Ordinance No. V (42A)

Master of Technology

(M.Tech.)

(Discipline: Power Electronics and Drives)

Faculty of Engineering & Technology

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT
SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING
ORDINANCE No. V (42A) RELATING TO
MASTER OF TECHNOLOGY (M.Tech.) PROGRAMME

(As per AICTE)
(Effective from the Session – 2018-19)

General

- This ordinance may be called **"Ordinance Relating to Master of Technology (M.Tech)"** Programme**.**
- It shall come enforced with immediate effect session 2018-19.
- This supersedes the previous Ordinance from the relating to Master of Technology (M.Tech)**.**
- The degree "Master of Technology" acronym as M.Tech. shall be of two years (four semesters) in the branches of Engineering.

CHAPTER - 1

1.1 Introduction

Chhatrapati Shahuji Subharti Institute of Technology and Engineering is a constituent Institute of Swami Vivekanand Subharti University, Meerut has been established in 2005 with the vision we make every decision to support the career and personal development of our learners. Our curriculum, teaching and services demonstrate that we value the diverse profiles of our learners. The University boasts of highly qualified, dedicated and competent faculty from all walks of life, world class infrastructure, fully equipped Laboratories with latest state-of-the-art equipment and a huge library with recent knowledge resources including e-resources. Swami Vivekanand Subharti University is providing a safe and healthy working environment for teaching and non-teaching employees, students, and visitors etc.

1.2 Vision

To become a dynamic, demand driven, quality conscious, efficient and innovative institute capable of becoming active partner in the techno-economic growth of the Nation and to provide world class technological education and research inputs to the society.

1.3 Mission

Strive to create centre of excellence in specialized areas of technology and enable its academic beneficiaries to become competent professionals capable of providing sustainable solutions to challenging problems of the society and industry.

1.4 Programme Educational Objectives (PEOs):

The Programme Educational Objectives of M.Tech. programmes are:

PEO1. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms

PEO2. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise

PEO3. To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, design and implementation skills

PEO4. To prepare graduates who will thrive to pursue life-long learning to fulfill their goals

1.5 Programme Outcomes (POs):

Engineering programmes are designed to prepare graduates to attain the following program outcomes:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAPTER – 2

General

2.1   The M.Tech. programme is available in the following discipline:

1) **Computer Science & Engineering Department**

   - Computer Science & Engineering
   - Cyber Security

2) **Electrical & Electronics Engineering Department**

   - Power Electronics & Drives
   - Energy Technology

3) **Electronics & Communication Engineering Department**

   - Radiofrequency & Microwave
   - Microelectronics

4) **Mechanical Engineering Department**

   - Production Engineering

5) **Environmental Engineering Department**

   - Environmental Engineering & Management

6) **Civil Engineering Department**

   - Construction Management
   - Structural Engineering

2.2   Modification/ addition/ deletion in the of specialties offered in the above list can be made by the faculty from time to time in accordance with the direction of the Academic Council which shall be subject to fulfillment of statutory norms, prescribed condition and approval by the Statutory Authorities.

2.3   The eligibility qualification for admission to the M.Tech. programmes in Swami Vivekanand Subharti University, Meerut in different specialties shall be as given below in the Table of Eligibility Qualification for M.Tech. admission:

Eligibility Qualification for M.Tech. Admission:

Department	Specialization	Eligibility
Computer		1. **BE/B.Tech** Electrical and Electronics/ Electronics &

