:Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Fourth Semester- Master of Technology

(Structural Engg.)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assign ments /Quiz	End Sem. Practic al/Viva	Practical Record/ Assignm ent/Quiz /Present ation	
1.	MVSE 401	Dissertation Part-II	-	-	20	20	-	-	-	300	200	500
		Total	-	-	20	20	-	-	-	300	200	500

L: Lecture - T: Tutorial - P: Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

First Semester- Master of Technology

(Power System Automation)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz /Presentation	
1.	**MTPA 101**	Smart Grid Technologies and Smart Energy Management System	3	1	-	4	70	20	10	-	-	100
2.	**MTPA 102**	Power System Dynamics Analysis & Control	3	1	-	4	70	20	10	-	-	100
3.	**MTPA 103**	Advance Power System Protection Relays	3	1	-	4	70	20	10	-	-	100
4.	**MTPA 104**	Elective- I	3	1	-	4	70	20	10	-	-	100
5.	**MTPA 105**	Elective- II	3	1	-	4	70	20	10	-	-	100
6.	**MTPA 106**	Lab-I	-	-	6	6	-	-	-	90	60	150
7.	**MTPA 107**	Lab-II	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L: Lecture - T: Tutorial - P: Practical

Elective- I A) Reliability Evolution of Power Systems B) POWER QUALITY & CONDITIONING

Elective- II A) Power System Economics & Trading B) MODELLING SIMULATION & EVOLUTIONARY TECHNIQUES

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Second Semester- Master of Technology

(Power System Automation)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Theory Slot)			Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Exam.	Tests (Two)	Assignments /Quiz	End Sem. Practical/ Viva	Practical Record/ Assignment/Quiz /Presentation	
1.	**MTPA 201**	Reactive Power Control & Facts	3	1	-	4	70	20	10	-	-	100
2.	**MTPA 202**	Computer Network & Cyber Security	3	1	-	4	70	20	10	-	-	100
3.	**MTPA 203**	Advanced Computer methods in Power systems	3	1	-	4	70	20	10	-	-	100
4.	**MTPA 204**	WIND ENERGY, SMALL HYDRO AND NEW RENEWABLE ENERGY TECHNOLOGIES	3	1	-	4	70	20	10	-	-	100
5.	**MTPA 205**	SCADA Systems	3	1	-	4	70	20	10	-	-	100
6.	**MTPA 206**	Lab-III	-	-	6	6	-	-	-	90	60	150
7.	**MTPA 207**	Lab-IV	-	-	6	6	-	-	-	90	60	150
		Total	15	5	12	32	350	100	50	180	120	800

L: Lecture - **T: Tutorial -** **P: Practical**

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Third Semester- Master of Technology

(Power System Automation)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical /Viva	Practical Record Assignment/ Quiz/ Presentation	
1.	**MTPA- 301**	Comprehensive Viva & Seminar	-	-	6	6	-	150	150
2.	**MTPA-302**	Dissertation Part- I (Literature Review/Problem Formulation/ Synopsis)	-	-	14	14	250	100	350
		Total	-	-	20	20	250	250	500

L: Lecture- T: Tutorial- P: Practical

School of Engineering and Technology, Vikram University, Ujjain (M.P)

Scheme of Examination

Fourth Semester-Master of Technology

(Power System Automation)

S.No.	Subject Code	Subject Name	Periods per week			Credits	Maximum Marks (Practical Slot)		Total Marks
			L	T	P		End Sem. Practical/Viva	Practical Record/ Assignment /Quiz /Presentation	
1.	MTPA-401	DissertationPart-II	-	-	20	20	300	200	500
		Total	-	-	20	20	300	200	500

L: Lecture- T: Tutorial- P: Practical

School of Engineering and Technology (SoET)

Swami Vivekanand Snatak Bhawan,

Vikram University, Dewas Road, Ujjain (M.P)

Program outcome of Master of Technology :

- Students successfully engage themselves in practice of engineering with capability of assimilating undergraduate fundamentals as well as advanced knowledge of their respective fields.
- Postgraduates will continue perpetual learning for professional advancement in engineering, contribute new knowledge and apply innovatively in an appropriate context within the field as well as multi-disciplinary situations; imbibing concern for eco-system, and an attitude to serve society & humanity at large.
- Postgraduates will have the ability to identify a significant research or development problem to undertake for their dissertation work and have capability to document the results in lucid and articulate form.

M Tech in Digital Communication

Program Specific Outcome:

- To acquire in-depth knowledge of communication systems and engineering , including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- To extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective) to the development of scientific/technological knowledge in one or more domains of communication engineering.
- To create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations of communication engineering.

MTDC – 101 DSP APPLICATION

Course Outcome

1. TO interpret, represent and process discrete/digital signals and sytems
2. To have a understanding of frequency domain analysis of discrete time signals.
3. Ability to design & analyze DSP systems like FIR and IIR Filter etc.

UNIT I

Review of Discrete time signals: sequences, representation. Discrete time systems: linear, time
in variant, LTI systems, properties, and constant coefficients difference equations. Frequency Domain representation of discrete time signals and systems.

Unit II

Review of Z Transform – Properties, ROC, Stability, Causality, Criterion. Inverse Z Transform, Recursive and Non Recursive systems, Realization of discrete time system.

Unit III

DFT: Properties, Linear and Circular convolution, Discrete Cosine Transform, Relationship between DFT and DCT. Computation of DFT: FFT/Decimation in Time and Decimation in Frequency.

Unit IV

FIR and IIR systems: Basic structure of FIR and IIR, Bilinear Transformation, Design of Discrete time IIR filter-Butterworth , Chebychev , Inverse Chebychev , Elliptic etc. Design of FIR filters by windowing – Rectangular, Bartlett, Hann, Hamming, Kaiser, Window filter, Design method relationship of Kaiser to other window. Application of MATLAB for Design of Digital filter. Effect of Finite register length in filter Design.

Unit V

Discrete time Random signals: Discrete time random process, Averages, Spectrum Representation of finite energy signals, response of linear systems to random signals. power spectrum estimation: Basic principals of spectrum estimation, estimate of auto con variance, power spectrum ,cross con variance and cross spectrum.

Advance signal processing technique and transforms: multi rate signal processing- down sampling/up sampling, introduction to discrete Hilberts Transform, Wavelet Transform, Haar Transform etc.

1. Discreate time signal Processing by Opperenheim & Schaffer PHI 2nd Edition
2. Digital Signal Processing using MATLAB by S.Mitra
3 Digital Signal Processing By Proakis Pearson Education
4. Theory & application of Digital Signal Processing by L.R.Rabiner & B. Gold PHI

MTDC 102- EMBEDDED SYSTEM AND MICROCONTROLLERS

Course Outcome:

1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
2. Understand the basics of Microcontrollers and describe the internal architecture of microcontroller systems, including counters, timers, ports, and memory.
3. Do programming for microcontrollers
4. Interface a microcontroller system to user controls and other electronic systems
5. Demonstrate knowledge of ARM and AVR microcontrollers

Unit I

Fundamentals of Embedded System: Embedded systems vs General Computing systems, Classification, Applications, Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components, Safety and reliability, environmental issues. Ethical practice. Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency. Embedded Product development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML.

Unit II

8051 Microcontroller Basics: Microcontrollers Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes

Unit III

Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051. Basics of serial communication, 8051 connection to RS232, 8051 serial port

programming in assembly, serial port programming in 8051. 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52

Unit IV

Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and sensor interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. Motor control: Relay, PWM, DC and stepper motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM. 8051 interfacing with 8255: Programming the 8255, 8255 interfacing

UnitV

Introduction to PIC, AVR family of microprocessors & ARM processors:Introduction, Salient features and Architecture of 8 bit PIC and AVR microcontroller s and 32 bit ARM processor.

Reference Books:

1. Ayala J.K., The 8051 Microcontroller: Architecture, programming and applications, Penram International
(2005) 3rd ed.
2. Mazidi,E. and Mazidi,F., The 8051 Microcontroller and Embedded Systems, Prentice-Hall of India (2004)
2nd ed.
3. Peatman J., Embedded system Design using PIC18Fxxx, Prentice Hall, 2003.
4. Raj Kamal, "Microcontroller - Architecture Programming Interfacing and System Design" 2nd Edition,
Pearson Education, 2011
5. Joseph Yiu," The Definitive Guide to the ARM Cortex-M3", Second Edition, Elsevier Inc. 2010.
6. Dr. K.V.K. Prasad, "Embedded / Real-Time Systems: Concepts, Design and Programming Black Book" ,
New ed (MISL-DT) Paperback – 12 Nov 2003
7. Ajay Deshmukh, "Microcontroller - Theory & Applications", Tata McGraw Hill, 2005 .
8. Shibu K.V, Introduction to embedded systems, Tata McGraw Hill

MTDC 103 - PRINCIPLES OF SENSORS AND SIGNAL CONDITIONING

Course Outcome:

1. Use concepts and common methods for converting a physical parameter into an electrical quantity
2. Know about the Sensor Materials and Technologies
3. Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc.
4. Evaluate performance characteristics of different types of sensors
5. Compete in the design, construction, and execution of systems for measuring physical quantities

UNIT I

Sensor Classification, Sensor Characteristics, Physical Principles of Sensing, Optical Components of Sensors Interface Electronic Circuits: Signal Conditioners, Sensor Connections, Excitation Circuits, Analog-to-Digital Converters, Integrated Interfaces, Data Transmission, Noise in Sensors and Circuits, Batteries for Low-Power Sensors, Energy Harvesting

UNIT II

Sensor Materials and Technologies; Occupancy and Motion Detectors: Ultrasonic Detectors, Microwave Motion Detectors, Micropower Impulse Radars, Ground Penetrating Radars, Capacitive Occupancy Detectors, Triboelectric Detectors, Optoelectronic Motion Detectors, Sensor Structures, Visible and Near IR Light Motion Detectors, Far-Infrared Motion Detectors, Optical Presence Sensors, Pressure-Gradient Sensors, 2D Pointing Devices, Gesture Sensing, Tactile Sensors

UNIT III

Position, Displacement and Level: Potentiometric Sensors, Piezoresistive Sensors, Capacitive Sensors, Inductive and Magnetic Sensors, Optical Sensors, Thickness and Level Sensors Velocity and Acceleration: Stationary Velocity Sensors, Inertial Rotary Sensors, Inertial Linear Sensors (Accelerometers)

UNIT IV

Force, Strain, and Tactile Sensors: Strain Gauges, Pressure-Sensitive Films, Piezoelectric Force Sensors, Piezoelectric Cables, Optical Force Sensors Pressure Sensors: Concepts and units of pressure, Mercury Pressure Sensor, Bellows, Membranes, and Thin Plates,

Piezoresistive Sensors, Capacitive Sensors, Optoelectronic Pressure Sensors, Indirect Pressure Sensor,

and Vacuum Sensors Flow Sensors: Basics of Flow Dynamics, Pressure Gradient Technique, Thermal Transport Sensors, Ultrasonic Sensors, Electromagnetic Sensors, Drag Force Sensors, Dust and Smoke Detectors,

UNIT V

Microphones: Microphone characteristics, Microphone Types Humidity and Moisture Sensors: Concept of Humidity, Capacitive and Resistive humidity Sensors, Electrical Conductivity Sensors, Thermal Conductivity Sensor, Optical Hygrometer, Oscillating Hygrometer

Light Detectors: Image Sensors, UV Detectors, Thermal Radiation Detectors, Detectors of Ionizing Radiation, Temperature Sensors, Chemical and Biological Sensors.

Reference Books:1.

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 5th edition, Springer, New York.

2.Jon. S. Wilson, "Sensor Technology Hand Book", 1st edition, Elsevier, Netherland.

MTDC 104 - ADVANCE COMPUTER NETWORKS

Course Outcomes:

1. Enumerate the layers of the OSI model and TCP/IP model and explain the function(s) of each layer.
2. Acquire the skills of subnetting and routing mechanisms.
3. Understand the protocols of computer networks, Design and implement networking protocols.
4. Understand the applications of transport layer protocols.
5. Identify core networking and infrastructure components, and the roles they serve.

UNIT I

Importance of computer networks, broadcast and point to point networks, Local area networks and Wide area networks , ISO-OSI reference model, TCP/IP model , interfaces and services, Protocol data unit, connection oriented and connectionless services, service primitives, Binding Protocol Address- ARP & RARP, packet format, Encapsulation, Data link layer and its functions, MAC and LLC Sub layer

UNIT II

Network layer- IP Addressing: Address space, Notations, Classfull addressing, Network Address Translation (NAT); Internet Protocol (IP): Datagram Format, Fragmentation, Options; ICMPv4: Messages, Debugging, Tools, ICMP, Checksum; IPv6 Addressing: Representation, address space, address space allocation, Autoconfiguration, Renumbering; Transition from IPv4 to IPv6: Dual Stack, Tunneling, Header Translation; IPv6 Protocol: Packet format, Extension Header

UNIT III

Network layer- Introduction toInter–domain, Intra-domain Routing; Routing Algorithms: Distance Vector Routing, Bellman Ford algorithm, Link State Routing, Path Vector Routing, Unicast Routing Protocols: Internet Structure, Routing Information Protocol(RIP), Open Shortest Path First(OSPF), Border Gateway Protocol Version 4(BGP4), Introduction: Unicast, Multicast and Broadcast; Intradomain Multicast Protocols:Mulicast Distance vector(DVMRP), Multicast Link State(MOSPF), Protocol Independent Multicast(PIM)

UNIT IV

Transport Layer-User Datagram Protocol: User Datagram, UDP Services, UDP Applications; Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options; SCTP: SCTP Services, SCTP Features, Packet Format, An SCTP Association, Flow Control, Error Control.

