Scheme & Syllabus

for

M.TECH. COURSE

in

POWER ELECTRONICS & DRIVES

(w.e.f. session 2019-20)

DEPARTMENT OF ELECTRICAL ENGINEERING

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

To contribute to the development of science and technology by synthesizing teaching, research and creative activities.

To provide an enviable research environment and state-of-the-art technological exposure to its scholars.

To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electrical Engineering

VISION

Electrical Engineering Department congregates the challenges of new technological advancements to provide comprehensively trained, career focused ,morally strong accomplished graduates, cutting edge researchers by experimental learning which contribute to ever changing global society and serve as competent engineers.

MISSION

- To commit excellence in imparting knowledge through incubation and execution of high quality innovative educational programs.
- To develop the Research oriented culture to build national capabilities for excellent power management.
- To inculcate and harvest the moral values and ethical behavior in the students through exposure of self -discipline and personal integrity.
- To develop a Centre of research and education generating knowledge and technologies which lay ground work in shaping the future in the field of electrical engineering.

J.C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES AND EXAMINATION-2019-20
M-TECH 1st YEAR (POWER ELECTRONICS & DRIVES) SEMESTER-I

Sr. No.	Course Code	Course Title	Hours Per Week			Sessional Marks	Final Marks	Total	Credits
			L	T	P				
1	MPED101	Electric Drives System	3	-	-	25	75	100	3
2	MPED102	Modeling and Analysis of Electrical Machines	3	-	-	25	75	100	3
3		Program Elective-I	3	-	-	25	75	100	3
4		Program Elective-II	3	-	-	25	75	100	3
5	RM101*	Research Methodology and IPR	3	-	-	25	75	100	3
6	MPED151	Electrical Drives Laboratory	-	-	4	15	35	50	2
7	MPED152	Electrical Machines Laboratory/Power Quality Lab	-	-	4	15	35	50	2
8	AUD01	Audit-I	2	-	-	25	75	100	0
		TOTAL				**180**	**520**	**700**	**19**

*Common with M.Tech Ist Sem Power Systems 2019-20 Scheme code: RM101A Research Methodology & IPR

	Course Code	Course Title
Program Elective-I	MPED103	Advanced Power Electronic Circuits
	MPS107A	Power Quality (Common with M.Tech PS Sem 1)
	MPS106A	Dynamics of Electrical Machine (Common with M.Tech PS Sem 1)

	Course Code	Course Title
Program Elective-II	MPS112A	Static VAR Controllers and Harmonic Filtering (Common with M.Tech PS Sem 1)
	MPED107	Optimal and Adaptive Control
	MPED109A	Advance Microcontroller based Systems (Common with M.Tech PS Sem1)

	Course Code	Course Title
AUD-1	**AUD01A**	English for Research Paper Writing
	AUD02A	Disaster Management
	AUD03A	Sanskrit for Technical Knowledge
	AUD04A	Value Education
	AUD05A	Constitution of India
	AUD06A	Pedagogy Studies
	AUD07A	Stress Management by Yoga
	AUD08A	Personality Development through Life Enlightenment Skills

Program Outcomes

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: An ability to design and analysis of various controllers for improvement of performance of Power System & Drives.

PO5: An ability to develop and apply artificial intelligence based techniques for the analysis of problems related to Power System.

FIRST SEMESTER

MPED 101 **Electric Drives System** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. Understand Basic electrical drives and their analysis.
2. Learn Design of controller for drives.
3. Understand Scalar control of electrical drives.

Syllabus

Units	Content
1	• Dynamics of Electric Drives: Fundamentals of torque equation, Speed torque convention and multi-quadrant operation, components of load torques.
2	• Classification of load torques steady state stability. • Load equation, Speed control and drive classification and close loop control of drives.
3	• DC motor Drives-Modeling of DC machines. • Steady state characteristics with armature and speed control, Phase controlled DC motor drives, Chopper controlled DC motor drives.
4	• Poly-phase induction machines- Dynamic modeling of induction machines. • Small signal equations, control characteristics of induction machines. • Phase-controlled induction machines,Stator voltage control, Slip energy recovery scheme, frequency control and vector control of induction motor drives.
5	• Traction motor: Starting, Speed-Time characteristics, Braking, Traction motors used in practice.
6	• Industrial Drives-Digital Control of Electric Drives, Stepper motor, Servo motor, Solar drive, BLDC drive, PMSM drive, SRM drive and their specific applications.

Suggested reading

1. G.K, Dubey, "Power semiconductor controlled Drives", Prentice Hall international, New Jersey, 1989.
2. R.Krishanam, "Electric motor drives modeling, analysis and control", PHI-India-2009.
3. G. K. Dubey,"Fundamentals of electric Drives, Narosa Publishing House", 2nd edition, 2011.
4. W. Leonhard, "Control of Electrical drives", Springer, 3rd edition, 2001.
5. P.C. Krause –, "Analysis of Electric Machine", Wiley-IEEE press 3rdedition.
6. K. Bose,"Modern Power Electronics and AC Drives", Prentice Hall publication, 1st edition, 2001.

Course Outcomes:

Students will be able to:

1. Model and simulate electric drive systems
2. Design modulation strategies of power electronics converters, for drives application
3. Design appropriate current/voltage regulators for electric drives
4. Select and implement the drives for Industrial Process
5. Implement various variable speed drives in Electrical Energy Conversion System

MPED 102 **MODELING AND ANALYSIS OF ELECTRICAL MACHINES** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. To understand the operation of an electrical machine mathematically.
2. To understand how a machine can be represented as its mathematical equivalent.
3. To develop mathematical model of AC & DC machines and perform transient analysis on them.

Syllabus

Units	Content
1	• Principles of Electromagnetic Energy Conversion. • General expression of stored magnetic energy. • Co-energy and force/torque, example using single and doubly excited system.
2	• Basic Concepts of Rotating Machines-Calculation of air gap mmf and per phase machine inductance using physical machine data; Voltage and torque equation of dc machine.
3	• Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form • Application of reference frame theory to three phase symmetrical induction and synchronous machines • Dynamic direct and quadrature axis model in arbitrarily rotating reference frames.
4	• Determination of Synchronous machine dynamic equivalent circuit parameters • Analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.
5	• Special Machines - Permanent magnet synchronous machine • Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines • Construction and operating principle • Dynamic modelling and self-controlled operation.
6	• Analysis of Switch Reluctance Motors. • Brushless D.C. Motor for space Applications • Recent trends.

Suggested reading

1. Charles Kingsle,Jr., A.E. Fitzgerald, Stephen D.Umans, "Electric Machinery", Tata Mcgraw Hill
2. R. Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", Prentice Hall of India
3. Miller, T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press
4. P.C.Krause "Analysis of Electric Machine" Wiley IEEE Press 3rd Edition

Course Outcomes:

Students will be able to:

1. Knowledge about the dynamic behavior rotating machines.
2. Able to understand equivalent circuit of synchronous machines.
3. To understand various practical issues of different machines.