Science & Engineering	Computer Science & Engineering	Communication/ Electronics Engineering/ Information Technology/ Computer Science & Engineering/ Instrumentation & Control/ Electronics & Instrumentation/ Instrumentation/ Computer Hardware & Software **Or** **2.** Five year integrated M.Sc in Information Technology/ Computer Science/ Software Engineering/ Computer Science/ Electronics. **Or** **3.** M.Sc (02 Year)
	Cyber Security	**1. BE/B.Tech.** Electrical and Electronics/ Electronics & Communication/ Electronics Engineering/ Information Technology/ Computer Science & Engineering/ Instrumentation & Control/ Instrumentation/ Electronics & Instrumentation/ Computer Hardware & Software. **Or** **2.** Five year integrated M.Sc. in Information Technology/ Computer Science/ Software Engineering/ Computer Science/ Electronics. **Course & M.Sc (2 Year) in IT Related Major Courses** **3.** Electronics/Electronics and Communication, Mathematics, Physics. **M.C.A.** **AMIETE/AMIE**
Electrical & Electronics Engineering	Power Electronics & Drives	BE/B.Tech/B.Sc (Engg) (EC, EEE, EE & EI). **Or** Associate Membership of Professional Bodies Approved by the Competent Authority. **Or** M.Sc. (Engg in Electrical) or Equivalent Degree.
	Energy Technology	BE/B.Tech/B.Sc (Engg) (EC, EEE, EE, EI, ME, Chemical & Auto). **Or** Associate Membership of Professional Bodies Approved by the Competent Authority. **Or** M.Sc. (Electronics, Physics, Chemistry) or Equivalent Degree
	Radiofrequency & Microwaves	B.Tech/BE/B.Sc (Engg) (EC, EE, EI & EEE). **Or** Associate Membership of Professional Bodies Approved by the Competent Authority. **Or** M.Sc. (Electronics, Physics with specialization

		in) or Equivalent Degree
Electronics & Communication Engineering	Microelectronics	B.Tech/BE/B.Sc (Engg) (EC, EE, EI & EEE). **Or** Associate Membership of Professional Bodies Approved by the Competent Authority. **Or** M.Sc. (Electronics, Physics with specialization in) or Equivalent Degree.
Mechanical Engineering	Production Engineering	B.Tech./BE/B.Sc (Engg) (ME, Production or Mechatronics). **Or** Associate Membership of Professional Bodies Approved by the Competent Authority.
Environment Engineering	Environmental Engineering & Management	B.Tech./BE/B.Sc (Engg)/Environment Engg./Civil Engg./Biotechnology/Chemical Engg./Mechanical Engg./Electrical & Electronics Engg./Fire Safety Engg.) **Or** Associate Membership of Professional Bodies Approved by the Competent Authority. **Or** M.Sc (Environment Science, Physical Sciences, Life Science) or Equivalent Degree
Civil Engineering	Construction Management	B.E./B.Tech/B.Sc (Engg) Degree in Civil Engineering/ Mining Engineering/ Transportation Engineering/Environmental Engineering/ Structural Engineering/Construction Technology & Management of any recognized Indian University. **Or** Bachelor's Degree in Architecture of any recognized Indian University **Or** Associate Membership of Professional Bodies Pertaining to Civil Engineering/Architecture Approved by the Competent Authority.
	Structure Engineering	B.E./B.Tech/B.Sc (Engg) Degree in Civil Engineering of any recognized Indian University. **Or** Bachelor's Degree in Architecture of any recognized Indian University. **Or** Associate Membership of Professional Bodies Pertaining to Civil Engineering/Architecture

		Approved by the Competent Authority.

2.4   Categories for M.Tech. Admission

Admission to M.Tech. in each specially shall be approved in any one of the following categories:-

2.4.1 M.Tech. (Regular): It shall be a Regular, Four Semester, Full Time Programme (24 month duration) in which the student will be expected to fulfill the complete requirement relating to the theory/Lab Work/Practical Training/Dissertation etc. while performing full time studies in the University and the Industries/institute/R&D Organization assigned to him/her by the university for completing the dissertation/Project Work.

2.4.2 M.Tech. (2nd Shift): with a view to allow opportunity for higher technical education to the engineering graduate employed in the field and teaching organizations, the university shall run M.Tech classes in the 2nd shift with identical curriculum and syllabi in the evening shift with class timing from 05:00 PM to 09:00 PM.