UNIT V

Application layer- World Wide Web and HTTP; File Transfer: FTP and TFTP; Electronic Mail: Architecture, Web- Based Mail, Email Security, SMTP, POP, IMAP and MIME, SNMP; DNS – Concept of Domain Name space, DNS Operation; DHCP- Static and Dynamic Allocation, DHCP Operation; Remote Login: TELNET, and SSH; Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP; Virtual Private Network: VPN Technology.

Reference Books:

1. Forouzan Behrouz A., "Internetworking with TCP/IP", McGraw Hill Education
2. Comer Douglas E., "Internetworking with TCP/IP", Volume I,II Fourth Edition, Prentice Hall of India
Private Limited
3. Tanenbaum Andrew S., "Computer Networks", PHI Learning

MTDC 105 (A) SOFTWARE ENGINEERING

Course Outcomes:

1. Understand the fundamental concepts of Software Engineering and software development life cycle.
2. Analyze a problem, identify and define the user and system requirements and design a software system and its process to meet user needs.
3. Evaluate and select and software systems considering user needs.
4. Evaluate processes and products against the applicable standards and metrics.
5. Assist in the creation of an effective software project plan and analyze software risks and identify mitigation strategies.

Unit I

Nature of Software, Software Engineering, Software Development Life Cycle, Software Process, Software Engineering Practice, Software Process Models: Linear, RAD, Incremental, Spiral, Component-based development, Fourth Generation Techniques, CMM

Unit II

Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements, Software Requirement Specification, Design within the context of Software Engineering, Design Process, Design Concepts, and Design Model-Software Architecture

Unit III

Strategic Approach to Software Testing, Testing Principles, Strategic Issues, Test Strategies for Conventional Software, Software Testing Fundamentals, Testing Techniques: Black box Testing, White box Testing and their types, Testing Strategy: Unit, Testing, Integration Testing, Validation Testing, System Testing, Regression Testing, Code walkthrough and reviews, Reliability models

Unit IV

Software Measures and Metrics, Product and Process Metrics, Metrics for the Requirements Model, Metrics for the Design Model - Architectural Design Metrics, Object-Oriented Design, Software Measurement, Metrics for Software Quality,Software cost estimation, COCOMO model, Software Quality Assurance

Unit V

Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring and Management, RMMM Plan, Software Maintenance, Software Supportability, Reengineering, Reverse Engineering.

Reference Books:

1. Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGrawHill,
2. Ian Sommerville, Software Engineering, 9th Edition, Addison-Wesley
3. Pankaj Jalote, A Concise Introduction to Software Engineering, Springer

MTDC 105 (B) DATABASE MANAGEMENT SYSTEM

Course outcome:

1. Describe the fundamental elements of relational database management systems
2. Understand the principles of storage structure and recovery management
3. Explain the need for distributed database technology to tackle deficiencies of the centralized database systems
4. Understand transaction management, concurrency control techniques
5. Create a relational database scheme.

Unit I

Structure of relational databases, Relational Algebra, Functional Dependency, Different anomalies in designing a database., Normalization using functional dependencies, Lossless Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

Unit II

Transaction processing, Concurrency control and Recovery management, Conflict and View serializability, Lock based protocols, Two phase locking

Unit III

Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency, replication. Distributed database design - fragmentation, allocation criteria. Distributed deadlocks. Time based and quorumbased protocols. Comparison. Reliability-non-blocking commitment protocols

Unit IV

Partitioned networks, Checkpoints and cold starts, Management of distributed transactions- 2 phase unit protocols, Architectural aspects, Node and link failure recoveries, Distributed data dictionary management, Distributed database administration, Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled

Unit V

Case Study of Oracle RDBMS and PostgreSQL

Reference Books:

1. Leon & Leon, Essentials of DBMS, McGraw Hill
2. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", McGraw Hill.
3. Saeed K. Rahimi, Frank S. Haug, "Distributed Database Management Systems: A Practical Approach", Wiley

MTDC 105 (C) ADVANCE DISTRIBUTED SYSTEM

Course outcome:

1.Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.
2. Design and develop distributed programs using sockets and RPC/RMI
3. Analyze different algorithms and techniques for the design and development of distributed systems
4. Understand Distributed File Systems and Distributed Shared Memory
5. Understand the importance of security in distributed systems

Unit I

Characterization of Distributed Systems:Introduction, Examples of Distributed Systems, Trends in Distributed Systems, Challenges, System Models, Interprocess Communication, Network Protocols, Naming, Remote Procedure Call, Remote Method Invocation, Models for Communication, Distributed File Systems

Unit II

Time in a Distributed System:Introduction, Logical Clocks, Vector Clocks, Events and Process States, Clock Synchronization, Algorithms for Internal and External Synchronization; Distributed Mutual Exclusion: Introduction, Solutions on Message Passing Systems, Token Passing Algorithms; Distributed Snapshot: Chandy-Lamport Algorithm; Distributed Debugging

Unit III

Global State Collection: Termination Detection Algorithms, Distributed Deadlock Detection; Coordination Algorithms: Introduction, Leader election, Bully Algorithm; Distributed Consensus: Introduction, Consensus in asynchronous and synchronous systems, Distributed Shared Memory

Unit IV

Transactions and Concurrency Control: Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Distributed Transactions, Flat and Nested Transactions, Atomic Commit Protocols, Concurrency Control and serializability in Distributed Systems, Transaction Recovery, Checkpointing and Rollback Recovery; Group Communication

Unit V

Architecture of replicated data management; Security in Distributed Systems:Security Mechanisms, Common Security Attacks, Encryption, Secret key and public key Cryptosystems, Hashing, Digital signature and Digital certificate, Authentication in Distributed Systems; Self Stabilizing Systems

Reference Books:

1. Sukumar Ghosh, Distributed Systems: An Algorithmic Approach, Second Edition
2. A.D. Kshemkalyani, M. Singhal, Distributed Computing: Principles, Algorithms, and Systems, ISBN: 9780521189842, Cambridge University Press, March 2011.
3. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education Asia
4. Gerard Tel. Introduction to Distributed Algorithms
5. Nancy A. Lynch. Distributed Algorithms

MTDC – 105 (D)Mobile & Satellite Communication

Course Outcome:

1. **To learn the concept of cellular communication and system design.**
2. **To understand the concept of satellite communication.**

Unit I

Review of wireless and cellular radio communication: The cellular concept, system design fundamentals, frequency reuse, reused distance, cluster size, channel assignment strategies, handoff strategies, co-channel interference and system capacity, trunking and grade of service.

Unit II

Speech coding for wireless system applications and broadcast systems, coding techniques for audio and voice and popular speech codes. Brief introduction to radio channel characterization,

multi-path propagation, co channel interference, exponential power delay profile, propagation effects, scattering, ground reflection, fading, long normal shadowing, coherence bandwidth.

Unit III

Modulation techniques for mobile and satellite communication, their generation and detection, performance of spectral and power efficiency. Physical layer technique, diversity, spread, spectrum, frequency hopping, direct sequence, adaptive equalization, Orthogonal Frequency Division Multiplexing (OFDM)

Unit IV

MAC Protocols; 802.11 and its variants, ETSI-HILARAN type 1 MAC protocol, multiple access

with collision avoidance.

Unit V

Introduction to GEO, MEO and LEO satellite systems, Antena positioning in GEO and Link calculations, wideband CDMA concepts principles.

Reference Books.

1. Wilkies and Garg, Principles of GSM technology, PHI
2. Schiller J., Mobile Communications, Addison Wesley
3. Viterbi A, CDMA, Addison Wesley
4. Gokhle, Introduction to Telecommunications, Delmer Thomson

MTDC 201-IoT ARCHITECTURE AND PROTOCOLS

Course Outcome:

1. Understand the concepts of IoT Architecture
2. Apply knowledge of IoT Networking and its components to design IoT-based systems
3. Understand data link layer and network layer protocols of IoT
4. Use the knowledge of IoT transport and session layer protocols in various applications of IoT
5. Design IoT-based systems for real-world problems

Unit I

IoT definition, Characteristics, IoT conceptual and architectural framework, Physical and logical design of IoT, IoT enablers, Modern day IoT applications, M2M communications, IoT vs M2M, IoT vs WoT, IoT reference architecture, IoT Network configurations, IoT LAN, IoT WAN, IoT Node, IoT Gateway, IoT Proxy.

Unit II

Basics of IoT Networking, IoT Components, Functional components of IoT, IoT service oriented architecture, IoT challenges, 6LowPAN, IEEE 802.15.4, RFID Features, RFID working principle and applications, NFC (Near Field communication), Bluetooth, Wireless Sensor Networks and its Applications.

Unit III

IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,ZWave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Unit IV

IoT Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, CoAP message types, CoAP Request-Response model, XMPP, AMQP, MQTT, MQTT methods and components, MQTT communication, topics and applications, SMQTT.

Unit V

IoT Service Layer Protocols & Security Protocols: Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC802.15.4 , 6LoWPAN, RPL, Application Layer

IoT Platforms, Arduino, Raspberry Pi Board, Other IoT Platforms; Data Analytics for IoT, Cloud for IoT Cloud storage models & communication APIs, IoT case studies

Reference Books:

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things, A Hands on Approach", University Press
2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media

MTDC 202-WIRELESS SENSOR NETWORKS

Course outcome:

1. Explain the basic concepts of wireless sensor networks, sensing, computing and communication tasks
2. Demonstrate knowledge of MAC protocols and routing protocols developed for WSN
3. Describe and explain radio standards and communication protocols adopted in wireless sensor networks
4. Be able to carry out simple analysis and planning of WSNs
5. To develop wireless sensor systems for different applications

Unit I

Overview of Wireless Sensor Networks: Network Characteristics, Network Applications, Network Design Objectives, Network Design Challenges, Technological Background : MEMS Technology , Wireless Communication Technology , Hardware and Software Platforms, Wireless Sensor Network Standards, Introduction, Network Architectures for Wireless Sensor Networks, Classifications of Wireless Sensor Networks, Protocol Stack for Wireless Sensor Networks.

Unit II

Fundamental MAC Protocols, MAC Design for Wireless Sensor Networks, MAC Protocols for Wireless Sensor Networks: Contention-Based Protocols, Contention-Free Protocols, Hybrid Protocols. Introduction, Fundamentals and Challenges, Taxonomy of Routing and Data Dissemination Protocols, Overview of Routing and Data Dissemination Protocols: Location-Aided Protocols, Layered and In-Network Processing- Based Protocols, Data-Centric Protocols, Multipath-Based Protocols, Mobility-Based Protocols, QoS Based Protocols, Heterogeneity-Based Protocols.

Unit III

Wireless Sensor Network Architectures and Overview of Node Clustering Structures, Query Processing in Wireless Sensor Networks, Data Aggregation in Wireless Sensor Networks, Node Localization: Concepts and Challenges of Node Localization Technologies, Ranging Techniques for Wireless Sensor Networks, Wireless Localization Algorithms, Wireless Sensor Node Localization.

Unit IV

Need for Energy Efficiency and Power Control in Wireless Sensor Networks, Passive Power Conservation Mechanisms: Physical-Layer Power Conservation Mechanisms, MAC Layer Power Conservation Mechanisms, Higher Layer Power Conservation Mechanisms, and Active Power Conservation Mechanisms: MAC Layer Mechanisms, Network Layer Mechanisms, Transport Layer Mechanisms.

Unit V

Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security .

Reference Books:

1. Wireless Sensor Networks A Networking Perspective, Jun Zheng & Abbas Jamalipour, a john Wiley & sons, Inc., publication .
2. Wireless sensor networks Technology, Protocols, and Applications , kazem sohraby, daniel minoli, taieb znati , John Wiley & sons, Inc., publication .
3. Fundamentals of wireless sensor networks theory and practice, Waltenegus Dargie, Christian
Poellabauer, John Wiley and Sons, Ltd., Publication.

MTDC – 203 Network Design Technology

Course Outcome:

1.To learn the concepts of network designing.

2. To understand different protocols in design technologies.

Unit I

Concepts of Layering and Layered models- OSI & TCP/IP LAN Technology, transmission Medium, Topology, Medium Access Control (MAC) Techniques including MAC& LLC sub layers,

Unit II

LAN system, Ethernet system, Fast Ethernet& Gigabit Ethernet, Token Ring, FDDI
Internet working with TCP/IP, Internet Protocol (IP) Suite including IP V4, IP V6 Transport Protocols, TCP and UDP

Unit III

Introduction to IP routing, various interior gateways protocols like RIP, OSPF and exterior gateway protocols like BGP

Unit IV

Introduction to label Switching and MPLS ,WAN technology: WAN Vs LAN, Circuit switching mechanism and network design, packet switched networking including routing and traffic control, X.25
ISDN and Broadband ISDN: Overview, ISDN, interface and functions, layers and ISDN services-
ISDN standards and services ,High Speed network frame relay, frame relay protocols, services and congestion control.