MPED103	ADVANCED POWER ELECTRONIC CIRCUITS	3L:0T:0P	3 Credits

Course Outcomes:

Students will be able to:

1. Analyse the operation of advanced power electronic circuit topologies.
2. Distinguish among various topologies of DC to Dc converter
3. Examine and analyse the concept of switched mode power supplies
4. Analyse the working of Resonant converter topologies
5. Design and understand the multilevel inverters and their applications
6. Apply the concept of Advanced power Electronic converters in various applications

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	Syllabus
Unit	**content**
1	• Review of basic power electronic converter • Boost type APFC and control.
2	• DC to DC converter : Buck, Boost, Buck-Boost Topologies. Cuck converter
3	• SMPS: Modes of operation –Push-Pull and Forward Converter Topologies , Voltage Mode Control. • Half and Full Bridge Converters
4	• Introduction to Resonant Converters. • Load Resonant Converter. Zero Voltage Switching and zero current switching converter Topologies. • Resonant DC Link Inverters
5	• Multi-level inverters, advantages, configurations: Diode clamped, flying capacitor and cascade multi-level inverters, applications.
6	• Applications of power electronic converter: UPS, Induction heating, ,HVDC Transmission system • Few power electronic circuits used in practice for controlling electric drives. DC-DC Converters for various renewable energy conversion.

Suggested reading

- Rashid "Power Electronics" Prentice Hall India 2007.
- G.K.Dubey et.al "Thyristorised Power Controllers" Wiley Eastern Ltd., 2005, 06.
- Dewan&Straughen "Power Semiconductor Circuits" John Wiley &Sons., 1975.
- B. K Bose "Modern Power Electronics and AC Drives" Pearson Education (Asia)., 2007
- Abraham I Pressman "Switching Power Supply Design" McGraw Hill Publishing Company.
- Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John‟s Wiley and Sons

MPS 107A **POWER QUALITY** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. Understand the different power quality issues to be addressed
2. Understand the recommended practices by various standard bodies like IEEE, IEC, etc. on voltage & frequency, harmonics
3. Understanding STATIC VAR Compensators

Syllabus

Units	Content	Hours
1	• Introduction-power quality-voltage quality-overview of power • Quality phenomena classification of power quality issues. • Power quality measures and standards-THD-TIF-DIN-C-message weights. • Flicker factor transient phenomena-occurrence of power quality problems • Power acceptability curves-IEEE guides • Standards and recommended practices.	5
2	• Harmonics-individual and total harmonic distortion • RMS value of a harmonic waveform • Triplex harmonics. Important harmonic introducing devices.SMPS • Three phase power converters-arcing devices saturable devices • Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.	8
3	• Modeling of networks and components under non-sinusoidal conditions • Transmission and distribution systems • Shunt capacitors-transformers.Electric machines. • Ground systems loads that cause power quality problems. • Power quality problems created by drives and its impact on drive.	6
4	• Power factor improvement- Passive Compensation. • Passive Filtering.Harmonic Resonance.Impedance Scan Analysis • Active Power Factor Corrected Single Phase Front End • Control Methods for Single Phase APFC. • Three Phase APFC and Control Techniques • PFC based on Bilateral Single Phase and Three Phase Converter.	6
5	• Static VAR compensators-SVC and STATCOM Active Harmonic Filtering Shunt Injection • Filter for single phase, three-phase three-wire and three-phase four- wire systems • d-q domain control of three phase shunt active filters uninterruptible power supplies constant voltage transformers • series active power filtering techniques for harmonic cancellation and isolation.	8
6	• Dynamic Voltage Restorers for sag , swell and flicker problems. Grounding 8 and wiring introduction • NEC grounding requirements-reasons for grounding • typical grounding and wiring problems solutions to grounding and wiring problems	8

Suggested reading

1. G.T. Heydt, “Electric power quality”, McGraw-Hill Professional, 2007
2. Math H. Bollen, “Understanding Power Quality Problems”, IEEE Press, 2000
3. J. Arrillaga, “Power System Quality Assessment”, John wiley, 2000
4. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,”Power system Harmonic Analysis”, Wiley, 1997

Course Outcomes:

Students will be able to:

1. Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonicson system equipment and loads
2. develop analytical modeling skills needed for modeling and analysis of harmonics innetworks and components
3. To introduce the student to active power factor correction based on static VAR compensators andits control techniques
4. To introduce the student to series and shunt active power filtering techniques for harmonics.

MPS106A **DYNAMICS OF ELECTRICAL MACHINES** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. Learn Performance characteristics of machine.
2. To understand the dynamics of the machine.
3. To understand how to determine stability of machine.
4. Learn the synchronous machine analysis.

Syllabus

Units	Content	Hours
1	• Stability. • Primitive 4 Winding Commutator Machine. Commutator Primitive Machine. • Complete Voltage Equation of Primitive 4 Winding Commutator Machine.	6
2	• Torque Equation. Analysis of Simple DC Machines using the Primitive Machine Equations. • The Three Phase Induction Motor. Transformed Equations. • Different Reference Frames for Induction Motor Analysis Transfer Function Formulation.	10
3	• Three Phase Salient Pole Synchronous Machine. • Parks Transformation- Steady State Analysis.	6
4	• Large Signal Transient. Small Oscillation Equations in State Variable form • Dynamical Analysis of Interconnected Machines.	6
5	• Large Signal Transient Analysis using Transformed Equations. • DC Generator /DC Motor System.	8
6	• Alternator /Synchronous Motor System.	4

Suggested reading

1. D.P. Sengupta & J.B. Lynn," Electrical Machine Dynamics", The Macmillan Press Ltd. 1980
2. R Krishnan "Electric Motor Drives, Modeling, Analysis, and Control", Pearson Education., 2001
3. P.C. Kraus, "Analysis of Electrical Machines", McGraw Hill Book Company, 1987
4. I. Boldia & S.A. Nasar,,"Electrical Machine Dynamics", The Macmillan Press Ltd. 1992
5. C.V. Jones, "The Unified Theory of Electrical Machines", Butterworth, London. 1967

Course Outcomes

Students will be able to:

1. Formulation of electrodynamic equations of all electric machines and analyze the performance characteristics
2. Knowledge of transformations for the dynamic analysis of machines
3. Knowledge of determination of stability of the machines under small signal and transient conditions
4. Study about synchronous machine

MPS 112A **STATIC VAR CONTROLLER AND HARMONIC FILTERING** **Sessional-25**
L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. Understand the various static converters
2. Understand the static converter control strategies
3. Understand the active and reactive power compensation and their control
4. Understand harmonic filtering and its control design.