2.5   Provided further that the Vice Chancellor may exercise special powers to allow such 2nd shift classes to be conducted on *Saturday, Sunday and Holidays* to ensure complete and effective coverage of the syllabi and completing teaching hours as per requirement laid down by the statutory authorities/UGC

CHAPTER - 3

Teaching Courses

3.1   The programme will be two years duration, divided into four semesters (for M.Tech. Regular).

3.2   Annual Academic calendar shall be published by the university.

I , III Semester (Odd)	Session - 1st Aug. to 30th Nov
	Exam - 1st Dec. to 20th Dec.
II, IV Semester (Even)	Session - 1st Jan. to 10th May
	Exam - 1st May to 20th May

3.3   The documentation relating to the '**Study & Evaluation Scheme', 'Syllabus' and 'Credits Approved'** for each subjects/course in the categories mentioned in each of the specialties stated in clause 2.1 above is provided in **Annexure-B1-B10** of the relevant programme in the Academic Ordinance.

3.4   Dissertation topics should be allotted to students in the third semester.

CHAPTER-4

Curriculum/Structure

4.1   The programme shall be spread over two academic years, spread over four semesters comprising actual teaching for a minimum of 90 days in each semester.

4.2   The programme focuses on the following aspects:

(a) Competency

(b) Entrepreneurship

(c) Skill Enhancement

(d) Value Added Courses

(e) Extracurricular activities

4.3   Choice Based Credit System (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising Professional/Program Core Courses (PCC), Professional/Program Elective Courses (PEC), Mandatory Courses (MC) and Open Elective Courses (OEC). The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Professional/Program Core Courses (PCC)

The departmental core consists of courses considered essential for a chosen engineering/science discipline including, engineering design, seminar, industrial training and project (PROJ).

Professional/Program Elective Courses (PEC)

The students are required to complete a specific number of elective courses. Every department offers a wide variety of elective courses to students providing them opportunity to discover their academic interest and enhancing their engagement in learning process.

Open Elective Courses (OEC)

The Open Electives courses are offered by different academic departments to the students of all disciplines. A wide range of elective courses is available with each branch. When a student opts elective courses offered in his/her program it will be termed as OEC.

Mandatory Courses (MC)

The mandatory courses considered essential for a B.Tech. programme to inculcate the essence of Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition etc.

CHAPTER-5

Attendance

5.1   The students are expected to attend all the classes and should not have less than 75 % attendance in theory as well as in practical classes, wherever held, to become eligible to appear for the university examination. Short fall in attendance can, however be condoned

in deserving cases to the extent of 10 % by the principal. If the short fall is more than 10 % but not more than 15 %, the Principal may recommend deserving cases to the Vice Chancellor for condo-nation. The order of the Vice chancellor in this regard shall be final.

CHAPTER-6

Examination

All Courses offered by SITE will have an evaluation system within two components as:

1. Continuous Comprehensive Assessment (CCA) accounting for 30% of the final grade that a student gets in a course, and

2. End-Semester Examination (ESE) accounting for the remaining 70% of the final grade that the student gets in a course.

A student will have to pass both the components i.e. CCA and ESE separately to become eligible to be declared successful in a course.

6.1 Continuous Comprehensive Assessment (CCA)

Award of Sessional Marks:

Sessional marks for theory subjects, practicals and projects shall be awarded as per the breakup of sessional marks given below:-

(i) Theory Subjects :

a) Class test will comprise two mid-term test of equal weightage **.- 20 Marks**

b) Marks for regular class attendance **- 10 Marks**

(ii) Practical :

a) Two–mid-term viva-voce test of equal weightage. **- 5 Marks**

b) Teacher's assessment (including 5 marks for regular attendance) based on lab record. **-10 Marks**

(iii) Make-up test may be held for those students who fail to appear in any one of the mid-term class test due to genuine unavoidable reasons, provided prior permission was consented from the Principal.