Unit V

ATM: ATM adaptation layer (AAL), ATM traffic and congestion control ATM LAN, ATM LAN emulation and multi protocols over ATM (MPOA)

Reference Books.

1. Redia Pearlman, Interconnections, bridges, routers, switches and Int protocols Pearson Edu
2. Comer, Internetworking with TCP/IP Vol. I PHI
3. Tenenbaum, Computer Networks, PHI
4. Forouzan B, Data communication and networking, TMH.
5. Stalling W, Data and computer communications, PHI
6. Hardy, Inside networks, PHI
7. Glover and Grant, Digital Communication, PHI

MTDC – 204 Optical Network

Course outcome:

1.To undertand multiplexing techniques and various optical networks.

2.To learn topologies , wavelength and switching in optical networks.

Unit I

Introduction to optical network: Telecommunication, first generation optical network, multiplexing technique, second generation optical network,virtual circuit services and data gram, transparencies of regenerator,Network components: couplers, Isolators, Circulators, Multiplexer , filter, frabry perot filters, acoustics optical tunable filters, characterization of switches, mechanical, electro-optic, thermo-optic, and SOA switches, switching architecture.

Unit II

First generation of optical network: SONET, SDH, goals of SONET design , Multiplexing in SONET,elements of SONET/SDH infrastructure, SONET physical layer,comuter interconnections, ESCON, fiber channel, FDDI,ATM,IP layered architecture , physical layer, data link layer, network layer, transport layer

Unit III

Broad cast and select network: topologies for broadcast networks, bus topology, star topology, media access control(MAC) protocols, throughput calculation, synchronization, aloha and slotted ALOHA, test beds,LAMBDANET,rainbow,starnet

Unit IV

Wavelength routing network: optical layer, wavelength cross connect, wavelength reuse reliability, virtual topology and circuit switching and node design, degree of wavelength conversion, network design and operation traffic models, and performance criteria, static and reconfigurable network, classification of light paths

Unit V

Photonic packet switching ,optical time domain multiplexing(OTDM),Method of multiplexing and demultiplexing, Broadcast ,OTDM network ,bit interleaving and packet interleaving, optical andgates non linear optical loop mirror, tera hertz optical asymmetric demultiplexer, switch based network, deflection routing

Referance Books:

1. Optical Networks: Apractical Prospective By R.Ramaswamy and K.N.Shivrajan
2. Optical Networks By C.S.R.Murthy and M.Guruswamy, PHI
3. Computer Networks By Tanenbaum

MTDC 205 (A) -MOBILE APPLICATION DEVELOPMENT

Course Outcome:

1. Understand the entire lifecycle involved in mobile app development
2. Design a mobile app
3. Understand Security considerations in mobile app development
4. Know about the range of techniques available for testing of Mobile Apps and understand when one approach is better than the others.
5. Follow general procedure for developing an App

UNIT I

Overview of Mobile App Development: Mobile Applications, A formula for designing engaging applications, Unique challenges for development of engaging applications, Enterprise mobile development, Mobile App Development Lifecycle Overview

UNIT II

Importance of Design, App Design issues and considerations, Scope of Design in Mobile App Development, Design Principles and Guidelines, Some Design Methods, Factors for choosing mobile app, Mobile App Architectural Components, Mobile App Flow, Mobile App Deployment Considerations

UNIT III

Building Mobile Apps Powered by Enterprise Backend, Connecting the Mobile App with Enterprise IT Services and Data, Types of IT Backend to Integrate from Mobile Apps, Type of API Protocols, Security Integration, Mobile Devices Security Considerations, Secured Data Store and Synchronization, Enterprise Mobile Application Management and Device Management, Special Challenges in Managing Mobile Applications and Devices

UNIT IV

Quality, Cost of Quality, Automated versus Manual Testing, Preproduction versus Post release, Automated Mobile App Testing Considerations, Monetizing Apps, Publishing Apps

UNIT V

The Android Operating System, Working of Android Apps, Programming languages used for developing Android Apps, Android Studio, Emulators, General Procedure for developing an App.

Reference Books:

1. Leigh Williamson, Roland Barcia, Omkar Chandgadkar, Ashish Mathur, Soma Ray, Darrell Schrag, Roger Snook, Jianjun Zhang, " Enterprise Class Mobile Application Development", IBM Press Pearson plc, 2016
2. Jakob Iversen Michael Eierman, "Learning Mobile App Development", Pearson Education, 2014
3. J. Paul Cardle, "Android App Development in Android Studio", Manchester Academic Publishers

MTDC 205 (B) Block chain Technology

Course outcome:

1. Understand block chain technology
2. Acquire knowledge of cryptocurrencies
3. Develop block chain based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks
4. Build and deploy block chain application for on premise and cloud based architecture
5. Integrate ideas from various domains and implement them using block chain technology in different perspectives

Unit I

Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Cryptocurrency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain; Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency

Unit II

Understanding Block chain with Crypto currency: Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashCash PoW, Bitcoin PoW, Attacks on PoW and the
monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool

Unit III

Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Unit IV

Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, and Identity on Block chain

Unit V

Block chain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

References:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming"
3. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
4. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5.Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing
6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018

MTDC 205 (C) CLOUD AND FOG COMPUTING

Course outcome:

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Have understanding of the Technological Drivers of Cloud Computing
4. Explain the core issues of cloud computing such as security, privacy, and interoperability and provide the appropriate cloud computing solutions and recommendations according to the applications used.
5. Attempt to generate new ideas and innovations in cloud computing and Fog computing.

UNIT I

Cloud Computing Fundamentals: Motivation for Cloud Computing, Defining Cloud Computing, Principles of Cloud Computing , Five Essential Characteristics, Cloud Ecosystem, Requirements for Cloud Services, Cloud Applications, Benefits and Drawbacks, Cloud Architecture, Network Connectivity in Cloud Computing, Managing the Cloud, Migrating Application to Cloud

UNIT II

Cloud Deployment Models: Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud; Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service, Their characteristics, Suitability, Pros and Cons, Cloud Service Providers

UNIT III

Technological Drivers of Cloud Computing: Virtualization, Approaches in Virtualization, Hypervisor and Its Role, Types of Virtualization; Memory and Storage Technologies, Networking Technologies, Web 2.0 and Web 3.0, Agile SDLC for Cloud Computing, Programming Models for Cloud Computing

UNIT IV

Security in Cloud Computing: Security Aspects, Data Security, Virtualization Security, Network Security, Security Issues in Cloud Service Models, Audit and Compliance, Data Protection in the Cloud, Cloud Security as a Service; Advanced Concepts in Cloud Computing: Intercloud, Cloud Management, Mobile Cloud, Cloud Governance, Green Cloud, Cloud Analytics

UNIT V

Introduction to Fog Computing, Difference between cloud computing and fog computing, Fog Computing benefits and drawbacks, Applications of Fog computing, Role of Fog computing in Internet of Things, Need for Fog computation, Fog data processing layers.

Reference Books:

1. K. Chandrasekaran, "Essentials of Cloud Computing", CRC Press, 2015
2. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", 2013.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms",Wiley
4. Rajkumar Buyya, Satish Narayana Srirama, " Fog and Edge Computing: Principles and Paradigms",Wiley
5. Assad Abbas, Samee U. Khan, Albert Y. Zomaya "Fog Computing: Theory and Practice", Wiley, 2020

MTDC – 301 Comprehensive Viva & Seminar

Course Outcomes:

At the end of the course the students will be able to:

- Comprehend the knowledge gained in the course work.
- Infer principles of working of digital communication.
- Demonstrate the ability in problem solving and to communicate effectively
- Identify and compare technical and practical issues related to the area of course specialization.
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presention

MTDC– 302 Dissertation Part-I

Course Outcomes:
At the end of the course:

- Identify a topic in advanced areas of digital communication.
- Review literature to identify gaps and define objectives & scope of the work.
- Employ the ideas from literature and develop research methodology,
- Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

MTDC–401 Dissertation Part-II

Course Outcomes:
At the end of the course:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyse and discuss the results to draw valid conclusions.
- Prepare a report as per the recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

M.Tech in Thermal Engineering

The Program Specific Outcomes:

(1) Graduates will demonstrate sound domain knowledge on wider perspective to become successful professionals.

(2) Graduates will demonstrate an ability to identify, formulate and solve thermal engineering problems.

(3) Graduates will demonstrate an ability to conceptualise designs of thermal system or component and evaluate them to select optimal feasible solution considering safety, environment and other realistic constraints.

(4) Graduates will demonstrate skill of good researcher to work on a problem, starting from scratch, to research into literatures, methodologies, techniques, tools, and conduct experiments and interpret data.

(5) Graduates will demonstrate research skills to critically analyse complex thermal engineering problem for synthesizing new and existing information for their solutions.

(6) Graduates will demonstrate skills to use modern engineering tools, software and equipment to analyze and solve complex engineering problems.

(7) Graduates will exhibit the traits of professional integrity and ethics and demonstrate the responsibility to implement the research outcome for sustainable development of the society.

(8) Graduates will be able to communicate effectively to comprehend and write effective reports following engineering standards.

(9) Graduates will demonstrate skills of presenting their work unequivocally before scientific community, and give and take clear instructions.

(10) Graduate will demonstrate traits of manager in handling engineering projects and related finance, and coordinate workforce towards achieving their goals.

(11) Graduates will demonstrate an ability to work on laboratory and multidisciplinary tasks.

MMTP – 101 Advanced Solar Energy System

Course outcomes:

After doing this course, the student should be able to

- Understand various aspects of solar radiation
- Learn about non-concentrating collectors
- Understand the characteristics of photo-voltaic cells
- Learn about various ways solar energy storage.

UNIT - 1

Introduction – Solar energy option, specialty and potential – Sun – Earth – Solar Radiation, beam and diffuse – measurement – estimation of average solar radiation on horizontal and tilted surfaces –

problems – applications. Capturing solar radiation – physical principles of collection – types – liquid

flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

UNIT - 2

Design of solar water heating system and layout, Power generation – Solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers, concentration ratio.

UNIT - 3

Thermal energy storage: Introduction – Need for – Methods of sensible heat storage using solids and

liquids – Packed bed storage – Latent heat storage – working principle – construction –application and limitations. Other solar devices – stills, air heaters, dryers, Solar Ponds & Solar Refrigeration, active and passive heating systems.

UNIT - 4

Direct energy conversion: solid-state principles – semiconductors – solar cells –performance – modular construction– applications. conversion efficiencies calculations.

UNIT - 5

Economics: Principles of Economic Analysis – Discounted cash flow – Solar system – Life Cycle costs – cost benefit analysis and optimization – cost-based analysis of water heating and photo voltaic applications.

REFERENCES:

1. Solar energy: Principles of Thermal Collection and Storage, Sukhatme, TMH 2nd edition
2. Solar Thermal Engineering Systems, Tiwari and Suneja ,Narosa
3. Principles of solar engineering/ Kreith and Kerider/Taylor and Franscis/2nd edition
4. Solar energy thermal processes/ Duffie and Beckman/John Wiley & Sons

MMTP –102 Advanced Thermodynamics and Combustion

Course Outcomes:

At the end of the course, the student will be able to:

- Explain basic thermodynamic concepts and laws
- Describe the concepts entropy and exergy and their use in analyses of thermal energy systems
- Use advanced thermodynamics on a research case

Unit 1

Classical Thermodynamics: Concept of classical thermodynamics, review of zeroth, first and second law of thermodynamics, Entropy, Availability analysis of thermal system and concept of energy conservation. Third law of thermodynamics, Nerst heat theorem.

UNIT 2

Phase and reaction equilibriums: Equilibrium constants. calculation of equilibrium composition of multi components gaseous mixtures.

UNIT 3

Equations of state: Equations of state & calculations of thermodynamics and transport properties of substances, reaction rates of first, second and higher order reactions, reactions in gaseous, liquid and solid phases.

Unit 4

Equilibrium, real substances and properties, triple point, critical point, temperature-entropy, entropy-enthalpy charts, Vanderwal's equation of state, Claperon's equation, Gibbs phase rule, law of corresponding states.

UNIT 5

Combustion and flames: combustion and flame velocities, Laminar and turbulent flames. Premixed and diffusion flames: their properties and structures. Theories of flame propagation, combustion of solid, liquid and gaseous fuels, combustion of fuel droplets and sprays, combustion systems, combustion in closed and open systems, application to IC engines, boilers, gas turbine, combustors and rocket motors.

Recommended Books:

1. Heat Power and Thermodynamics by M.W.Zemansky (McGraw Hill).
2. Combustion, Flames and explosions of gases, B.Lewis and G.Von Elbe Academic P.
3. Thermal Sciences, Potter, Cengage Learn (Thomson)
4. Engineering thermodynamics by Gurdon Rogers Yon Mayhew.
5. Concept of thermodynamics by Obert (McGraw Hill).

MMTP – 103 Advanced Heat Transfer

Course Outcomes:

At the end of the course, the student will be able to:

- Impart the advances knowledge of heat transfer.
- Get analytical solutions for 2-D steady and transient heat conduction problems.
- Deep understanding on the governing equations for convection heat transfer; knowing the dimensionless parameters (influencing the convection performance).
- Apply the concept of natural convection for electronic cooling, HVAC etc.
- Understand the boiling and condensation mechanism.
- Apply the concepts of radiation heat transfer for enclosure analysis.