Syllabus

Units	Content	Hours
1	• Fundamentals of Load Compensation. • Steady-State Reactive Power Control in Electric Transmission Systems. • Reactive Power Compensation and • Dynamic Performance of Transmission Systems.	6
2	• Power Quality Issues: Sags, Swells, Unbalance, Flicker, Distortion. • Current Harmonics.Sources of Harmonics in Distribution Systems and Ill Effects .	6
3	• Static Reactive Power Compensators and their control.Shunt Compensators. • SVCs of Thyristor Switched and Thyristor Controlled types and their control, • STATCOMs and their control. • Series Compensators of thyristor Switched and Controlled Type and their Control. • SSSC and its Control, Sub-Synchronous Resonance and damping. • Use of STATCOMs and SSSCs for Transient and Dynamic Stability Improvement in Power System.	10
4	• Converters for Static Compensation. • Single Phase and Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM). • GTO Inverters. Multi-Pulse Converters and Interface Magnetics. • Multi-Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM). • Multi-level inverters of Cascade Type and their modulation. Current Control of Inverters.	8
5	• Passive Harmonic Filtering. • Single Phase Shunt Current Injection Type Filter and its Control. • Three Phase Three-wire Shunt Active Filtering and their control using p-q theory and d-q modeling. • Three phase four wire shunt active filters. • Hybrid Filtering using Shunt Active Filters. • Dynamic Voltage Restorer and its control. • Power Quality Conditioner	8
6	• Series Active Filtering in Harmonic Cancellation Mode. • Series Active Filtering in Harmonic Isolation Mode.	4

Suggested reading

1. Ned Mohan et.al, “Power Electronics”,John Wiley and Sons,2006.
2. G. Massobrio, P. Antognet,” Semiconductor Device Modeling with Spice”, McGraw-Hill, Inc.,1988.
3. B. J. Baliga,” Power Semiconductor Devices”,Thomson, 2004
4. V. Benda, J. Gowar, D. A. Grant,” Power Semiconductor Devices. Theory and Applications”,JohnWiley& Sons1994.

Course Outcomes

Students will be able to:

1. Acquire knowledge about the fundamental principles of Passive and Active Reactive PowerCompensation Schemes at Transmission and Distribution level in Power Systems.
2. To introduce the student to various single phase and three-phase Static VAR Compensationschemes and their controls
3. To develop analytical modeling skills needed for modeling and analysis of such Static VAR

MPED 107 **OPTIMAL AND ADAPTIVE CONTROL** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. To know the operation of closed and open loop optimal control.
2. Understand the adaptive control strategies.
3. Learn dynamic programming method.

Syllabus

Units	Content	Hours
1	• Optimal control problem – fundamental concepts and theorems of calculus of variations–Euler - Language equation and extremal of functional.	5
2	• Variational approach to solving optimal control problems. • Hamiltonian and different boundary conditions for optimal control problem.	8
3	• Linear regulator problem - Pontryagin‟s minimum principle.	6
4	• Dynamic programming - Principle of optimality and its application to optimal control problem.	6
5	• Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis**.**	8
6	• Introduction to design method based on the use of Liapunov function. • Design and simulation of variable structure adaptive model following control.	8

Suggested reading

1. Donald E. Kirk, “Optimal Control Theory, An introduction”, Prentice Hall Inc., 2004
2. A.P. Sage, “Optimum Systems Control”, Prentice Hall, 1977
3. HSU and Meyer , “Modern Control, Principles and Applications”, McGraw Hill, 1968
4. Yoan D. Landu, “Adaptive Control (Model Reference Approach)”, Marcel Dekker. 1981
5. K.K.D.Young, “Design of Variable Structure Model Following Control Systems”, IEEE Transactions on Automatic Control, Vol. 23, pp 1079-1085, 1978.

Course Outcomes:

Students will be able to:

1. Knowledge in the mathematical area of calculus of variation so as to apply the same for solving optimal control problems.
2. Problem formulation, performance measure and mathematical treatment of optimal control problems.
3. Acquire knowledge on solving optimal control design problems by taking into consideration the physical constraints on practical control systems.
4. To obtain optimal solutions to controller design problems taking into consideration the limitation on control energy in the real practical world.

MPS109A **ADVANCED MICRO-CONTROLLER BASED SYSTEMS** **Sessional-25**

L T P Cr **End Sem-75**

3 0 0 3 **Total-100**

Course Objectives:

Students will be able to:

1. To understand the architecture of advance microcontrollers
2. To understand the applications of these controllers
3. To get some introduction to FPGA.

Syllabus

Units	Content	Hours
1	• Basic Computer Organization. • Accumulator based processes-Architecture-Memory • Organization-I/O Organization	6
2	• Micro-Controllers-Intel 8051, Intel 8056- Registers, Memories. • I/O Ports, Serial Communication. Timers, Interrupts, Programming.	8
3	• Intel 8051 – Assembly language programming-Addressing-Operations-Stack & Subroutines,Interrupts-DMA.	6
4	• PIC 16F877- Architecture Programming. • Interfacing Memory/ I/O Devices, Serial I/Oand data communication	8
5	• Digital Signal Processor (DSP) - Architecture – Programming, Introduction to FPGA	8
6	• Microcontroller development for motor control applications. • Stepper motor control using micro controller.	8

Suggested reading

1. John.F.Wakerly: "Microcomputer Architecture and Programming", John Wiley and Sons 1981.
2. Ramesh S.Gaonker: "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing (India), 1994.
3. Raj Kamal: "The Concepts and Features of Microcontrollers", Wheeler Publishing, 2005.
4. Kenneth J. Ayala, "The 8051 microcontroller", Cengage Learning, 2004.
5. John Morton," The PIC microcontroller: your personal introductory course", Elsevier, 2005.
6. Dogan Ibrahim," Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series", Elsevier, 2008.
7. Microchip datasheets for PIC16F877.

Course Outcomes

Students will be able to:

1. To learn how to program a processor in assembly language and develop an advanced processor based system
2. To learn configuring and using different peripherals in a digital system
3. To compile and debug a Program
4. To generate an executable file and use it

RM101 **Research Methodology and IPR** **Sessional-25**
L T P Cr **End Sem-75**
3 0 0 3 **Total-100**

Teaching Scheme Lectures: 1hrs/week	

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today‟s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis

Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students""
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

MPED 151- ELECTRICAL DRIVES LABORATORY

List of experiments:

1. Study of Thyristor controlled D.C Drive.
2. Study of Chopper Fed DC Motor.
3. Study of A.C single phase motor speed control using TRIAC.
4. PWM inverter fed three phase induction motor control using PSPICE/MATLAB/PSIM software.
5. VSI/CSI fed induction motor drive analysis using MATLAB/PSPICE/PSIM software.
6. Study of V/f control operation of three phase induction motor.
7. Study of permanent magnet synchronous motor drive fed by PWM inverter using software.
8. Regenerative/ Dynamic breaking operatation for DC motor study using software.
9. Regenerative/ Dynamic breaking operatation for AC motor study using software.
10. PC/PLC based AC/DC motor control operation.