(iv) A maximum of 10 marks in each subject shall be awarded for attending classes (theory/practical) as per the following norms:

85 % or more attendance	-	10 Marks
80 % or more but less than 85 % attendance	-	09 Marks
75 % or more but less than 80 % attendance	-	08 Marks
70 % or more but less than 75 % attendance	-	07 Marks
65 % or more but less than 70 % attendance	-	06 Marks
60 % or more but less than 65 % attendance	-	05 Marks
51 % or more but less than 60 % attendance	-	04 Marks
50 % attendance	-	01 Marks

Less than 50 % attendance   -   0 Marks

6.2   END SEMESTER EXAMINATION (ESE)

The remaining 70% of the final grade of the student in a course will be assessed on the basis of an End Semester Examination (ESE) that will be for three hours duration and will cover the entire syllabus of the course. The question papers for the ESE will be got set by the Controller of Examinations (COE) of the Swami Vivekanand Subharti University (SVSU) by a selected faculty panel.

6.3   The entire programme has to completed within a maximum of four years from the date of original admission in the programme.

CHAPTER-7

Paper Setting

7.1   The work of setting the end semester examination papers and evaluation of scripts and conduct of the end semester practical examination shall be assigned to the course teachers as well as to outsiders, ordinarily in the ratio of 50:50 for internal and external valuation respectively.

Results

7.2   The result shall be prepared at the end of each academic year of the programme by aggregating the marks obtained in the theory and practical examinations in all the semesters of the programme till date.

(a) The minimum passing marks in each theory subject (including sessional marks) shall be 40% and 50% in aggregate. The minimum pass marks in a project/ Practical subject (including sessional marks if any), Seminars, Industrial Training and Educational Tour, Viva-Voce etc. shall be 50%.

(b) If a student obtained 40% marks in at least 50% of the papers (ignoring fractions) including project report, he/she will be provisionally promoted to the next year with carryover papers and will have to appear & obtain pass marks in carryover papers along with the subsequent regular examinations for the relevant semester.

(c) If a candidate fails in only one head/subject and having passed in all other head/subject of the given examination of the year than his/her deficiency of maximum five (05) marks may be fulfilled by grace marks after fulfilling the conditions given below:

7.3   If a candidate fails in only one head/subject and having passed in all other heads/subjects of the given examination of a **semester*/year**, then his/her deficiency of marks may be fulfilled by grace marks under the following conditions:-

(i)   Grace marks is not a matter of right of the student but is the discretion of the University.

(ii) Provided that the candidate has appeared in the main examination of the concerned programme and falls short of pass marks by not more than five (05) marks in theory paper only. Benefit of above mentioned shall not be given to the candidate who had appeared in supplementary/special examination/carry over examination.

(iii) Further, benefit of grace marks may be given only to the candidate who will pass the entire concerned examination of the **semester*/year** after awarding the grace marks and not for the purpose of promoting the student to next year with back papers or for improvement of division or percentage.

(iv) If in a head/subject of an examination passing in Theory, Practical or sessional exams separately is mandatory, then the benefit of grace marks shall be given only in Theory examination of the University examination.

(v) The award of grace marks permissible shall be on the basis of 1 grace mark for every 05 marks secured by an examinee over and above the minimum passing aggregate marks of all subjects of the year.

7.4 Awarding of Grace Marks shall be done as given below:-

Aggregate Marks Obtained over & above minimum passing marks	Permissible Grace Marks
1-5	1
6-10	2
11-15	3
16-20	4
21-25	5

Total number of Grace Marks given to the student will be marked with astrick (*) at the bottom of the mark sheet.

* Grace Mark in semester examination will be considered hereinafter.

A student not covered by clause 7.2 (a) to (c) above shall have the following options to complete his/her programme -

(i) He/ she may take admission on payment of full annual programme fee and repeat the entire year of study. He /She shall be treated as a regular student. Or

(ii) He /She may pay only University exam fee for the End Semester Examination and appear in the End Semester University exams directly. He /She shall not be allowed to attend classes and the Sessional marks obtained earlier shall be retained. Or

(iii) He /She may pay half of the annual programme fee and attend classes. The sessional marks obtained by him/her earlier shall be retained. There will not be any requirement of minimum attendance for appearing in the University examination

7.5 A student will not be promoted to the next academic year if the carryover papers are more than 50% at one point of time.

Evaluation under Grading Assessment

7.6 The minimum Grade/ Grade Point required to pass each paper in a semester examination under CBCS shall be Grade D/ Grade Point 4 in each theory paper/

Practical/Project (wherever applicable) in External Examination and Internal Assessment separately.