UNIT – I

Introduction: Brief Introduction to different Modes of heat transfer- Conduction- General heat conduction equation – Boundary conditions – Steady simplified heat transfer in Cartesian coordinates – Finned surfaces- 1-D Heat transfer with internal heat generation.

UNIT – II

Transient heat conduction: Lumped system analysis – Heisler charts – Semi-infinite solid – Product solution- 2D – steady state heat conduction – Use of conduction shape factors- -Transient heat conduction – Analytical solution- Finite Difference methods for Heat Conduction Problems- 1 D & 2 D steady state and Unsteady heat conduction – Implicit and Explicit methods.

UNIT – III

Forced Convection: Concept of boundary layer- Hydrodynamic and Thermal boundary layer concepts-Equations of Motion and Energy-Methods to determine heat transfer coefficient-Dimensional Analysis –Importance of Non – Dimensional numbers –Analogies between Heat and Momentum Transfer-External flows and integral methods for flow over a flat plate-Application of empirical relations to various geometrics

Free convection: Dimensionless parameters of Free convection-An Approximate Analysis of Laminar Free Convection on a Vertical Plate-Free convection on a Horizontal Plate, Cylinder and Sphere- Combined free and forced convection.

UNIT 4

Boiling heat transfer, nature of vaporization, nucleate pool boiling and empirical correlations for pool boiling heat transfer, factors affecting pool boiling film coefficients, high heat flux boiling. Condensation: Physical Mechanisms, Laminar film condensation on a vertical plate, turbulent film condensation, drop wise condensation.

UNIT 5

Radiation: Radiation Properties & Law, Electrical analogy, Radiation exchange between surfaces, Applications to cavities & enclosures.

Reference Books:

1. Heat Transfer, Krieth, Cengage learn (Thomson)
2. Heat transfer by J.P. Holman.
3. Analysis of Heat transfer E.R.G.Eckerst and R.M. Drake Jr. McGraw Hills.
4. Heat mass and momentum transfer .W.M.Roshenow and P.Choi, Prentice Hall .
5. Heat transfer B.Gebhart ,McGraw Hills .
6. Conduction Heat Transfer V.S. Arpaci ,Addison Wesley .
7. Thermal radiation H.C. Hotel .

MMTP – 104 Advanced Fluid Mechanics

Course Outcomes:

At the end of the course, the student will be able to:

- Understanding the concept of fluid and the models of fluids
- Understanding the basic physical meaning of general equations
- Understanding the concept of stream function and potential function
- Ability to derive the equation for viscous flow, including laminar flow and turbulent flow
- Ability to address such problems in engineering, and to solve the problems

UNIT 1

INVISCID FLOW OF INCOMPRESSIBLE FLUIDS: Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three-dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Cartesian systems normal and tangential accelerations, Euler's, Bernoulli equations in 3D– Continuity and Momentum Equations

UNIT 2

Viscous Flow: Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases: Plain Poisoulle flow - Coutte flow with and without pressure gradient - Hagen Poisoulle flow - Approximate solutions – Creeping motion (Stokes) – Oseen's approximation.

UNIT 3

Boundary Layer Theory: Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate –- Von-Karman momentum integral equation - Blasius solution- Laminar boundary layer – Turbulent Boundary Layer - Expressions for local and mean drag coefficients for different velocity profiles. – Total Drag due to Laminar & Turbulent Layers – Problems.

UNIT 4

Introduction to Turbulent Flow: Fundamental concept of turbulence–Time Averaged Equations– Boundary Layer Equations-Prandtl Mixing Length Model - Universal Velocity Distribution Law: Van Driest Model –Approximate solutions for drag coefficients –More Refined Turbulence Models – k-epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders.

Internal Flow: Smooth and rough boundaries–Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes–Roughness of Commercial Pipes – Moody's diagram.

UNIT 5

Compressible Fluid Flow – I: Thermodynamic basics – Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State

Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

Reference Books:

1. Fluid Mechanics and Fluid Machines by S K Som and G Biswas, TMH
2. Fluid Mechanics by Joseph H Spurk and Nuri Aksel, Springer

3. Compressible Fluid Dynamics by B K Hodge and Keith Koenig, Pearson
4. Fluid Mechanics by Potter, Cengage Learning
5. Fluid Mechanics by Jog, Cambridge
6. Fluid Mechanics and Machinery by Khan, Oxford
7. Fluid Mechanics by Cohen and Kundu, Elsevier, 5th edition
8. Fluid Mechanics by William S Janna, CRC Press
9. Dynamics & Theory and Dynamics of Compressible Fluid Flow by Shapiro.
10. Fluid Dynamics by William F. Hughes & John A. Brighton, TMH

MMTP – 105 Steam and Gas Turbines

Course Outcomes:

At the end of the course, the student will be able to:

- Understand construction and design features of steam and gas turbines as used for power generation.
- Understand thermodynamics cycles and different sizes and layouts of steam gas turbine plant
- Understand thermodynamics and fluid mechanics component for enhancing the efficiency and effectively of gas turbines.

Unit 1

Steam Turbines: Principle and working of steam turbines, type of turbines, impulse and reactions, compounding for pressure and velocity. Velocity triangles for various types. stage to blade,speed ratio for optimum efficiency, diagram efficiency, steam performance. Energy losses in steam turbine, turbine performance at various loads and governing of steam turbines. Constructional details and description of steam turbine components in brief.

Unit 2

Regenerative feed heating cycles:

Introduction: Most Ideal Regenerative f eed heating cycle. Regenerative feed heating cycles and their represenation on T-s and h-s Diagram. Representation of actual process on T-s and h-s Diagram Regenerative cycles. Other types of feed heating arrangements. Optimum feed water temperature and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters, Deaerators.

Unit 3

Reheating – Regenerative and Regenerative water – Extraction Cycles. Reheating of steam. Practical reheating and Non- reheating cycles, advantage & disadvantages of reheating, regenerative water extraction cycles, practical feed heating arrangements. Feed heating system for 120MW, 200MW, 350MW, 500MW & 660 MW Units.

Unit 4

Mixed Pressure Turbines: Low- pressure Turbines, Mixed pressure Turbines, Heat Accumulators.

Unit 5

Gas Turbines: Open and closed cycles, constant pressure and constant volume cycles, cycles with inter cooling, reheating and heat exchanger, compressor and turbine efficiencies, pressure losses, performance characteristics of various cycles, practical problems.

Jet Propulsion: Calculation of thrust, Power, speed and efficiency, turbo – jet and turbo propulsion systems.

Reference books:

1. Fluid dynamics and heat transfer of turbo-machinery, Budugur Lakshminarayana, Amazon.com
2. Cohen H Rogers, Sarvanmutto, Gas Turbine Theory, Longman Pub.
3. Mathur, Sharma, Gas turbine, Standard Pub And Distributors Delhi.

MMTP – 201 Design of Thermal Power Plant

Course Outcomes:

At the end of the course the students will be able to:

- Gain the knowledge about resources of energies available in India for Power Production by thermal processes.
- Analyse the processes and cycles followed in Thermal Power Plants and components used in the power plants and identify the losses to get better efficiency.
- Apply the knowledge in calculating the Power Load Calculations and Distribution.
- Develop the methods for the Economies of Power Generation and Power plant instrumentation.

UNIT 1

Conventional thermal power plants, super-critical power plants and its principles of working, performance curves and flow diagrams.

UNIT 2

Power plant components: Fuel and ash handling, pulverized fuel firing burners, dust handling, fluidized bed combustion. Radiant super heaters and re-heaters, economizer and pre-heaters, combustion and furnace design, boiler water supply and treatment. Drat and arrangement of draft fans, different types of cooling systems, open closed, mixed and dry cooling tower systems, air cooled condensers. Ejector and vacuum pumps, feed heating systems, heaters, evaporators and de-aerator, feed line protection, boiler feed pumps, different type of drives for it, steam turbine driven feed pumps.

Unit 3

Plant instrumentation for thermal power plants, need and importance, distributed and centralized, pneumatic and electro-mechanical transducers and controllers, distributed computer control. Piping and insulation: design and layout of ducting for air fuel, gases and pulverized fuels, selection of piping, pipe flexibility analysis, Various control valves and actuators. Insulation optimum thickness and costs.

Unit 4

Installation, commissioning and operation: Preliminary performance checks and acceptance test for various components, heat balance of items and entire plant. Starting loading and normal operation checks, maintenance logging, parallel operations, droop setting, performance analysis, maintenance, safety and pollution controls.

UNIT 5

Plant Management: Preparing specifications and contract documents, guarantee. Training of power plant personnel, safety, and seismic analysis. Purchase and contract for fuel supplies.

Reference Books:

1. Power Plant Engineering, F T Morse
2. Power Plant Engineering, P K Nag
3. Power Plant Engineering, Arora and Domkundwar

MMTP – 202 Design of Heat Exchangers

Course Outcomes:

At the end of the course:

1. Students will demonstrate a basic understanding of several types of heat exchangers that will include shell-and-tube, double pipe, plate-and-frame, finned tube, and plate-fin heat exchangers, Heat pipes.
2. Students will design and analyses of shell-and-tube double pipe, compact, plate heat exchangers.
3. Students will demonstrate the performance degradation of heat exchangers subject to fouling.

UNIT 1

Heat Exchangers – Classification according to transfer process, number of fluids, surface compactness, and construction features. Tubular heat exchanger, plate type heat exchangers, extended surface heat exchangers, heat pipe, Regenerators. Classification according to flow arrangement: counter flow, parallel flow, cross flow exchanger.

UNIT 2

Heat exchanger design methodology, assumption for heat transfer analysis, problem formulation, e-NTU method, *P*-NTU method, Mean temperature difference method, fouling of heat exchanger, effects of fouling, categories of fouling, fundamental processes of fouling.

UNIT 3

Double Pipe Heat Exchangers: Thermal and Hydraulic design of inner tube, Thermal and hydraulic analysis of Annulus, Total pressure drop. Compact Heat Exchangers: Thermal and Hydraulic design of compact heat exchanger.

UNIT 4

Shell and Tube heat exchangers – Tinker's, kern's, and Bell Delaware's methods, for thermal and hydraulic design of Shell and Tube heat exchangers

UNIT 5

Mechanical Design of Heat Exchangers – design standards and codes, key terms in heat exchanger design, material selection, and thickness calculation for major components such as tube sheet, shell, tubes, flanges and nozzles. Introduction to simulation and optimization of heat exchangers, flow induced vibrations.

Reference:

1. Ramesh K. Shah and Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" John Wiley & sons Inc., 2003.
2. D.C. Kern, "Process Heat Transfer", McGraw Hill, 1950.
3. Sadik Kakac and Hongton Liu, "Heat Exchangers: Selection, Rating and Thermal Design" CRC Press, 1998.
4. A .P. Frass and M.N. Ozisik, "Heat Exchanger Design", McGraw Hill, 1984
5. Afgan N. and Schlinder E.V. "Heat Exchanger Design and Theory Source Book".
6. T. Kuppan, "Hand Book of Heat Exchanger Design".
7. "T.E.M.A. Standard", New York, 1999.
8. G. Walkers, "Industrial Heat Exchangers-A Basic Guide", McGraw Hill, 1982.

MMTP – 203 Advance Refrigeration and Air Conditioning System

Course Outcomes:

At the end of the course the learners will be able to

- Introduce students to HVAC technology, engineering, research, systems, system designs, energy impacts, and overall goals
- Develop understanding of the principles and practice of thermal comfort.
- Develop generalized psychrometrics of moist air and apply to HVAC processes.
- Understand the components of vapor compression systems and other types of cooling systems.

UNIT 1

Introduction: Thermodynamics Properties of pure and Mixed Refrigerants and their selection. Vapor Compression System, Actual Vapor Compression System, Deviation from theoretical System, Multi-pressure System with Flash Chamber and Inter Cooling, Cascade system.

UNIT 2

Refrigeration Equipments: Compressors, Analysis and Thermal Design of Reciprocating, Centrifugal and Screw Compressors, Performance Characteristics & Capacity control. Expansion Devices: Capillary, Automatic and Thermostatic Expansion Valve. Other Equipments: Liquid Receiver, Oil Separators, Liquid Line Strainers, Driers, Liquid Sub- coolers.

UNIT 3

Condenser & Evaporator: Types, performance & Their Controls.

UNIT 4

Thermodynamics of Refrigerant: Absorbent Combinations, Analysis of simple and Industrial Vapor Absorption system using various working fluids Solar Powered Refrigeration & Heat Pump.

UNIT 5

Air –conditioning: Psychrometric properties and processes – Construction of Psychrometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature. Summer , Winter and year round air – conditioning systems. Cooling load Estimation: Occupants, equipments, infiltration, duet heat gain fan load, Fresh air load.

Air –conditioning Systems: All Fresh air, Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP, RSHF, ESHF and GSHF for different systems. **Components:** Humidification and dehumidification equipment – Systems of Air cleaning – Grills and diffusers – Fans and blowers – Measurement and control of Temperature and Humidity.