MPED152- ELECTRICAL MACHINES LABORATORY/POWER QUALITY LABORATORY

Electrical Machines lab

List of experiments:

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiencycharacteristics.
2. Field Test on dc series machines.
3. Speed control of dc shunt motor by armature and field control.
4. Swinburne's Test on dc motor.
5. Retardation test on dc shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on three phase induction motor.
8. No load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).
9. Load test on induction generator.
10. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.
11. Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.
12. Conduct an experiment to draw V and curves of synchronous motor at no load and load conditions.

Power Quality Lab

2. To study the effect of non linear loads on power quality.
3. To demonstrate the voltage and current distortions experimentally.
4. To reduce the current harmonics with filters.
5. To study the voltage sag due to starting of large induction motor.
6. To study the capacitor switching transients.
7. To study the effect of balanced non linear load on neutral current , in a three phase circuit
8. To study the effect of ground loop.
9. To study the effect of voltage flicker .
10. To calculate the distortion power factor.
11. Study the effect of harmonics on energy meter reading.
12. To study effect of voltage sag on electrical equipments.
13. To obtain the current harmonics drawn by power electronics interface using PSCAD software

J.C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES AND EXAMINATION M-TECH 1st YEAR
(POWER ELECTRONICS & DRIVES) SEMESTER-II

Semester-2							
S.No.	**Course Code**	**Core/Elective**	**Course Name**				**Credits**
				L	**T**	**P**	
1	**MPED201**	**Core**	**PWM converter and Applications**	**3**	**0**	**0**	**3**
2	MPED202	Core	Digital Control of Power Electronic and Drive Systems	3	0	0	3
3	PE3	Elective	Switched Mode and Resonant Converters/Industrial Load Modeling and Control /SCADA System And Applications	3	0	0	3
4	PE4	Elective	Distributed Generation/ /Advanced Digital Signal Processing/Artificial Intelligence Techniques	3	0	0	3
5	MPED 250		Mini Project with Seminar	0	0	4	2
6	MPED 251		Power Electronics Laboratory	0	0	4	2
7	MPED252/ MPED 253		Artificial Intelligence Lab/ or Digital Signal Processing Lab	0	0	4	2
8	Audit-II		Audit II	2	0	0	0
	Total Credits				**18**		

	Course Code	Course Title
Program Elective-3	MPED203	Switched Mode and Resonant Converters
	MPED204	Industrial Load Modeling and Control
	MPS209A	SCADA System And Applications(Common with M.Tech Power Systems Sem II)

	Course Code	Course Title
Program Elective-4	MPED205	Distributed Generation
	MPS210A	Artificial Intelligence Techniques (Common with M.Tech Power Systems Sem II)
	MPS204A	Advanced Digital Signal Processing(Common with M.Tech Power Systems Sem II)

MPED201	PWM CONVERTERS AND APPLICATION	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. Differentiate among the working of various power electronics converters
2. Analyse the concept of multilevel inverter and purpose of PWM
3. Evaluate the basic PWM techniques of inverters
4. Have the knowledge of space vector concept and its applications in PWM
5. Evaluation of dead-time effect and understand the over modulation
6. Apply the concept of PWM in electric drives

Syllabus

Units	Content
1	• AC/DC and DC/AC powerconversion Overview of applications of voltage source converters and current source converters.
2	• Practical devices in converter • Purpose of PWM • Review of Multilevel inverters
3	• . Pulse width modulation techniques for bridge converters: Single and multiple PWM, sinusoidal PWM • Unipolar and Bipolar Modulation • Advanced PWM techniques
4	• Space vector modulation • Concept of space vector • Space vector based modulation • Conventional space vector PWM Bus-clamping PWM.
5	• Estimation of current ripple in inverter fed drives. • Concept of overmodulation • Effect of inverter dead-time Compensation for dead-time effect
6	• Active power filtering. • Selective harmonic elimination PWM technique for power electric drives. • Constant V/F induction motor drives

Suggested reading

1. Mohan, Undeland and Robbins, “Power Electronics: Converters, Applications and Design”, John‟s Wiley andSons.
2. Erickson RW, “Fundamentals of Power Electronics”, Chapman andHall.
3. Vithyathil. J, “Power Electronics: Principles and Applications”, McGrawHill.

Course Outcomes:

Students will be able to:

1. Knowledge concepts and basic operation of PWM converters, including basic circuit operation anddesign
2. Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and powerquality
3. Able to recognize and use the following concepts and ideas:Steady-State and transient modelling and analysis of power converters with various PWMtechniques.

MPED202	DIGITAL CONTROL OF POWER ELECTRONICS AND DRIVE SYSTEMS	3L:0T:0P	3Credits

Course Objectives:

Students will be able to:

1. To understand different control strategies
2. To understand state space modeling of different converters
3. To perform simulation of different power converters

Syllabus

Units	Content	Hours
1	• Review of numericalmethods. • Application of numerical methods to solve transients in D.C. • Switched R, L, R-L, R-C and R-L-C circuits. Extension to AC circuits.	6
2	• Modelling of diode in simulation. • Diode with R, R-L, R-C and R-L-C load with AC supply. • Modelling of SCR, TRIAC, IGBT and Power Transistors in simulation. • Application of numerical methods to R, L, C circuits with power electronic switches. • Simulation of gate/base drive circuits, simulation of snubber circuits.	8
3	• State space modeling and simulation of linear systems. • Introduction synchronous aspects.to electrical machine machines, simulation modelling: induction, of basic electricdrives,DC, and stability	6
4	• Simulation of single phase and three phase uncontrolled and controlled (SCR)rectifiers. • Converters with self-commutated devices- simulation of power factor correctionschemes.	8
5	• Simulation of converter fed DC motordrives. • Simulation of thyristor choppers with voltage. • Current and load commutationschemes. • Simulation of chopper fed DC motor.	8
6	• Simulation of single and three phase inverters with thyristors and self-commutated devices. • Space vectorrepresentation. • Pulse-width modulation methods for voltagecontrol. • Waveform control. Simulation of inverter fed induction motordrives.	8

Suggested reading

1. Simulink Reference Manual, Math works, USA

Course Outcomes

Students will be able to:

1. To provide knowledge on modelling and simulation of power simulation circuits andsystems.
2. The candidate will be able to simulate power electronic systems and analyse the system response.

MPED203	SWITCHED MODE AND RESONANT CONVERTERS	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. To understand different types ofconverters
2. To understand different switch mode topologies & control methods
3. To understand different resonant converter topologies.