Calculation Criteria

7.7 To implement the following grading system, the colleges/campuses shall use the following UGC recommended 10 point grading system:

Marks (%)	Letter Grades	Grade Points (G)
85-100	A++ (Outstanding)	10
75 to < 85	A+ (Excellent)	9
70 to <75	A (Very Good)	8
65 to <70	B+ (Good)	7
60 to <65	B (Above Average)	6
50 to <60	C (Average)	5
40 to <50	D (Pass)	4
0 to <40	F (Fail)	0
	AB (Absent)	0

7.8 **Computation of Semester Grade Point average (SGPA) and Cumulative Grade Point Average (CGPA)**

$$(Si) = \text{\textsterling} (Ci \times Gi) / \text{\textsterling} Ci,$$

where Ci is the number of credits of the ith programme and Gi is the grade point scored by the student in the ith programme.

$$CGPA = \text{\textsterling}(Ci \times Si) / \text{\textsterling} Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts

CHAPTER-8
Power to Modify

8.1 In the event of any emergent situation, if any deviation is considered necessary, the Vice-Chancellor is authorized to modify the ordinance. Subjected to subsequent ratification by the executive council.

SWAMI VIVEKANAND
SUBHARTI UNIVERSITY, MEERUT

EVALUATION SCHEME & SYLLABUS

M.TECH.
(POWER ELECTRONICS AND DRIVES)

W.E.F. SESSION 2018-19

SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT
STUDY & EVALUATION SCHEME
M.Tech Ist Year/Ist Semester (Power Electronics and Drives)
w.e.f academic Session 2018-19

S. No	Course Code	Course Name	Course Type	Periods			CCA			ESE			Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		

		SEMESTER I												
S. No	Course Code	Course Name	Course Type	L	T	P	CT	TA	Total	PS	TE	PE	Total	Credit
1	MPED-101	Electric Drives System	PCC-1	3	0	0	20	10	30	-	70	-	100	3
2	MPED-102	Modeling and Analysis of Electrical Machines	PCC-2	3	0	0	20	10	30	-	70	-	100	3
3	MPED-111-MPED-114	Professional Elective Course-1	PEC-1	3	0	0	20	10	30	-	70	-	100	3
4	MPED-121-MPED-123	Professional Elective Course -2	PEC-2	3	0	0	20	10	30	-	70	-	100	3
5	MPED-151	Electrical Drives Lab	PCC-3	0	0	4	-	-	-	15	-	35	50	2
6	MPED-152	Electrical Machines Lab	PCC-4	0	0	4	-	-	-	15	-	35	50	2
7	METC-101	Research Methodology and IPR	MC-1	2	0	0	20	10	30	-	70	-	100	2
8	METC-111-METC-118	Audit I	MC-2	2	0	0	20	10	30	-	70	-	100	0
		TOTAL											700	18

M.Tech Ist Year/IInd Semester (Power Electronics and Drives)
w.e.f academic Session 2018-19

		SEMESTER II												
S. No	Course Code	Course Name	Course Type	L	T	P	CT	TA	Total	PS	TE	PE	Total	Credit
1	MPED-201	Power Electronic Converters	PCC-5	3	0	0	20	10	30	-	70	-	100	3
2	MPED-202	Digital Control of Power Electronic and Drive Systems	PCC-6	3	0	0	20	10	30	-	70	-	100	3
3	MPED-211-MPED-213	Professional Elective Course-3	PEC-3	3	0	0	20	10	30	-	70	-	100	3
4	MPED-221 MPED-223	Professional Elective Course-4	PEC-4	3	0	0	20	10	30	-	70	-	100	3
5	MPED-251	Mini Project with Seminar	PROJ	0	0	4	-	-		50	-	-	50	2
6	MPED-252	Power Electronics Lab	PCC-7	0	0	4	-	-	-	15	-	35	50	2
7	MPED-253	Microcontroller Lab	PCC-8	0	0	4	-	-	-	15	-	35	50	2