Books:

1. Refrigeration & Air Conditioning by W.F.Stoecker
2. Refrigeration & Air Conditioning by C.P.Arora
3. Refrigeration & Air Conditioning by Manohar Prasad
4. Refrigeration and Air Conditioning: Ananthanarayana (TMH)
5. Refrigeration and Air Conditioning: Ballany – Khanna
6. Refrigeration and Air Conditioning: Domkundwar – Dhanpatrai

MMTP – 204 Computational Fluid Dynamics (CFD)

Course Outcomes:

At the end of the course the learner will be able to

- Derive the basic governing equations applied for fluid flow problems.
- Apply the differential equations to fluid flow problems.
- Understand the concept of discretization.
- Solve simple algorithms for incompressible fluid flow.
- Apply the basics of CFD to heat transfer problems.

UNIT 1

Introduction to CFD: Computational approach to Fluid Dynamics and its comparison with experimental and analytical methods, Basics of PDE: Elliptic, Parabolic and Hyperbolic Equations. **Governing Equations:** Review of Navier-Stokes Equation and simplified forms, Solution Methodology: FDM and FVM with special emphasis on FVM, Stability, Convergence and Accuracy.

UNIT 2

Finite Volume Method: Domain discretization, types of mesh and quality of mesh, SIMPLE, pressure velocity coupling, Checkerboard pressure field and staggered grid approach.

UNIT 3

Geometry Modeling and Grid Generation: Practical aspects of computational modeling of flow domains, Grid Generation, Types of mesh and selection criteria, Mesh quality, Key parameters and their importance.

UNIT 4

Methodology of CFDHT: Objectives and importance of CFDHT, CFDHT for Diffusion Equation, Convection Equation and Convection-Diffusion Equation

UNIT 5

Solution of N-S Equations for Incompressible Flows: Semi-Explicit and Semi-Implicit Algorithms for Staggered Grid System and Non-Staggered Grid System of N-S Equations for Incompressible Flows.

Reference Books:

1. Computational Fluid Dynamics, The Basic with applications by John A. Anderson, Jr., McGraw Hill International editions, Mechanical Engineering series.
2. Numerical Methods in Fluid Flow & Heat Transfer by Dr. Suhas Patankar.
3. An Introduction to Computational Fluid Flow (Finite Volume Method), by H.K. Versteeg, W.Malalasekera, Printice Hall.
4. Computational Methods for Fluid Dynamics by Ferziger and Peric, Springer Publication.
5. An Introduction to Computational Fluid Mechanics by Chuen-Yen Chow, Wiley Publication.
6. Computational Fluid Flow & Heat Transfer by Murlidhar and Sundarrajan, Narosa Publication

MMTP – 205 (A) ENERGY CONSERVATION AND MANAGEMENT

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the fundamentals of energy management and its influence on environment
- Understand the methods of energy production for improved utilization.
- Apply the principles of thermal engineering and energy management to improve the performance of thermal systems.
- Analyse the methods of energy conservation and energy efficiency for buildings, air conditioning, heat recovery and thermal energy storage systems.
- Assess energy projects on the basis of economic and financial criteria.

UNIT-I

INTRODUCTION: Principles of energy management. Managerial organization, Functional areas for i) manufacturing industry, ii) Process industry, iii) Commerce, iv) Government, Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT -II

ENERGY AUDIT: Definition and concepts. Types of energy audits, Basic energy concepts, Resources for plant energy studies. Data gathering, Analytical techniques. Energy Conservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT-III

ECONOMIC ANALYSIS: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT-IV

METHODS OF EVALUATION OF PROJECTS: Payback, Annualized costs, Investor's rate of return, Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT-V

ALTERNATIVE ENERGY SOURCES: SOLAR ENERGY: Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

References:

1. Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamon Press
3. Energy Management / W.R.Murthy and G.Mc.Kay / BS Publication
4. Management / H.Koontz and Cyrill Donnel / McGraw Hill
5. Financial Management / S.C.Kuchhal / Chaitanya Publishing House

MMTP – 205 (B) ADVANCED I.C. ENGINES

Course Outcomes:

At the end of the course, the student will be able to:

- Apply thermodynamic analysis to IC engines and describe combustion phenomena in spark ignition and compression ignition engines.
- Describe the working of major systems used in conventional and modern engines.
- Summarize the methods used to improve engine performance and estimate performance parameters.
- Describe engine emission control techniques and implement viable alternate fuels.

UNIT-I: Introduction – Historical Review – Engine Types – Design and operating Parameters. Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles – Real Engine cycles - differences and Factors responsible for – Computer Modeling.

UNIT - II:

GAS EXCHANGE PROCESSES: Volumetric Efficiency – Flow through ports –Supercharging and Turbo charging. Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT - III:

ENGINE COMBUSTION IN S.I ENGINES: Combustion and Speed – Cyclic Variations –Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing. Combustion in CI engines: Essential Features – Types off Cycle. Pr. Data – Fuel Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system.

UNIT - IV:

POLLUTANT FORMATION AND CONTROL: Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate Emissions-Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NOx, Catalysts.

UNIT - V:

ENGINE HEAT TRANSFER: Importance of heat transfer, heat transfer and engine energy balance, Convective heat transfer, radiation heat transfer, Engine operating characteristics. Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.

Modern Trends in IC Engines: Lean Burning and Adiabatic concepts, Rotary Engines, Modification in I.C engines to suit Bio – fuels, HCCI and GDI concepts.

References:

1. I.C. Engines / V.Ganesan/TMH
2. I.C. Engines/G.K. Pathak & DK Chevan/ Standerd Publications
3. I.C. Engines Fundamentals/Heywood/TMH
4. Dual-Fuel Diesel Engines – Ghazi A. Karim – CRC Press
5. I.C. Engines /RK Rajput/Laxmi Publications
6. Internal Combustion Engines – S.S. Thipse - Jaico
7. Computer Simulation of C.I. Engine Process/ V.Ganesan/University Press
8. Fundamentals of IC Engines/HN Gupta/PHI/2nd edition
9. I.C. Engines/Fergnson/Wiley
10. The I.C. Engine in theory and Practice Vol.I / Teylor / IT Prof. And Vol.II
11. Computer Simulation of Spark-Ignition Engine Processes – V. Ganesan – Universities Press

MMTP – 205 (C) Computer Aided Design of Thermal System

Course Outcomes:

At the end of the course, the student will be able to:

- Design of Thermal systems and interdisciplinary engineering applications using suitable optimization technique.
- Understand the various optimization techniques such as classified optimization, linear programming. One dimensional minimization method, unconstrained optimization techniques, constrained optimization techniques and dynamic programming.

UNIT 1

Basic Consideration in Design: Formulation of Design problems, conceptual design steps in design process computer aided design material selection.

UNIT 2

Modeling of Thermal System: Types of model, mathematical & Physical modelling Dimensional Analysis Numerical modeling & simulation, simulation of thermal processes Application to casting extrusion, heat treatment, Refrigeration systems, thermal design of heat engine.

UNIT 3

Numerical Modeling & Simulation: Numerical modeling, System simulation, Methods for Numerical Simulation.

UNIT 4

Optimization: Basic Concepts, Objective function, constraints, Mathematical Formulation.

UNIT 5

Optimization Methods: Calculus Method, search method linear & dynamic programming, Geometric Programming Introduction to Genetic Algorithms.

Reference Books:

1. Design of thermal systems by W.F. Stoecker
2. Design of optimization of thermal systems by Yogesh Jaluria
3. Optimization Techniques by Rao
4. Optimization Techniques & Genetic Algorithms by Kalyan Mchan Deb.

MMTP – 301 Comprehensive Viva & Seminar

Course Outcomes:

At the end of the course the students will be able to:

- Comprehend the knowledge gained in the course work
- Infer principles of working of thermal energy systems
- Demonstrate the ability in problem solving and to communicate effectively
- Identify and compare technical and practical issues related to the area of course specialization.
- Prepare a well-organized report employing elements of technical writing and critical thinking
- Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presenting.

MMTP – 302 Dissertation Part-I

Course Outcomes:

At the end of the course:

- Identify a topic in advanced areas of thermal engineering,
- Review literature to identify gaps and define objectives & scope of the work,
- Employ the ideas from literature and develop research methodology,
- Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

MMTP–401 Dissertation Part-II

Course Outcomes:

At the end of the course:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyse and discuss the results to draw valid conclusions.
- Prepare a report as per the recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

M. Tech. in Structural Engineering

Program specific outcomes (PSOs):

- To understand the graduate students to advanced Structural Analysis, Structural Dynamics, allied theory in elasticity and plasticity, FEM etc.
- To impart training to graduate students in behavior and design of Advanced RC structures, behavior and design of Advanced Steel structure, latest technology in earthquake resistant design practices and earthquake resistant design philosophies.
- To able the graduate students to latest design codes, current national and international scenario on Structural Engineering and to motivate them in interdisciplinary involvement in problems related to Structural Engineering.
- To orient the graduate students to high value research related to Structural Engineering so that they get impetus to pursue research and lifelong learning.
- To understand the graduate behavior of various structure in different load combination.

MVSE – 101 Design of Earth quake Resistant Structures

Course outcome (Cos):

- Earthquake-resistant construction, the fabrication of a building or structure that is able to withstand the sudden ground shaking that is characteristic of earthquakes, thereby minimizing structural damage and human deaths and injuries.
- Construction methods can vary dramatically throughout the world, so one must be aware of local construction methods and resource availability before concluding whether a particular earthquake-resistant design will be practical and realistic for the region.

UNIT 1 Seismic Strengthening of Existing Buildings: Cases Histories-Learning from earthquakes, seismic strengthening procedures.

UNIT 2 Torsion & Rigidity: Rigid Diaphragms, Torsional moment, Center of mass and center of rigidity torsion effects. Lateral Analysis of Building Systems: Lateral load distribution with rigid floor diaphragms, moment resisting frames, shear walls, lateral stiffness of shear walls, shear wall-frame combination, examples.

UNIT 3 Concept of Earthquake Resistant Design: Objectives of seismic design , Ductility, Hysteric response & energy dissipation, response modifications factor, design spectrum, capacity design, classification of structural system, IS code provisions for seismic design of structures, multi-storied buildings, design criteria, P-A effects, storey drift, design examples ductile detailing of RCC structures.

UNIT 4 Seismic Design of Special Structures: Elevated liquid storage tanks, Hydrodynamic pressure in tanks, stack like structures, IS-1893 code provisions for bridges; Superstructures, substructures, submersible bridges, dams; Hydrodynamic effect due to reservoir, concrete gravity dams.

UNIT 5 Engineering Seismology: Basic terms, seismic waves, earthquake magnitude and intensity, ground motion, dynamic response of structures, normalized response spectra, seismic coefficients and seismic zone coefficients.

Reference Books:

1. Chopra A.K., Dynamics of Structures', Theory & Applications to Earthquake Engineering , Prentice Hall India, New Delhi-1995
2. Clough & Penzien, Dynamics of Structures , McGraw Hill Book CO. Inc.
3. Paz M, Structural Dynamics,, Van Nostrand Reinhold, New York.
4. Paz, M, International Handbook of Earthquake Engineering, Chapman & Hall, New York.

5. IS-1893-1984, Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
6. IS-4326-1993, Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings, B.I.S., New Delhi.

MVS E – 102 Strength of material and theory of elasticity

Course outcome (Cos)

- The graduates will be able to develop numerical solution for various structural engineering problems like bending, buckling, analysis of beams and plates, etc.
- To understand the properties of material and their elastic properties.

UNIT-I Plane Stress & Plane Strain: Plane Stress, Plane Strain, Stress and Strain at a points, Differential equations of equilibrium, constitutive relation : ansisotropic materials Linear elasticity; Stress, strain, constitutive relations; Boundary conditions, Compatibility equation, stress function.

UNIT-II Two Dimensional Problems in Rectangular Co-ordinates: Solutions by Polynomials , Saint-Venants Principle, Determination of displacements, bending of beams, solution of two dimensional problem in Fourier series.

UNIT-III Two Dimensional Problems in Polar Coordinates : General equations in Polar coordinates, Pure bending of curved bars, displacements for symmetrical stress distributions, bending of curved bar, stress distribution in plates with circular holes, stresses in a circular disc general solution.

UNIT-IV Analysis of stress and strain in Three Dimensions : Principal stress and strain, shearing stress and strains, elementary equation of equilibrium , compatibility conditions, problems of elasticity involving pure bending of prismatic bars.

UNIT-V Torsion of Prismatic Bars : Torsion of prismatic bars, membrane analogy, torsion of a bar of narrow rectangular cross section, torsion of rectangular bars, solution of torsional problem, torsion of rolled section, torsion of hollow shafts and thin tubes, torsion buckling torsional flexural buckling.

References Books:

1. Timoshenko, S.P. , Theory of Elasticity
2. Timoshenko, S.P., Theory of Elastic Stability
3. Iyenger N.G.R., Structural Stability of Columns & Plate

MVSE – 103 Advance Structural Analysis

Course outcome (Cos):

- Analyse the beam and plane frame using Matrix method.
- Calculate displacements and internal forces of statically indeterminate structures.
- Obtain the static and kinematic indeterminacy of structure.

UNIT1 Matrix Method (Flexibility Method) : Force methods, Basic Concepts, evaluation of flexibility, transformation, analysis of a single member of different types, transformation of single member.

UNIT 2 Applications to plane and space structures with pin joints and rigid joints, energy approach in flexibility method, effect of support displacement and transformation

UNIT 3 Matrix Method (stiffness Method): Displacement methods, Basic concepts, Evaluation of stiffness coefficients, Direct stiffness method, energy approach in stiffness method. Code No. approach for global stiffness matrix, effect of support displacement and temperature.