Syllabus

Units	Content	Hours
1	• Buck, Boost, Buck-Boost SMPS Topologies. • Basic Operation-Waveforms - modes of operation –switching stresses. • Switching and conduction losses. Optimum switching frequency. • Practical voltage, current and power limits – design relations. • Voltage mode control principles. • Push-Pull and Forward Converter Topologies – Basic Operation, Waveforms. • Flux Imbalance Problem andSolutions	6
2	• Transformer Design. Output Filter Design. Switching Stresses and Losses. • Forward Converter Magnetics. Voltage Mode Control. • Half and Full Bridge Converters. Basic Operation and Waveforms. • Magnetics, Output Filter, Flux Imbalance, Switching Stresses andLosses, Power Limits, Voltage Mode Control.	8
3	• Classification of Resonant Converters. Basic Resonant Circuit Concepts. • Load Resonant Converter, Resonant Switch Converter, Zero.	6
	• Voltage Switching Clamped VoltageTopologies. • Resonant DC Link Inverters with Zero Voltage Switching. • High Frequency Link Integral Half Cycle Converter. • Fly back Converter- discontinuous mode operation, waveforms,control. • Magnetics- Switching Stresses and Losses, Disadvantages - Continuous Mode Operation, waveforms, control, design relations.	
4	• Voltage Mode Control of SMPS- Loop Gain and Stability Considerations. • Error Amp– frequency Response and Transfer Function. • Trans-conductance Current Mode Control of SMPS. • Current Mode Control Advantages, Current Mode Vs Voltage Mode.	8
5	• Current Mode Deficiencies. • Slope Compensation. • Study of a typical Current Mode PWM Control IC UC3842. Modeling of SMPS. • Small Signal Approximation- General Second Order Linear Equivalent Circuits. • Study of popular PWM Control ICs (SG 3525,TL 494,MC34060 etc.)	8

6	• DC Transformer, Voltage Mode SMPS Transfer Function. • General Control Law Consideration. • EMI Generation and Filtering in SMPS - Conducted and Radiated Emission Mechanisms in SMPS. • Techniques to reduce Emissions, Control of Switching Loci. • Shielding and Grounding, Power Circuit Layout for minimum EMI. • EMI Filtering at Input and Output, Effect of EMI Filter on SMPS Control Dynamics. Introduction to ResonantConverters.	8

Suggested reading

1. Abraham I Pressman, "Switching Power Supply Design,". McGraw Hill Publishing Company,2001.
2. Daniel M Mitchell,"DC-DC Switching Regulator Analysis," McGraw Hill Publishing Company-1988.
3. Ned Mohan et.al, "Power Electronics," John Wiley and Sons2006.

Course Outcomes

1. Acquire knowledge about the principles of operation of non-isolated and isolated hard-switched DC-DC converters.
2. Acquire knowledge on various loss components in a switched mode converter and choice of switching frequency with a view towards design of suchconverters.

MPED204	INDUSTRIAL LOAD MODELING AND CONTROL	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. To understand the energy demand scenario
2. To understand the modeling of load and its ease to study load demand industrially
3. To know Electricity pricing models
4. Study Reactive power management in Industries

Syllabus

Units	Content	Hours
1	• Electric Energy Scenario-Demand Side Management-Industrial Load Management. • Load Curves-Load ShapingObjectives-Methodologies. • Barriers; Classification of Industrial Loads- Continuous and Batch processes -Load Modeling.	6
2	• Electricity pricing – Dynamic and spot pricing–Models. • Direct load control- Interruptible loadcontrol. • Bottom up approach- scheduling- Formulation of load models- Optimization and control algorithms – Case studies.	8
3	• Reactive power management in industries-controls-power quality impacts-application of filters Energy saving inindustries.	6
4	• Cooling and heating loads- load profiling-Modeling. • Cool storage-Types- Controlstrategies. • Optimal operation-Problem formulation- Case studies.	8
5	• Captive power units- Operating and control strategies- Power Pooling-Operationmodels. • Energy banking-Industrial Cogeneration	8
6	• Selection of Schemes Optimal OperatingStrategies. • Peak load saving-Constraints-Problem formulation- Case study. • Integrated Load management for Industries	8

Suggested reading

1. C.O. Bjork “Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands,1989.
2. C.W. Gellings and S.N. Talukdar, “Load management concepts,” IEEE Press, New York, 1986, pp.3-28.
3. Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April1981.
4. H. G. Stoll, "Least cost Electricity Utility Planning”, Wiley Interscience Publication, USA,1989.
5. I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi,1995.
6. IEEE Bronze Book- “Recommended Practice for Energy Conservation and cost effective planningin Industrial facilities”, IEEE Inc,USA.

Course Outcomes:

Students will be able to:

1. Knowledge about load control techniques in industries and its application.

2. Different types of industrial processes and optimize the process using tools like LINDO and LINGO.
3. Apply load management to reduce demand of electricity during peak time.
4. Apply different energy saving opportunities in industries.

MPS209A	SCADA SYSTEM AND APPLICATIONS	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. To understand what is meant by SCADA and itsfunctions.
2. To know SCADAcommunication.
3. To get an insight into itsapplication.

Syllabus

Units	Content	Hours
1	• Introduction to SCADA: Data acquisition systems, Evolution of SCADA, • Communication technologies.	6
2	• Monitoring and supervisory functions, SCADA applications in Utility Automation, • Industries SCADA	8
3	• Industries SCADA System Components: Schemes- Remote Terminal Unit(RTU), • Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems	6
4	• SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850.	6
5	• SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. open standard communicationprotocols.	6
6	• SCADA Applications: Utility applications- Transmission and Distribution sector- • Operations, monitoring, analysis and improvement. Industries - oil, gas and water. • Case studies, Implementation, Simulation Exercises	8

Suggested reading

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of AmericaPublications,USA,2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford,UK,2004.
3. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books,2006.
4. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes,2003.
5. Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power",PennWell1999.

Course Outcomes

1. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typicalapplications**.**
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of eachsystem.

3. Knowledge about single unified standard architecture IEC61850.
4. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADAserver.
5. Learn and understand about SCADA applications in transmission and distribution sector, industriesetc.

MPED205	DISTRIBUTED GENERATION	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. To understand renewable energy sources.
2. To gain understanding of the working of off-grid and grid-connected renewable energy generation schemes.

Syllabus

Units	Content	Hours
1	• Need for Distributed generation. • Renewable sources in distributed generation and current scenario in Distributed Generation.	6
2	• Planning of DGs. • Sitting and sizing of DGs optimal placement of DG sources in distribution systems. • Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces. • Aggregation of multiple DG units.	8
3	• Technical impacts ofDGs. • Transmission systems Distribution Systems De-regulation Impact of DGs upon protective relaying. • Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis.	6
4	• Economic and control aspects of DGs Market facts. • Issues and challenges Limitations of DGs, Voltage control techniques. • Reactive power control, Harmonics Power quality issues, Reliability of DG based systems.	8
5	• Introduction to micro-grids. • Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids. • Modeling & analysis of Micro-grids with multiple DGs. • Micro-grids with power electronic interfacing units.	8
6	• Transients in micro-grids, Protection of micro-grids, Case studies, Advanced topics.	8

Suggested reading

1. H. Lee Willis, Walter G. Scott, “Distributed Power Generation – Planning and Evaluation”, Marcel Decker Press.
2. M.Godoy Simoes, Felix A.Farret, “Renewable Energy Systems – Design and Analysis with Induction Generators”, CRC press.
3. Stuart Borlase. “Smart Grid: Infrastructure Technology Solutions” CRC Press