8	METC-211-METC-218	Audit II	MC-3	2	0	0	20	10	30	–	70	-	100	0
							TOTAL						650	18

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

STUDY & EVALUATION SCHEME

M.Tech. IInd Year/IIIrd Semester (Power Electronics and Drives)

w.e.f academic Session 2018-19

SEMESTER III														
S. No	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	MPED-311-MPED-313	Professional Elective Course-5	PEC-5	3	0	0	20	10	30	-	70	-	100	3
2	MPED-001-MPED-006	Open Elective Course	OEC-1	3	0	0	20	10	30	-	70	-	100	3
3	MPED-351	Dissertation-I	PROJ	0	0	20	-	-	-	100	-	100	200	3
				TOTAL									400	16

M.Tech IInd Year/IVth Semester (Power Electronics and Drives)

w.e.f academic Session 2018-19

SEMESTER IV														
S. No	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	MPED-451	Dissertation-II	PROJ	0	0	32	-	-	-	100	-	300	400	16
				TOTAL									400	16

M.TECH. (PED) GRAND TOTAL CREDITS – 68

COURSE TYPE NOMENCLATURE

Course Code	Definitions
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Electives Course
MC	Mandatory Courses
PROJ	Project
CCA	Continuation Comprehensive Assessment
ESE	End Semester Examination
L	Lecture
T	Tutorial
P	Practical
CT	Class Test
AT	Attendance
PS	Practical Sessional
TE	Theory Exam
PE	Practical Exam

LIST OF ELECTIVES, OPEN ELECTIVES AND MANDATORY COURSES

PROFESSIONAL CORE COURSES (PCC)
MPED-101: Electric Drive System
MPED-102: Modeling and Analysis of Electrical Machines
MPED-151: Electrical Drives Lab
MPED-152: Electrical Machines Lab
MPED-201: Power Electronic Converters
MPED-202: Digital Control of Power Electronic and Drive Systems
MPED-252: Power Electronics Lab
MPED-253: Microcontroller Lab

PROFESSIONAL ELECTIVE COURSES
PROFESSIONAL ELECTIVE COURSE-I (PEC-I)
MPED-111: Advanced Power Electronic Circuits
MPED-112: Optimal and Adaptive Control
MPED-113: Power Quality
MPED-114: Dynamics of Electrical Machines

PROFESSIONAL ELECTIVE COURSE-2 (PEC-2)
MPED-121: Static VAR Controllers and Harmonic Filtering
MPED-122: PWM converter and Applications
MPED-123: Power Semiconductor Devices & Modeling

PROFESSIONAL ELECTIVE COURSE-3 (PEC-3)

MPED-211: Switched Mode and Resonant Converters

MPED-212: Industrial Load Modeling and Control

MPED-213: Advanced Digital Signal Processing

PROFESSIONAL ELECTIVE COURSE-4 (PEC-4)

MPED-221: Advanced Microcontroller based Systems

MPED-222: Distributed Generation

MPED-223: Smart Grids

PROFESSIONAL ELECTIVE COURSE-5 (PEC-5)

MPED-311: SCADA Systems and Applications

MPED-312: FACTS and Custom Power Devices

MPED-313: HVDC

OPEN ELECTIVE COURSE (OEC)

MPED-001: Business Analytics

MPED-002: Industrial Safety

MPED-003: Operations Research

MPED-004: Cost Management of Engineering Projects

MPED-005: Composite Materials

MPED-006: Waste to Energy

MANDATORY COURSES (MC)

AUDIT COURSE I & II

METC-111/ METC-211: English for Research Paper Writing

METC-112/ METC-212: Disaster Management

METC-113/ METC-213: Sanskrit for Technical Knowledge

METC-114/ METC-214: Value Education

METC-115/ METC-215: Constitution of India

METC-116/ METC-216: Pedagogy Studies

METC-117/ METC-217: Stress Management by Yoga

METC-118/ METC-218: Personality Development through Life Enlightenment Skill

MPED-101: ELECTRIC DRIVES SYSTEM

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.

Unit-I: Dynamics of Electric Drives.