UNIT 4 Symmetrical & anti-symmetrical problems, Stiffness of plane & space frames solution of problems, comparison of force and displacement methods of solution

Reference Books:

1. C.S. Reddy , Basic Structural Analysis ,TMH, Publishers
2. W Wearer Jr. & James M. Gere, Matrix Analysis of Framed Structures, CBS Pub.
3. Rajsekeran, Sankarsubramanian, Computational structural Mechanics, PHI
4. Pandit, Structural Analysis: a matrix approach, TMH

MVS E – 104 Design of concrete structures

Course outcome (Cos):

- To understand the effect of wind on various structure and design various structure's.
- To able the the student to understand Pre-stressed concrete and theories for them.

Unit 1 Earthquake and wind effects on structures, loads on structures, reinforced concrete design of flat slabs, grid floors, deep beams, design of buildings load bearing and framed structures, design of foundations, seismic analysis.

Unit 2 Design of ground and elevated water tanks, design of bridge decks.

Unit 3 Pre-stressed concrete: analysis and design of sections under flexure using limit state approach, anchorage zone and end block design, composite construction, introduction to statistically indeterminate pre-stressed concrete structures.

Unit 4 Silos and bunkers, Janseens and Airys theory, rectangular bunkers with sloping bottoms and with high side walls, battery of bunkers.

Reference Books:

1 .Jaikrishna, Chandrasekaran, Elements of earthquake engineering.
2. Shah and Karve, Text book of reinforced concrete
3. Punamia, RCC designs
4. IS-456, -875, -1893, -1984
5. Krishna Raju, Prestressed concrete.
6. Varghese, Advanced RC Designs, PHI
7. Everard, Theory and problems of RC design (Shaums Outline S),

MVSE – 105 Computer aided design

Course outcome (Cos):

- Apply/develop solutions or to do research in the areas of Design and simulation in structural Engineering.
- Execute steps required for modeling 3D objects by using various command and Convert 3D solid models into 2D drawing-different views, sections Use isometric views and dimensioning of models.

Unit 1 Cpp programming language: Basics of programming, loops, decisions, structures, functions, objects/ classes, arrays.

Unit 2 Overloading, inheritance, virtual functions and pointers, object oriented programming, Turbo Cpp features and programming, structure engineering problems programming.

Unit 3 Computer Aided drafting, 2-D and 3-D drawings, Introduction to CAD software, drawing of buildings.

Unit 4 Introduction to computer graphics, 3-D modeling software and analysis software.

Reference Books:

1. Robert Lafore, Object oriented programming in CPP
2. E. Balaguruswamy, Programming in C
3. Syal and Gupta, Computer programming and engineering analysis.
4. AutoCAD, SolidEdge, Cadlab software and Manuals.

MVSE - 201 Structural Dynamics

Course outcome (Cos):

- **To** understand the behavior of structure under dynamic loads .
- To Calculate response of SDOF and MDOF systems.
- Find out mode shape, frequencies and amplitude for motion of two/three DOF systems.

UNIT 1 Single Degree of Freedom System: Free and forced vibrations, Linear Viscous Damper, Coulomb Damper: Response to harmonic excitation, rotating unbalance and support excitations, Vibration isolation and transmissibility, single degree of freedom system as vibro-meter and accelerometer, response to periodic and arbitrary excitation.

UNIT-II Duhamels integral. Impulse response function, Laplace transform Fourier transform methods. Frequency response function. Phase-Plane Techniques. Critical Speed of rotors. Energy methods, Rayleighs method, Equivalent viscous damping.
UNIT-III Two Degree of Freedom System. Matrix Formulation, Free Vibration, Beat phenomenon. Principle of damped and un-damped vibration absorbers.

UNIT-IV Multi Degree of Freedom System: Matrix formulation, stiffness and flexibility influence coefficients, eigenvalue problem, normal modes and their properties. Matrix iteration technique for eigenvalue, and eigen vectors, Free and forced vibration by modal analysis.

UNIT-V Continuous System: Axial vibration of bar, torsion of shafts, transverse vibration of strings and bending vibration beams. Forced vibration. Normal mode method. Lagrangles equation. Approximate methods of Rayleigh-Ritz, Galerkin etc.

Reference Books:
1. RW Clough, J Penzien, Dynamics of structures
2. D G Fertia, Dynamics and vibration of Structures
3. J M Biggs, Introduction to structural dyna

MVSE - 202 FEM in Structural Engineering

Course outcome (Cos):

- To understand graduate Use Finite Element Method for structural analysis.
- To Solve continuous and complicated problems using finite element analysis.

UNIT-I Introduction to Finite Element Method: General Applicability and Description of Finite Element Method Comparison with other methods.

UNIT 2 Solution of Finite Element Method: Solution of Equilibrium Problems, Eigen value problems, propagation problems, computer implementation of Gaussian eliminations, Choleskis decomposition, Jocobis and Ranga Kutta Method.

UNIT 3 General Procedure of Finite Element Method: Descretization of the domain, Selection of Shapes, Types and Number of elements, node numbering technique, Interpolation Polynomials, their selection and derivation in terms of global and local coordinates, Convergence requirements. Formulation of Element Characteristic matrices and vectors, Variational approach. Assembly of Element matrices and Vectors and Derivation system equations, computation of element resultants.

UNIT-IV Iso-parametric Formulation: Lagrange and Hermite interpolation functions, Isoparametric Elements, Numerical Integration.

UNIT-V Static Analysis: Formulation of equilibrium equation, Analysis of truss, Frames, Plane Stress and Plane Strain Problems Plates and Shells.

Reference Books:

1. Weaver, Johnson, Finite element and structural analysis
2. HC Martin, Matrix structural analysis
3. CF Abel, CS Desai, Finite element methods
4. Buchanan, Finite element Analysis (schaum Outline S), TMH
5. Krishnamurthy, Finite element analysis, TM

MVSE - 203 Advance Concrete Technology

Course outcome (Cos):

- To expose about advanced concrete ingredients and its influence on gaining strength
.
- To determine the properties of fresh and hardened of concrete with time and different conditions .
- To understand the design of concrete mix using ACI and IS code methods and Provide solutions related with concrete and concreting problems.

UNIT 1 Cement & its properties, properties of fresh concrete compaction of concrete, curing of concrete.

UNIT 2 Properties of hardened concrete, strength characteristic, shrinkage, creep, durability, fattier.

UNIT 3 Permeability & durability of concrete is detail. Special concrete and their properties.

UNIT 4 Concrete at low & high temp. Air entrained concrete, high performance concrete.

UNIT 5 Mix Design, Non destructive Testing of Concrete.

Reference Books:

1. A.M. Nobille, Concrete Technology , ELBS, London
2. M.L. Gambir, Concrete Technology, Tata Mc Graw Hill Book Co.
3. Peurifoy R.L., Construction Planning Equipment & Methods, TMH 4. Verma Ma

MVSE 204 Analysis and Design of Multistoried Buildings

Course outcome (Cos):

- A review of the analysis and design of a multi-storey building with STAAD Pro is carried out. Planning is done by using AutoCAD and load calculations were done manually and then the structure was analysed using STAAD Pro.
- The dead load, imposed load and wind load with load combination are calculated and applied to the structure.

Unit- I Performance based design philosophy, structural systems for multistoried buildings, gravity and lateral loads on buildings, analysis of multistoried frames. Analysis of asymmetric buildings- mass irregularity in plan and elevation, analysis for torsion in buildings.

Unit- II Behavior of framed tube system, tube-in-tube system, bundled tube system, simplified analytical models for symmetrical tubular structures.

Unit- III Design of buildings with shear walls and coupled- shear walls, design specification in IS codes.

Unit- IV Design and detailing of various members and beam-column joints for ductility, design specifications IS codes.

Unit- V Design of raft and pile foundations, design specifications in IS codes. Application of software packages such as MS-Excel, ETABS and SAFE.

Suggested books:

1. Jain, A.K., "Reinforced Concrete –Limit State Design", Nem Chand & Bros.
2. James, K.K.and Gregor, J.G.M., "Reinforced Concrete Mechanics and Design", Pearson.
3. Arthur, H.N., "Design of Concrete Structures," Tata McGraw-Hill.
4. Park, R. and Paulay, T., "Reinforced Concrete Structures", John-Wiley.

MVSE - 205 Theory of Plates and Shells

Course outcome (Cos):

- To use analytical methods for the solution of thin plates and shells and theories .
- To apply numerical techniques for the complex problems in thin plates and shells.

UNIT 1 Theory of Plates: Bearing of long rectangular plates to the cylindrical surface with different edge conditions. Pure bending of plates-Differential equations of equilibrium. Theory of small deflections of laterally loads plates. Boundary conditions, momentcurvature relationship.

UNIT 2 Analysis of rectangular plates, Naviers and levy solutions, exact theory of plates, symmetrical bending of circular plates, continuous rectangular plates

UNIT 3 Special and approximate methods of theory of plates, singularities, use of influence surfaces, use of infinite integrals and transforms, strain energy methods, experimental methods.

UNIT 4 Theory of Shells: Classification of shells, Gaussian curvature, General theory of cylindrical shells, membrane theory and bending theory for cylindrical shells, long and short shells, shells, shells with and without edge beams, Fourier loading.

UNIT 5 Equation of equilibrium for shells of surface of revolution, Reduction to two differential equations of second order. Spherical shells, membrane theory for shells of double curvature-syn-elastic and anti-elastic. Cylindrical shells, Hyperbolic-parabolic shells, funicular shells.

Reference Books: 1. S Timoshenko, S Woinowasky K, Theory of Plates and Shell

MVSE – 301 Comprehensive Viva & Seminar

Course Outcomes:

At the end of the course the students will be able to:

- Comprehend the knowledge gained in the course work.
- Infer principles of working of Structural Engineering
- Demonstrate the ability in problem solving and to communicate effectively
- Identify and compare technical and practical issues related to the area of course specialization.
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presentation

MVSE– 302 Dissertation Part-I

Course Outcomes:
At the end of the course:

- Identify a topic in advanced areas of structural engineering.
- Review literature to identify gaps and define objectives & scope of the work.
- Employ the ideas from literature and develop research methodology,
- Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

MVSE–401 Dissertation Part-II

Course Outcomes:
At the end of the course:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyse and discuss the results to draw valid conclusions.
- Prepare a report as per the recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

MASTER OF TECHNOLOGY (M.Tech)

POWER SYSTEM AUTOMATION

PROGRAMME SPECIFIC OUTCOMES

- To apply knowledge of power system configuration, electrical equipment and protection practices to understand electrical generation, transmission, distribution and utilization systems.
- Design and develop electric power and energy systems
- To Design, analyse, test and evaluate the performance of the electrical machines and transformers.
- Deliver technological solutions in the field of power systems by assimilating advances in allied disciplines.
- Simulate and experiment in the field of power systems using modern tools.
- Design renewable energy systems to protect environment and ecosystems.
- Practice professional ethics with social sensitivity.
- Develop innovative and entrepreneurial solutions.
- To develop the expertise in the technology associated with efficient conversion and control of electrical power by static means from available form to the required form.

MTPA 101 Smart Grid Technologies and Smart Energy Management System

COURSE EDUCATIONAL OBJECTIVES :

The objectives of the course are to make the students,

- To understand the basic concepts, components and architecture of smart grid
- To understand the various measurement technologies in smart grid
- To educate the importance of renewable energy in smart
- To know about battery technology and energy storage
- To brief about role of Electric Vehicles in smart grid

UNIT I INTRODUCTION

Today's Gird Versus Smart Grid, Rationale for Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, Shareholders Roles and Function, Architecture, Functions of Components

UNIT II SENSORS AND MEASUREMENT

Sensors for Smart Grid, Monitoring and Measurement Technologies, PMU, Smart meters, Smart Appliances, Multi Agent Systems (MAS) Technology, Micro grid and Smart grid comparison, Wide Area Measurement

UNIT III DISTRIBUTED GENERATION

Solar Energy, PV Systems, Wind turbine Systems, Biomass, Small and Micro Hydro Power, Fuel Cell, Geothermal heat pumps. UNIT IV ENERGY STORAGE 9 Batteries, Flow Batteries, Fuel Cell and hydrogen electrolytes, Flywheel, Super conduction magnetic energy storage systems, super capacitors, Simulation and case studies

UNIT V ELECTRIC VEHICLES

Plugin Electric Vehicles and hybrid, Vehicle classes, Vehicle Architecture, Gird to Vehicle (G2V) Charging, Grid Impacts, Vehicle to Grid (V2G)

TEXT BOOKS:

1. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012.

2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko

3. Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons Inc, 2012.

4. Lars.T.Berger, K.Iniewski, "Smart Grid: Applications, Communications & Security" Wiley India Pvt. Ltd, Reprint 2015.

REFERENCE BOOKS:

1. Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012.

2. Clark W.Gellings, "The smart grid: Enabling energy efficiency and demand response", Fairmont Press Inc,2009. 3. Qi Huang, Shi Jing "Innovative Testing and Measurement Solutions for Smart Grid", John Wiley & Sons Inc, 2015.