Course outcomes

Students will be able to:

1. To understand the planning and operational issues related to Distributed Generation.
2. Acquire Knowledge about Distributed Generation Learn Micro-Grids

MPS210A	ARTIFICIAL INTELLIGENCE TECHNIQUES	3L:0T:0P	3 Credits

Units	Content	Hours
1	Biological foundations to intelligent Systems Artificial Neural Networks, Single layer and Multilayer Feed Forward NN LMS and Back Propagation Algorithm Feedback networks and Radial Basis Function Networks	8
2	Fuzzy Logic Knowledge Representation and Inference Mechanism Defuzzification Methods	8
3	Fuzzy Neural Networks some algorithms to learn the parameters of the network like GA	8
4	System Identification using Fuzzy and Neural Network	6
5	Genetic algorithm Reproduction cross over, mutation Introduction to evolutionary program	8
6	Applications of above mentioned techniques to practical problems	6

Suggested reading

1. J M Zurada , "An Introduction to ANN",Jaico **Publishing** House
2. Simon Haykins, "Neural Networks", Prentice Hall
3. Timothy Ross, "Fuzzy Logic with Engg.Applications", McGraw. Hill
4. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication
5. Golding, "Genetic Algorithms", Addison-Wesley **Publishing** Com

Course Outcomes: -

Students will be able to:

1. Learn the concepts of biological foundations of artificial neural networks
2. Learn Feedback networks and radial basis function networks and fuzzy logics
3. Identifications of fuzzy and neural network
4. Acquire the knowledge of GA

MPS204A	ADVANCED DIGITAL SIGNAL PROCESSING	3L:0T:0P	3 Credits

Course Objectives:-Students will be able to:
1. To understand the difference between discrete-time and continuous-time signals
2. To understand and apply Discrete Fourier Transforms (DFT)

Syllabus

Units	Content	Hours
1	• Discrete time signals • Linear shift in variant systems- • Stability and causality • Sampling of continuous time signals- • Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform • Z transform-Properties of different transforms	8
2	• Linear convolution using DFT • Computation of DFT Design of IIR digital filters from analog filters • Impulse in variance method • Bilinear transformation method	8
3	• FIR filter design using window functions • Comparison of IIR and FIR digital filters • Basic IIR and FIR filter realization structures • Signal flow graph representations Quantization process and errors • Coefficient quantisation effects in IIR and FIR filters	8
4	• A/D conversion noise- Arithmetic round-off errors • Dynamic range scaling • Overflow oscillations and zero Input limit cycles in IIR filters • Linear Signal Models	8
5	• All pole, All zero and Pole-zero models • Power spectrum estimation- Spectral analysis of deterministic signals. • Estimation of power spectrum of stationary random signals	6
6	• Optimum linear filters • Optimum signal estimation • Mean square error estimation • Optimum FIR and IIR Filters	6

Suggested reading

1. SanjitK Mitra, "Digital Signal Processing: A computer-based approach ",TataMc Grow-Hill Edition1998
2. Dimitris G .Manolakis, VinayK. Ingle and Stephen M. Kogon, "Statistical and Adaptive Signal Processing", Mc Grow Hill international editions .-2000

Course Outcomes :

Students will be able to:

2. Knowledge about the time domain and frequency domain representations as well analysis of discretetime signals and systems.

3. Study the design techniques for IIR and FIR filters and their realizationstructures.
4. Acquire knowledge about the finite word length effects in implementation of digitalfilters.
5. Knowledge about the various linear signal models and estimation of power spectrum of stationary random signals.

6. Design of optimum FIR and IIR filters

Semester-3						
S. No.	**Course Code**	**Course Name**				**Credits**
			L	T	P	
1	PE5	FACTS and Custom Power Devices/Energy Management/ Advanced Electrical Drives/Optimization Algorithms/ Modern Control Theory	3	0	0	3
2	OE	Open Elective	3	0	0	3
3	MPED 351	Phase-I Dissertation	0	0	20	10
	Total Credits			**16**		

	Course Code	Course Title
Program Elective	MPED 301	Modern Control Theory
	MPED 302	Energy Management
	MPED 303	Advanced Electrical Drives
	MPED 304	Optimization Algorithms
	MPS 302 A	FACTS and Custom Power Devices (Common with M.Tech Power Systen 3rd Sem)

	Course Code	Course Title
Open Elective	MOEL 01	Business Analytics
	MOEL 02	Industrial Safety
	MOEL 03	Operations Research
	MOEL 04	Cost Management of Engineering Projects
	MOEL 05	Composite Materials
	MOEL 06	Waste to Energy
	MOEL 07	Machine Learning
	MOEL 08	Introduction to PHYTHON

MPED302	**ENERGY MANAGEMENT**	**3L:0T:0P**	**3 Credits**

Introduction, need of energy management, importance of energy audit and its types, financial analysis techniques, energy monitoring and targeting.
Energy efficiency control of boilers, furnaces, cogeneration, HVAC, cooler tower and lighting systems.
Energy demand analysis and forecast: energy data management, energy demand analysis, energy control and forecast methods.
Energy management of drive systems: industrial systems, measurements, performance estimation, energy efficient motors, planning and saving analysis.
Intelligent buildings: energy saving opportunities, measurement and control. Smart grid and its role in energy management.

References: 1. “Energy Management Principles, Applications, Benefits, Savings”, Craig B. Smith, Peragamon Press, New York, 1981. 2. “Energy Management of Drive System”, Office of Industrial Technology, Energy Efficiency and Renewable Energy, US Department of Energy. 3. “Energy Management Systems”, Edited by P. GiridharKini,InTech, Publication, 2011.

MPED303	ADVANCED ELECTRICAL DRIVES	3L:0T:0P	3 Credits

Vector Control of Induction Motor: Principles of vector control, direct vector control, derivation of indirect vector control, implementation-block diagram; estimation of flux, flux weakening operation.

Control of Synchronous Motor Drives: Synchronous motor and its characteristics- Control strategies- Constant torque angle control- power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

Control of Switched Reluctance Motor Drives: SRM Structure-Stator Excitation-techniques of sensor less operation-convertor topologies-SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple-Instantaneous Torque control -using current controllers-flux controllers.

Control of BLDC Motor Drives: Principle of operation of BLDC Machine, Sensing and logic switching scheme, BLDM as Variable Speed Synchronous motor-methods of reducing Torquepulsations -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive.

MPED304	**OPTIMIZATION ALGORITHMS**	**3L:0T:0P**	**3 Credits**

Optimization Fundamentals – Definition, Classification of problems, Unconstrained and constrained optimization, Optimality conditions.
Linear Programming – Simplex Method, Duality, Sensitivity methods.
Nonlinear Programming – Powel‟s method, Steepest descent method, conjugate gradient method, Newton‟s method, GRG method, Sequential quadratic programming, Penalty function method, Augmented Lagrange multiplier method.
Dynamic Programming and Integer Programming – Interior point methods, Karmakar‟s algorithm, Dual affine, Primal Affine, Barrie algorithm Meta- Heuristic Optimization – Simulated annealing,
Evolutionary Programming, Genetic Algorithm, Swarm optimization and other nature inspired algorithms.