Fundamentals of torque equation: Speed torque convention and multi-quadrant operation, components of load torques: Classification of load torques steady state stability: Load equation, Speed control and drive classification. Close loop control of drives.

Unit-II: 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.

Unit-III: Poly-Phase Induction Machines.

Dynamic modeling of induction machines, Small signal equations and control characteristics of induction machines.

Unit-IV: Phase-Controlled Induction Machines.

Stator voltage control, Slip energy recovery scheme, frequency control and vector control of induction motor drives.

Unit-V: Traction motor and Industrial Drives.

Traction motor: Starting, Speed-Time characteristics and Braking. Traction motors used in practice.

Industrial Drives: Digital Control of Electric Drives: Stepper motor. Servo motor and their 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.
W. Leonhard, "Control of Electrical drives", Springer, 3rd edition, 2001.
4. P.C. Krause –, "Analysis of Electric Machine", Wiley-IEEE press 3rdedition.
5. 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.
6. Select and implement the drives for Industrial Process
7. Implement various variable speed drives in Electrical Energy Conversion System

MPED-102: MODELING AND ANALYSIS OF ELECTRICAL MACHINES

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.

Unit-I:
Principles of Electromagnetic Energy Conversion, General expression of stored magnetic energy, Co-energy and force/torque, example using single and doubly excited system. 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.

Unit-II:
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. Determination of Synchronous machine dynamic equivalent circuit parameters.

Unit-III:
Analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

Unit-IV:
Permanent magnet synchronous machine- Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines-Construction and operating principle, Dynamic modeling and self-controlled operation.

Unit-V :
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.

PROFESSIONAL ELECTIVE COURSE-I (PEC-I)

MPED- 111: ADVANCED POWER ELECTRONIC CIRCUITS

Course Objectives:

Students will be able to:

1. Understand the operation of advanced power electronic circuit topologies.
2. Understand the control strategies involved.
3. Learn few practical circuits, used in practice.

Unit-I:

Boost type APFC and control. Three phase utility inter phases and control-Buck, Boost, Buck-Boost, SMPS Topologies.

Unit-II:

Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control. Half and Full Bridge Converters. Flyback Converter.

Unit-III:

Introduction to Resonant Converters: Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies.

Unit-IV:

Resonant DC Link Inverters with Zero Voltage Switching. High Frequency Link Integral Half Cycle Converter.

Unit-V:

Modeling and design of DC-DC Converters for various renewable energy conversions, few power electronic circuits used in practice for controlling electric drives.

Suggested reading

1. Rashid "Power Electronics" Prentice Hall India 2007.
2. G.K.Dubey et.al "Thyristorised Power Controllers" Wiley Eastern Ltd., 2005, 06.
3. Dewan&Straughen "Power Semiconductor Circuits" John Wiley &Sons., 1975.
4. G.K. Dubey& C.R. Kasaravada "Power Electronics & Drives" Tata McGraw Hill., 1993
5. Cyril W Lander "Power Electronics" McGraw Hill., 2005.
6. B. K Bose "Modern Power Electronics and AC Drives" Pearson Education (Asia)., 2007
7. Abraham I Pressman "Switching Power Supply Design" McGraw Hill Publishing Company., 2001.

Course Outcomes:

Students will be able to:

1. Knowledge about analysis and design of Load Commutated CSI and PWM CSI.
2. Learn analysis and design of series Inverters.
3. Acquire knowledge about analysis and design of Switched Mode Rectifiers, APFC, DC-DC converters & resonant converters.

MPED - 112: OPTIMAL AND ADAPTIVE CONTROL

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
Unit-I:
Optimal control problem – fundamental concepts and theorems of calculus of variations–Euler - Language equation and external of functional.

Unit-II:
Variational approach to solving optimal control problems. Hamiltonian and different boundary conditions for optimal control problem

Unit-III:
Linear regulator problem - Pontryagin's minimum principle.

Unit-IV:
Dynamic programming - Principle of optimality and its application to optimal control problem.

Unit-V:
Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis.