MTPA – 102 POWER SYSTEM DYNAMICS ANALYSIS & CONTROL

Program Learning Outcomes of Master of Technology

- To develop dynamic modeling of a synchronous machine.
- To describe the modeling of excitation and speed governing system.
- To analyze the small signal stability without controllers
- To analyze the small signal stability with controllers
- To explain the methods to enhance the small signal stability of the power system.

UNIT 1
INTRODUCTION TO POWER SYSTEM STABILITY PROBLEM: Basic concepts and definitions: Rotor angle stability, voltage stability and voltage collapse, Midterm and long-term stability, Classification of stability, states of operation and system security system dynamic problems.

UNIT 2
REVIEW OF CLASSICAL METHOD: System model, some mathematical analysis of steady state stability, analysis of transient stability, simplified representation of excitation control.

UNIT 3
MODELING OF SYNCHRONOUS MACHINE: Introduction, synchronous machine, parks transformation, analysis of steady state performance per unit equivalent circuits of synchronous machine, determination of parameters of equivalent circuits, measurements for obtaining data, saturation models, transient analysis of a synchronous machine.

UNIT 4
EXCITATION AND PRIME MOVER CONTROLLERS: Excitation system Modeling, system representation by state evasions, prime move control systems.

UNIT 5
TRNMISSION LINE, SVC AND LOADS: D-Q transformation using L-B variables, static var compensators, loads Dynamics of a synchronous generator connected to estimate bus: system model, synchronous machine model, calculation of initial conditions, inclusion of SVC Model, Analysis of single machine system, Small signal analysis with block diagram representation, synchronizing and damping torque analysis, small signal model, nonlinear oscillators.

UNIT 6
APPLICATION OF POWER SYSTEM STABILIZERS: Basic concepts, control signals,

structure and tuning of PSS, field implementation and operating experience 8 Hours.

Reference Books:

1. K.R. Padiyar, Power system dynamics, stability and control, BS Pub. Hydbd
2. P Kunder, Power system stability and control, TMH.
3. P. W. Sauer & M A Pai: Power system dynamics and stability: Pearson.

MTPA – 103 ADVANCE POWER SYSTEM PROTECTION RELAYS

Program Learning Outcomes of Master of Technology

- To discuss different techniques dealing with sparse matrix for large scale power systems.
- To explain different methods of power flow solutions.
- To solve optimal power flow problem.
- To analyze various types of short circuit faults
- To demonstrate different numeric al integration methods and factors influencing transient stability

Unit 1
Protective Relays: Relaying review, characteristics and operating equations of relays. CT's and PT's differential relay, over-current relay, reverse power relay, distance relays, applications of relays.

Unit 2
STATIC RELAYS: Introduction, advantages and disadvantages, classification logic ckts, smoothing circuits, voltage regulator square wave generator, time delay ckts level detectors, summation device, sampling circuit, zero crossing detector, output devices. COMPARATORS: Replica Impedance, mixing transformers, general equation of phase and amplitude comparator, realization of ohm, impedance and off set impedance characteristics, duality principle, static amplitude comparators, coincidence circuit, Hall effect devices, Magneto receptivity, zener diode phase comparator multi input comparators.

Unit 3
Generator and transformer protection: Protective devices for system. Protective devices for stator, rotor, and prime mover of generator, percentage differential relays protection, three winding transformer protection, earth fault protection, generator transformer unit protection.

UNIT 4
Bus bar and transmission line protection: Distance protective schemes, directional wave detection relay. Phase compensation carrier protection. High impedance differential scheme, supervisory and check relay, Some features of 500 KV relaying protection.

Unit 5
Modern trends in power system protection: Different types of digital and computer aided relays, Microprocessor based relays, auto-reclosing, frequency relays, under and

over frequency relays, di/dt relays. Algorithms for transmission line, transformer & bus bar protection; out-of-step relaying Introduction to adaptive relaying & wide area measurements

Reference Books:

1. Power System Protection and Switchgear, B.Ram – Tata Mc-Graw Hill Pub.
2. Switchgear and Protection, M.V.Deshpande - Tata Mc-Graw Hill Pub.
3. Power System Protection & Switchgear, Ravindra Nath, M.Chander, Willy P
4. Computer Relaying for power system, Arun Phadke, James Thorp, Johns W P
5. Power System Protection, M.A.Date, Bharti Prakashan, Vallabh Vidya N,(Guj).

MTPA – 104 (Elective- I) A
RELIABILITY EVOLUTION OF POWER SYSTEMS

Program Learning Outcomes of Master of Technology

- To determine the reliability of ISO and interconnected generation systems.
- To analyze the transmission system reliability
- To explain the expansion planning and capacitor placement problem in transmission system and radial distributions system.
- To design the primary and secondary distribution system and to explain distribution system protective scheme and its coordination

UNIT I
Reliability definition , requirement, methods of enhancement, Reliability importance and allocation, concept of random variable, distribution functions, distribution functions of a single random variable.

UNIT II
Failure density function eg. Exponential , Weibul, Normal, Hypoexponential, Hyperexponential etc. Hazard Function, Reliability function and inter relationship, safety and reliability. Effect of Wear-in-period on reliability. Effect of preventive maintenance, Reliability evaluation with component replacement.

UNIT III
Network methods of Reliability evaluation, Event-space method, Decomposition method, Tie-set method and Cut-set method, Random number generators, Generation of random variats from failure distributions eg. Exponential, Normal, Rayleigh etc. Montecarl0o simulation based network reliability evaluation. Convergence using coefficient of variation and confidence intervals, Standby systems and load sharing systems, Multi state models.

UNIT IV
Markov modeling , state equations, MTTF calculations, steady state and time dependent state probabilities, System availability and unavailability. Concept of frequency and durations, State enumeration method for frequency, MUT, MDT calculations.

UNIT V
Basic concepts of LOLP, evaluation of indices for isolated system. Generation and Transmission system reliability, analysis using frequency and duration methods. Distribution system reliability evaluation for radial system with perfect and imperfect switching.

Reference Books:

1.Reliability Evaluation of Engineering systems: Concepts and techniques – RoyBillinton, Ronald N. Allan, Pitman Advanced Publishing Program. 1984.
2.Reliability and Maintainability Engineering TMH 2006, C.E. Ebeling
3.J. Endreny, Reliability Modelling in Electrical Power Systems, Jhon Wiley & Sons. Roy Billinton & Ronald, N allan .
4. Reliability Evaluation of Power Systems, Plenum Press, New York

MTPA – 104 (Elective- I) B
POWER QUALITY
Program Learning Outcomes of Master of Technology.

- **To describe various power quality issues**
- **To explain the concept of power and power factor in single phase and three phase systems supplying non linear loads**
- **To discuss the conventional compensation techniques used for power factor correction and load voltage regulation.**
- **To explain the active compensation techniques used for power factor correction.**
- **To analyze the active compensation techniques used for load voltage regulation.**

UNIT 1
Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances

UNIT 2
Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics

UNIT 3
Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters,design of harmonic filters,Improved power quality converter topologies,(single and three phase), transformer connections, Elimination/suppression of harmonics using active power filters – topologies, and their controlmethods, PWM converter as a voltage source active filter, current source active filter

UNIT 4
Active waveshaping of input line current, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control,Electromagnetic interference(EMI), EMI generation ,EMI standards,and elimination.

Reference Books:
1. Power Quality – by R.C. Duggan
2. Power system harmonics – by A.J. Arrillga
3. Power electronic converter harmonics – by Derek A. Paice
4. Power Electronics –Mohan,Undeland,Robbins

MTPA – 105 (Elective -II) A
POWER SYSTEM ECONOMICS & TRADING

Program Learning Outcomes of Master of Technology

- To list the objectives of load forecasting and to apply the AI technique for load forecasting
- To explain the expansion planning and capacitor placement problem in transmission system and radial distributions system.
- To design the primary and secondary distribution system and to explain distribution system protective scheme and its coordination

UNIT I
POWER SYSTEM FUNDAMENTALS: Regulation and deregulation ,conditions for deregulation, problems with regulation , problems with deregulating electricity, risk management and forward markets, congestion management, ATC, Energy sector reforms, Indian Electricity Act 2003.

UNIT II
COMPETITION IN POWER MARKET: What is competition, efficiency of perfect competition, marginal cost in power market, role of marginal cost, working with marginal cost, results of marginal cost, screening curve.

UNIT III
MAR KET ARCHITECTURE: Introduction, spot markets, forward markets, settlements, two settlement system, day ahead designs, the day ahead market in theory, the real time market in theory, the day ahead market in practice, the real time market in practice, the market for operating reserves.

UNIT IV
LOCATIONAL PRICING: Power transmission and losses, physical transmission limits, congestion pricing fundamentals, congestion pricing methods, congestion pricing fallacies, refund and taxes, pricing losses on line, pricing losses at nodes, transmission rights.

UNIT V
POWER TRADING: Availability based tariff, power scheduling, unscheduled interchange charges, TOU/ TOD charges, Demand forecasting, National energy policy, National tariff policy.

References Books :
Power system economics-designing for electricity –Steven Soft. (IEEE press and WILEY- INTERSCIENCE)
Loi Lei Lai, " Power system Restructuring and Deregulation", Jhon Wiley & Sons

Ltd.,Englandss.
Kankar Bhattacharya,Math H.J. Boller, Jaap E. Daalder, "Operatersional of Restructered providers" Klumer Academic Publisher-2001
Mohammad Sahidehpour , and Muwaffaq Alomoush, - " Restuctured electrical power systems" Marcel Dekker , Inc. 200

MTPA – 105 (Elective -II) B
MODELLING SIMULATION & EVOLUTIONARY TECHNIQUES

Program Learning Outcomes of Master of Technology.

- **To develop coding to solve power flow problem using NR and GS methods**
- **To develop coding to calculate generation shift factor and line outage factor**
- **To develop coding to solve UC and ED problems**
- **To analyze transient stability of SMIB system using MATLAB and to analyze the switching surges using EMTP**
- **To simulate and analyze voltage source inverters**
- **To analyze the functions of protective relays using simulation**

Unit-I
Model classification, Mathematical, physical and analog models, Computer simulation of continuous and discrete systems. Introduction to soft computing, Human brain and Biological Neurons, Model of an artificial neuron, Comparison between artificial and biological neural network, Characteristics of Artificial Neural Network (ANN), Basic concepts of ANN, Classification of ANN, Perceptron model and linear separability, Multilayer perceptron model, backpropagation learning, supervised, unsupervised and competitive learning, Architecture and training algorithm of Hopfield network, Radial basis function network, Kohonen self organizing feature map, counter propagation network

Unit-II
Introduction to fuzzy sets and operations, fuzzy relations, measure of fuzziness, fuzziness and probability theory, membership function and their features, fuzzification, defuzzification, fuzzy inference system (FIS), fuzzy inference methods, Mamdani and Takagi-Sugeno fuzzy methods, Fuzzy controller, Hybrid fuzzy neural systems.

Unit-III.
Evolutionary versus traditional optimization methods, Classification of optimization problems, Genetic algorithm concepts and working principle, differences between GAs and traditional methods, similarities between GAs and traditional methods, fitness function, reproduction, crossover and mutation operators in binary coded and real coded GAs, concept of schema, constraint handling in GAs.

Unit-IV
Introduction to Swarm Intelligence, Particle Swarm Optimization, Differential evolution, Ant Colony Optimization, bacterial foraging algorithm, Harmony search algorithm, and artificial bee colony optimization. Algorithm and population update mechanism of the above nature inspired evolutionary optimization techniques. Statistical analysis of results, Determination of mean and standard deviation of population, Introduction to hybrid evolutionary techniques

Unit-V
Introduction to MATLAB and Its tool boxes (like Neural network, fuzzy logic, Genetic Algorithm, Optimization toolbox), MATLAB implementation of neural networks, fuzzy logic, Genetic

algorithm, Particle Swarm Optimization, Differential evolution etc. with examples

Reference Books:-

- P.D. Wasserman: Neural Computing Theory and Practice
- B. Yegnanarayana: Artificial Neural Networks
- Fu Limin: Neural Networks in Computer Intelligence
- S.N. Sivanandam, S. Sumathi and S.N. Deepa: Introduction to Neural Networks using Matlab 6.0
- S. Rajasekaran and G.A. Vijayalakshmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms
- N.P. Padhy: Artificial Intelligence and Intelligent Systems
- S.N. Sivanandam, S. Sumathi and S.N. Deepa: Introduction to Fuzzy Logic using Matlab
- K. Deb: Optimization for Engineering Design
- K. Deb: Multiobjective Optimization using Evolutionary Algorithms
- Principles of Soft Computing by S.N Sivanandanam and S. N.Deepa

MTPA – 106 LAB-I

Program Learning Outcomes of Master of Technology

- Ability to design and conduct engineering experiments, as well as to analyze and interpret data.
- Ability to identify, formulate, solve and analyze the problems in various disciplines of engineering.
- Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.
- Ability to use techniques, skills and modern technological/scientific/engineering software/tools for professional practices.
- Ability to enrich skills so as to facilitate greater employability.