References: 1. Rao S. S., "Engineering Optimization", New Age International Pvt Ltd.
2. Gill Murray and Wright, "Practical Optimization", Academic Press. 3. Laurence A. Wolsey, "Integer Programming", John wiley and Sons. 4. Fred Glover, G. A. Kochenberger, "Handbook of Metaheuristics", Kluwer Academic Publishers.

MPED301	MODERN CONTROL THEORY	3L:0T:0P	3 Credits

Course Objectives:

- To introduce students about the state variable analysis.
- To give the exposure to students about discrete time system & Z-transform methods.
- To introduce the students to state analysis of linear discrete time system and multivariable system.
- To introduce the students to various pole placement methods andstate observers

Syllabus

State Variable Analysis

Introduction, vectors and matrices, state variable representation, conversion of transfer function model to state variable model, conversion of state variable model to transfer function model, decomposition of transfer function into canonical state variable models, Eigen values and Eigen vectors, solution of state equations. Concept of controllability and observability, equivalence between transfer function and state variable representation.

Discrete time system and Z transform methods

Introduction to discrete time system**,** the Z transform, solution of difference equations, inverse Z transform, pulse transfer function, Stability analysis in Z plane.

State variable analysis of discrete time system

State space analysis of linear discrete time system, controllability and observability, multivariable system.

Pole placement and state observers

Introduction, stability improvement by state feedback, necessary and sufficient condition for arbitrary pole placement, state regulator design, design of state observers, state feedback with integral control, digital control system with state feedback.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand state space variable form, various canonical forms, state equation and its solutions.

- Understand controllability &observability for continuous time as well as discrete time systems.

 Understand stability as well as stability improvement using pole placement, state observer for discrete as well as continuous time systems.

Text Books

1. Control System by B. C. Kuo, TMH

2. Digital and non linear control by M. Gopal, TMH

3. Control System by Nagrath and Gopal, New Age Publications

MPS 302A	FACTS AND CUSTOM POWER DEVICES	3L:0T:0P	3 Credits

Course Objectives:

Students will be able to:

1. To learn the active and reactive power flow control in power system
2. To understand the need for static compensators
3. To develop the different control strategies used for compensation

Syllabus

Units	Content	Hours
1	• Reactive power flow control in Power Systems – Control ofdynamic power unbalances in PowerSystem. • Power flow control -Constraints of maximum transmission line loading – Benefits of FACTS Transmission linecompensation. • Uncompensated line -Shunt compensation - Series compensation–Phase angle control. Reactive powercompensation. • Shunt andSeries compensation principles – Reactive compensationat transmission and distribution level.	6
2	• Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensatorcontrol. • Comparison between SVC and STATCOM.	8
3	• Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators – TCVR and TCPAR Operation and Control –Applications, Staticseriescompensation–GCSC,TSSC,TCSCandStaticsynchronous series compensators and their Control.	6
4	• SSR and its damping Unified Power Flow Controller: Circuit Arrangement, Operation and control ofUPF. • Basic Principle of P and Q control- Independent real and reactivepower flow control-Applications.	6
5	• Introduction to interline power flow controller. Modeling and analysis of FACTS Controllers – Simulation of FACTS controllers Power quality problems in distribution systems,harmonics. • Loads that create harmonics, modeling, harmonic propagation, series and parallel resonances, mitigation of harmonics, passive filters, activefiltering – shunt , series and hybrid and their control.	6
6	• Voltage swells, sags, flicker, unbalance and mitigation of these problems by • power line conditioners- IEEE standards on powerquality.	6

Suggested reading

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New AgeInternationalPublishers,2007.
2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control",SpringerVerlag, Berlin,2006.
3. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi,2001.
4. K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003.

5. G. T.Heydt, “Power Quality”, McGraw-Hill Professional,2007.
6. T. J. E. Miller, “Static Reactive Power Compensation”, John Wiley and Sons, Newyork,1982.

Course Outcomes:

Students will be able to:

1. Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in PowerSystems.
2. Learn various Static VAR Compensation Schemes like Thyristor/GTOControlled.
3. Reactive Power Systems, PWM Inverter based Reactive Power Systems and theircontrols.
4. To develop analytical modeling skills needed for modeling and analysis of such Static VARSystems.

OPEN ELECTIVES

MOEL01	**BUSINESS ANALYTICS**	**3L:0T:0P**	**3 Credits**

Teaching scheme

Lecture: - 3 h/week

Course Code	
Course Name	**Business Analytics**
Credits **Prerequisites**	

Total Number of Lectures: 48

Course objective
1. Understand the role of business analytics within anorganization. 2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of anorganization. 3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decisionmaking. 4. To become familiar with processes needed to develop, report, and analyze businessdata. 5. Use decision-making tools/Operations researchtechniques. 6. Mange business process using analytical and managementtools. 7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospaceetc.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	9

Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	8
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

COURSE OUTCOMES

1. Students will demonstrate knowledge of dataanalytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deepanalytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support businessdecision-making.
4. Students will demonstrate the ability to translate data into clear, actionableinsights.

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, personsEducation.

MOEL02	INDUSTRIAL SAFETY	3L:0T:0P	3 Credits

Teaching scheme

Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment andmethods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment‟s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustionengine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their generalcauses.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii.Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept andimportance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, Mcgrew HillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & HallLondon.

MOEL03	OPERATIONS RESEARCH	3L:0T:0P	3 Credits

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuousvariables.
2. Students should able to apply the concept of non-linearprogramming
3. Students should able to carry out sensitivityanalysis
4. Student should able to model the real world problem and simulateit.

Syllabus Contents:

Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI,2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi,1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub.2009
5. Pannerselvam, Operations Research: Prentice Hall of India2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010

MOEL04	COST MANAGEMENT OF ENGINEERING PROJECTS	3L:0T:0P	3 Credits

Teaching scheme

Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

2. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
3. Charles T. Horngren and George Foster, Advanced ManagementAccounting
4. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting
5. AshishK. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
6. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

MOEL05	COMPOSITE MATERIALS	3L:0T:0P	3 Credits

Teaching scheme

Lecture: - 3 h/week

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix

Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.

References:

1. Hand Book of CompositeMaterials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L.Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MOEL06	WASTE TO ENERGY	3L:0T:0P	3 Credits

Teaching scheme

Lecture: - 3 h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers,digestors

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields andapplications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion-

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996.