1. Study of Power System economics & trading.
2. Separation of eddy current & iron losses of single phase transformer.
3. To perform slip test on synchronous machine and to determine d-axis & q-axis reactance.
4. To measure the direct axis sub transient reactance of synchronous machine.
5. To measure the quadrature axis sub transient reactance of synchronous machine
6. To develop a program in Matlab for information of Y-bus matrix for N bus system.
7. Load flow solution for 3-bus system using Gauss- Seidel, Newton Raphson and FDLF methods upto 3 iteration.
8. Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.
9. To determine the effect of compensation on voltage profile of IEEE 6-bus system by using Mi Power / MATLAB Software

MTPA – 107 LAB-II

Program Learning Outcomes of Master of Technology

- Ability to design and conduct engineering experiments, as well as to analyze and interpret data.
- Ability to identify, formulate, solve and analyze the problems in various disciplines of engineering.
- Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.
- Ability to use techniques, skills and modern technological/scientific/engineering software/tools for professional practices.
- Ability to enrich skills so as to facilitate greater employability.

1). Operating Characteristics of Percentage based differential relays.
2). Operating Characteristics of Directional Relays.
3) Operating Characteristics of the micro controller based over/under voltage relays.
4). To draw characteristics and determine time of operation for specific PSM & TLS of electromechanical type IDMT relays.
5) . Verify correctness of operation of Bus Bar Protection for various bus faults condition.
6). Verify operation of generator Protection relay for various types of faults..
7). Study of Relay Coordination using any Application software.

MTPA – 201 REACTIVE POWER CONTROL & FACTS

Program Learning Outcomes of Master of Technology.

- To explain the importance of restructuring of Power Systems, different market models and the function of ISO role in power market.
- To discuss the Concepts of Transmission Congestion and to calculate ATC
- To Calculate Locational marginal pricing and explain the significance of Financial Transmission rights.
- To define Ancillary services management and analyze transmission pricing issues.
- To outline the reform initiatives taken by Indian Government, Electricity act 2003 and open access issues

UNIT 1

Description and definition of Introduction to FACTS: Basic Types of ccontrollers – Benefits from FACTS technology- Static Var Compensator (SVC): Principle of operation, configuration and control. Thyristor Controlled Series compensator (TCSC): Principle of operation, configuration and control, Application for damping electromechanical Oscillations, Application for mitigation of SSR. Static Compensator (STATCOM): Principle of operation, configuration and control. Static Synchronous Series Compensator (SSSC): Principle of operation, configuration and control. Thyristor Controlled Phase Angle Regulator (TCPAR): Principle of operation, configuration and control, Unified Power Flow Controller (UPFC): Principle of operation, configuration and control, Simulation of UPFC, Steady state model of UPFC. Interline Power Flow Controller (IPFC): Principle of operation, configuration and control.

UNIT 2

Oscillation Stability Analysis and Control: Introduction – Linearised model of power systems installed with FACTS based Stabilisers – Heffron-Phillips model of a SMIB system installed with SVC, TCSC and TCPS – Heffron-Phillips model of a SMIB system with UPFC – Heffron-Phillips model of a Multi-machine system installed with SVC, TCSC and TCPS

UNIT 3

Analysis and Design of FACTS based stabilisers: Analysis of damping torque contribution by FACTS based stabilisers installed in SMIB systems, Design of robust FACTS based stabilisers installed in SMIB systems by phase compensation method. Selection of installing locations and feed back signal for FACTS based stabilizers

UNIT 4

Transient Stability control with FACTS: Introduction – Analysis of Power systems installed with FACTS devices: Power transmission control using Controllable Series Compensation(CSC), Power Transmission Control using SSSC, Power Transmission Control using UPFC, Power Transmission Control using Phase Shifting Transformer(PST), Power Transmission Control using UPFC, Control of FACTS devices for transient stability improvement – General considerations of FACTS control strategy: CSC,SSSC, SVC, STATCOM and UPFC control strategy – General Structure of the FACTS devices control.

MTPA – 202 COMPUTER NETWORK & CYBER SECURITY

Program Learning Outcomes of Master of Technology.

- To explain the concept of artificial neural network and to develop ANN structure and back propagation algorithm
- To develop Hopfield neural network model and explain adaptive resonant theory
- To describe fuzzy concept and to develop fuzzy logic systems

UNIT I

Introduction to Network Security, Computer Security and Cyber Security. Security Terminologies and Principle, Security Threats, Types of attacks (Operating System, application level, Shrink Wrap code, Misconfiguration attacks etc.). Introduction to Intrusion, Terminologies, Intrusion Detection System (IDS), Types of Intrusion Detection Systems, System Integrity Verifiers (SIVS).Indication of Intrusion: System Indications, File System Indications Network Indications. Intrusion Detection Tools ,Post attack IDS Measures & Evading IDS Systems. Penetration Testing, Categories of security assessments, Vulnerability Assessment, Types of Penetration Testing. Risk Management.

UNIT II

Cryptography, Classical Cryptographic Techniques, Encryption, Decryption, Code Breaking: Methodologies, Cryptanalysis, Cryptography Attacks, Brute-Force Attack, Use of Cryptography. Public key cryptography, Principles of Public key Cryptosystems, Cryptographic Algorithms RSA, Data Encryption Standard (DES), RC4, RC5, RC6, Blowfish, Key Management, Diffie-Hellman key exchange, elliptic curve cryptography.

UNIT III

Hash Functions, One-way Hash Functions, SHA (Secure Hash Algorithm), Authentication Requirements, Authentication Functions, Kerberos. Message Authentication codes, Message Digest Functions, MD5, SSL (Secure Sockets Layer), SSH (Secure Shell), Algorithms and Security, Disk Encryption, Government Access to Keys (GAK)
Digital Signature: Analysis, Components, Method, Applications, Standard, Algorithm: Signature Generation/Verification, ECDSA, Elgamal Signature Scheme, Digital Certificates.

UNIT IV

Trojans and Backdoors: Overt and Covert Channels, Working, Types (Remote Access Trojans, Data-Sending Trojans, Destructive Trojans, Trojans, Proxy Trojans, FTP Trojans, Security Software Disablers).
Viruses and Worms: Characteristics, Working, Infection Phase, Attack Phase. Sniffers: Definition, spoofing, Sniffing, Vulnerable Protocols, Types.
Phishing: Methods, Process, Attacks Types (Man-in-the-Middle Attacks, URL Obfuscation Attacks, Hidden Attacks, Client-side Vulnerabilities, Deceptive Phishing, Malware-Based Phishing, DNSBased Phishing, Content-Injection Phishing, Search Engine Phishing).
Web Application Security- Secured authentication mechanism, secured session management, Cross-site Scripting, SQL Injection and other vulnerabilities
Denial-of Service Attacks: Types of Attacks (Smurf Attack, Buffer Overflow Attack, Ping of

Death Attack, Teardrop Attack, SYN Attack, SYN Flooding), DDoS Attack(Distributed DoS Attack.), Session Hijacking, Spoofing v Hijacking, TCP/IP hijacking, CAPTCHA Protection

UNIT V

IP Security, Web Security, Firewalls: Types, Operation, Design Principles, Trusted Systems. Computer Forensics, Need, Objectives, Stages & Steps of Forensic Investigation in Tracking Cyber Criminals, Incident Handling.

Hacking, Classes of Hacker (Black hats, grey hats, white hats, suicide hackers), Footprinting, Scanning (Types-Port, Network, Vulnerability), E-Mail Spiders, Overview of System Hacking Cycle.

MTPA – 203 ADVANCED COMPUTER METHODS IN POWER SYSTEMS

Program Learning Outcomes of Master of Technology.

- To develop state model for linear time invariant and time variant system and non-linear system
- To solve the state equation
- To analyze controllability and observability of the system using state model
- To analyze the stability of the linear time invariant, time variant and nonlinear systems using Lyapunov, Krasovskii and Variable-Gradiant Methods.
- To design state and output feedback controllers and estimators

Unit I
Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line laudability, capability curves of alternator.

Unit II
Control of load bus voltage using reactive power control variable, SVC & SVS, Regulated shunt compensation, series and shunt compensation, Uniform series and shunt compensation and effect on load ability of transmission lines.

Unit III
Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.

Unit IV
Power system security – Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and postcontingency, corrective rescheduling.

Unit V
Voltage stability - Difference between voltage and angle stability, PV Curve for voltage stability assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability , effect of load models.

MTPA204 WIND ENERGY, SMALL HYDRO AND NEW RENEWABLE ENERGY TECHNOLOGIES

Objective:

Describe the fundamentals and main characteristics of wind, small hydro, fuel cell, geothermal energy and other new renewable energy technologies

Specific Objectives of Learning

- At the end of the course learner will be able to
- Develop basic knowledge about Wind energy conversion Technology and its terminologies.
- Design and assess the small wind turbine and its performance.
- Enumerate the Small mini Hydro plants for Energy generation.
- Selecting the Hydro power plant capacity for the given circumstances.
- Develop the basic technological idea about various New & Renewable energy conversion Technology.

Unit I Wind Energy Conversion –

Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics. – Site Selection Criteria – Advantages – Limitations – Wind Rose Diagram – Indian Wind Energy Data – Organizations like NIWE etc., Wind Energy Conversion System - Design - Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element and combine theory; Rotor characteristics; Maximum power coefficient; Prandlt's tip loss correction.

Unit II Design of Wind Turbine –

Wind turbine design considerations; Methodology; Theoretical simulation of wind turbine characteristics; Test methods. Wind Energy Application - Wind pumps: Performance analysis, design concept and testing; Principle of WEG; Stand alone, grid connected and hybrid applications of WECS; Economics of wind energy utilization; Wind energy in India; Case studies.

Unit III Small Hydropower Systems –

Overview of micro, mini and small hydro systems; Hydrology; Elements of pumps and turbine; Selection and design criteria of pumps and turbines; Site selection and civil works

Unit IV Speed and voltage regulation;

Investment issues load management and tariff collection; Distribution and marketing issues: case studies; Potential of small hydro power in India. – SHP – Renovation and Modernization – Testing Methods

Unit V

Tidal Energy- Geothermal- MHD - Thermionic- Thermoelectric energy conversion system- Fuel Cells – Batteries – Micro Alge – Biodiesel from Alge

References:

1. G L Johnson, Wind Energy Systems, Prentice Hall Inc, New Jersey, 1985.

2. David A. Spera, (Editor) Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering,American Society of Mechanical Engineers; (1994)

3. Erich Hau,Wind Turbines: Fundamentals, Technologies, Application and Economics, Springer Verlag; (2000)

4. Paul Gipe , Karen Perez, Wind Energy Basics: A Guide to Small and Micro Wind Systems, Chelsea Green Publishing Company; (1999)

5. J. F. Manwell, J. G. McGowan, A. L. Rogers, Wind Energy Explained , John Wiley & Sons; 1st edition (2002)

6. Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi, Wind Energy Handbook , John Wiley & Sons; 1st edition (2001)

7. Mukund R. Patel, Wind and Solar Power Systems , CRC Press; (1999) 8. Tong Jiandong(et al.) , Mini Hydropower , John Wiley, 1997 9. John F. Walker and Nicholas Jenkins, Wind Energy Technology, John Wiley, 1997

MTPA-205 SCADA SYSTEMS

Program Learning Outcomes of Master of Technology.

- Controlling & monitoring Process in real time from Remote location
- Analyze & calculation of complex the Process & maintain accordingly the Control Signals
- Data Acquisition, Historical Data Logging, Archiving & retrieving
- Trend & Alarm generation
- Recipe Management for Process & Chemical Industries
- Report Generation

UNIT-I

SCADA SYSTEM: Need of computer control of power systems, Data acquisition and control, SCADA System evolution, SCADA System architecture, SCADA System desirable properties, Remote Terminal Unit- RTU Principle, Test and configuration tools for RTU, SCADA human – machine interface (HMI)

UNIT-II

SCADA COMMUNICATION - Transducers- Analog and Digital transducers, Digital data acquisition systems, Signal conditioning system, Data telemetry- Voltage and current telemetry, Position telemetry , radio frequency telemetry, Transmission channels and media

UNIT-III

SCADA Protocols- Evolution of SCADA Protocols, Proprietary and open protocols , OSI Model, TCP/IP Model, Modbus, DNP3, UCA, IEC 61850 Standards, SCADA security system

UNIT- IV

Automatic Substation Control and Distribution Automation : Topology and functionality, hardware implementation , system configuration and testing, Factors influencing the application of automation of distribution networks, Primary and secondary distribution network automation, Autoreclosers , Sectionalizers , Ring Main Units (RMU) ,Fault passage Indicators (FPI)

UNIT-V

Smart Grid- Principle and architecture of Smart Grid, Self healing and adaptive grids, Key drivers, components of smart grid, smart grid management center, Advance metering infrastructure for smart grid , Zigbee and home area network (HAN), Phasor measurement unit (PMU), smart grid security , India's initiative and development toward smart grid , challenges in smart grid implementation.

MTPA – 301 Comprehensive Viva & Seminar

Course Outcomes:

At the end of the course the students will be able to:

- Comprehend the knowledge gained in the course work.
- Infer principles of working of power system automation.
- Demonstrate the ability in problem solving and to communicate effectively
- Identify and compare technical and practical issues related to the area of course specialization.
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presenting.

MTPA– 302 Dissertation Part-I

Course Outcomes:
At the end of the course:

- Identify a topic in advanced areas of power system automation.
- Review literature to identify gaps and define objectives & scope of the work.
- Employ the ideas from literature and develop research methodology,
- Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

MTPA–401 Dissertation Part-II

Course Outcomes:
At the end of the course:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyse and discuss the results to draw valid conclusions.
- Prepare a report as per the recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.