MOEL07	PROGRAMMING IN PYTHON	3L:0T:0P	3 Credits

UNIT 1: Introduction To Python & Data Types

Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks, Declaring and using Numeric data types: int, float, complex, Using string data type and string operations,

Defining list and list slicing, Use of Tuple data type

UNIT 2: Python Program Flow Control, String, List And Dictionary Manipulations

Conditional blocks using if, else and elif, simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block, Understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build functions

UNIT 3: Python Functions, Modules, Packages & Python File Operation

Organizing python codes using functions, Organizing python projects into modules Importing own module as well as external modules Understanding Packages, Powerful Lamda function in python, Programming using functions, modules and external packages , reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

UNIT 4 : Python Object Oriented Programming & Exception handling :

Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support, Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling

UNIT 5 : Data Manipulation using Python

SQL Database connection using python, Creating and searching tables, Reading and storing config information on database, Programming using database connections , **The Basics of NumPy:** NumPy Array Basics , Boolean Selection, Helpful Methods and Shortcuts , Vectorization , Multi-Dimensional Arrays, Querying Slicing, Combining, and Splitting Arrays, **Pandas DataFrame Basics:** Reading Files, Plotting, and Basic Methods , More Plotting, Joins, Basic DateTime Indexing, and Writing to Files, Adding & Reseting Columns, Mapping with Functions , More Mapping, Filling NaN values, Plotting, Correlations, and Histograms , More Plotting, Rolling Calculations, Basic DateTime

Indexing, Analysis Concepts, Filling NaN Values, Cumulative Sums and Value Counts , Data Maintenance, Adding/ Removing Columns and Rows , Basic Grouping, Concepts of Aggregate Functions.

Suggested Readings :

1. Head First Python , A brain friendly guide – Paul Barry , O reilly, 2nd Edition.
2. A byte of Python- C.H. Swaroop
3. Python Cookbook by David Beazley and Brian K. Jones
4. Introduction to Machine Learning with Python Paperback – by Andreas C. Mueller

MOEL08	MACHINE LEARNING	3L:0T:0P	3 Credits

UNIT-I

Introduction: Learning, Types of Machine Learning.

Some Basic Statistics: Averages, Variance and Covariance, Gaussian distribution, Bayes theorem.

Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.

Learning with Trees: Constructing Decision Trees, CART, Classification Example

UNIT-II

Time Series : AR, MA, ARMA, ARIMA , ARMAX for predictions using time dependent data.

Linear Discriminants: Linear Separability, Linear Regression ,

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

SUPPORT Vector Machines: Optimal Separation, Kernels

The Bias-Variance Tradeoff.

UNIT-III

Bayesian learning: Introduction, Bayes Optimal Classifier, Naive Bayes Classifier, Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm,

Neural Networks : The Perceptron, Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation

UNIT-IV

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming

Ensemble learning: Boosting, Bagging

UNIT-V

Case studies : Use of Data sets , Data Pre-processing and application of the suitable algorithms .

Suggested Reading:

1. Tom M. Mitchell, Machine Learning, Mc Graw Hill, 1997
2. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009
3. Margaret H Dunham, Data Mining, Pearson Edition., 2003.
4. Galit Shmueli, Nitin R Patel, Peter C Bruce, Data Mining for Business Intelligence, Wiley India Edition, 2007
5. Rajjan Shinghal, Pattern Recognition, Oxford University Press, 2006.

Semester-4						
S. No.	**Core/Elective**	**Course Name**				**Credits**
			L	T	P	
1	MPED 451	Phase-II Dissertation	0	0	32	16
2	MOOC	MOOC Course				2
	TotalCredits				**18**	

GRAND TOTALCREDITS 71

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level ofreadability
2. Learn about what to write in eachsection
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-timesubmission

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who DidWhat, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟sbook.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London,2011

AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflictsituations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home countryor the countries they work in

Syllabus

Units	CONTENTS	Hours
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, TypesAnd Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts AndFamines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People‟s Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging TrendsIn Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal bookCompany.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, NewDelhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., NewDelhi.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in theworld
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science &other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	Content	Hours
1	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	8
2	• Order • Introduction of roots • Technical information about Sanskrit Literature	8
3	• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India‟s Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self-development
2. Imbibe good values instudents
3. Let the should know about the importance ofcharacter

Syllabus

Unit	Content	Hours
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgements	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism. Love for nature, Discipline	6
3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.	6
	• Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	
4	• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence ,Humility, Role of Women. • All religions and same message. • Mind your Mind,Self-control. • Honesty, Studying effectively	6

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, NewDelhi

Course Outcomes

Students will be able to

1.Knowledge of self-development

2.Learn the importance of Human values

3.Developing the overall personality

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals‟ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. ToaddresstheroleofsocialisminIndiaafterthecommencementoftheBolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Units	Content	Hours
1	• **History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	• **Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	• **Contours of Constitutional Rights &Duties:** • Fundamental Rights	4
	• Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy • Fundamental Duties.	
4	• **Organs of Governance:** • Parliament • Composition • Qualifications and Disqualifications • Powers and Functions • Executive • President • Governor • Council of Ministers • Judiciary, Appointment and Transfer of Judges,Qualifications • Powers and Functions	4
5	• **Local Administration:** • District‟s Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. • Pachayati raj: Introduction, PRI: Zila Pachayat. • Elected officials and their roles, CEO Zila Pachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • Importance of grass root democracy	4

6	• **Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus

Units	Content	Hours
1	• **Introduction and Methodology:** • Aims and rationale, Policy background, Conceptual framework and terminology • Theories of learning, Curriculum, Teacher education. • Conceptual framework, Research questions**.** • Overview of methodology and Searching.	4
2	• Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	2
3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers‟ attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow-up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4
5	• **Research gaps and future directions** • Research design • Contexts • Pedagogy • Teacher education • Curriculum and assessment • Dissemination and research impact.	2

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London:DFID.
4. AkyeampongK, LussierK, Pryor J, Westbrook J (2013) Improving teaching and learning of basic

maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston:Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, „learning to read" campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body andmind
2. To overcomestress

Syllabus

Unit	Content	Hours
1	• Definitions of Eight parts of yog. (Ashtanga)	8
2	• Yam and Niyam. Do`s and Don‟t‟s inlife. i) Ahinsa, satya, astheya, bramhacharya andaparigraha ii) Shaucha, santosh, tapa, swadhyay,ishwarpranidhan	8
3	• Asan andPranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

1. „Yogic Asanas for Group Tarining-Part-I" : Janardan Swami YogabhyasiMandal,Nagpur
2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda, Advaita Ashrama(Publication Department),Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social healthalso
2. Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride &heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont‟s) • Verses- 71,73,75,78 (do‟s)	8
2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41,47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23,35, • Chapter 18-Verses 45, 46,48.	8
3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62,68 • Chapter 12 -Verses 13, 14, 15, 16,17,18 • Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses36,37,42, • Chapter 4-Verses 18,38,39 • Chapter18 – Verses37,38,63	8

Suggested reading

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department),Kolkata
2. Bhartrihari‟s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, NewDelhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal inlife
2. The person who has studied Geeta will lead the nation and mankind to peace andprosperity
3. Study of Neetishatakam will help in developing versatile personality ofstudents.