Unit-VI:
Introduction to design method based on the use of Liapunov function. Design and simulation of variable structure adaptive model following control.

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.
6. 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.

MPED- 113: POWER QUALITY

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

Unit-I:
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.

Unit-II:

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.

Unit-III:

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.

Unit-IV:

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.

Unit-V:

Hamilton-Jacobi-Bellman equation - model reference adaptive Systems (MRAS) - Design hypothesis.

Unit-VI:

Introduction to design method based on the use of Liapunov function. Design and simulation of variable structure adaptive model following control.

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 harmonics on system equipment and loads develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components.
2. To introduce the student to active power factor correction based on static VAR compensators and its control techniques.
3. To introduce the student to series and shunt active power filtering techniques for harmonics.

MPED-114: DYNAMICS OF ELECTRICAL MACHINES
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-I:
Stability. Primitive 4 Winding Commutator Machine. Commutator Primitive Machine. Complete Voltage Equation of Primitive 4 Winding Commutator Machine.

Unit-II:
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.

Unit-III:
Three Phase Salient Pole Synchronous Machine. Parks Transformation- Steady State Analysis.

Unit-IV:
Large Signal Transient. Small Oscillation Equations in State Variable form. Dynamical Analysis of Interconnected Machines.

Unit-V:
Large Signal Transient Analysis using Transformed Equations. DC Generator /DC Motor System.

Unit-VI:
Alternator /Synchronous Motor System.

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 electro-dynamic 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.

<p align="center">PROFESSIONAL ELECTIVE COURSE-2 (PEC-2)</p>

MPED-121 STATIC VAR CONTROLLER AND HARMONIC FILTERING

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

Unit-I:

Fundamentals of Load Compensation. Steady-State Reactive Power Control in Electric Transmission Systems. Reactive Power Compensation and Dynamic Performance of Transmission Systems.

Unit-II:

Power Quality Issues: Sags, Swells, Unbalance, Flicker, Distortion. Current Harmonics. Sources of Harmonics in Distribution Systems and Ill Effects .

Unit-III:

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.

Unit-IV:

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.

Unit-V:

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.

Unit-VI:

Series Active Filtering in Harmonic Cancellation Mode. Series Active Filtering in Harmonic Isolation Mode.

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 Power Compensation Schemes at Transmission and Distribution level in Power Systems.
2. To introduce the student to various single phase and three-phase Static VAR Compensation schemes and their controls.
3.To develop analytical modeling skills needed for modeling and analysis of such Static VAR

MPED-122: PWM CONVERTERS AND APPLICATION

Course Objectives:
Students will be able to:
1. Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
2. Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Syllabus
Unit-I:
AC/DC and DC/AC power conversion. Overview of applications of voltage source converters and current source converters.

Unit-II:
Pulse width modulation techniques for bridge converters, Bus clamping PWM. Space vector based PWM. Advanced PWM techniques.

Unit-III:
Practical devices in converter. Calculation of switching and conduction power losses.

Unit-IV:
Compensation for dead time and DC voltage regulation. Dynamic model of PWM converter. Multilevel converters. Constant V/F induction motor drives.

Unit-V:
Estimation of current ripple and torque ripple in inverter fed drives. Line-side converters with power factor compensation.

Unit-VI:
Active power filtering. Reactive power compensation. Harmonic current compensation. Selective harmonic elimination PWM technique for high power electric drives.

Suggested reading:
1. Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons.
2. Erickson RW, "Fundamentals of Power Electronics", Chapman and Hall.
3. Vithyathil. J, "Power Electronics: Principles and Applications", McGraw Hill.
Course Outcomes:
Students will be able to:
1. Knowledge concepts and basic operation of PWM converters, including basic circuit operation and design.
2. Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.
3. Able to recognize and use the following concepts and ideas: Steady-State and transient modeling and analysis of power converters with various PWM techniques.

MPED-123: POWER SEMICONDUCTOR DEVICES AND MODELING

Course Objectives:

Students will be able to:

1. Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.

2. Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Syllabus

Unit-I:

Energy auditing: Types and objectives. Audit instruments- ECO assessment and Economic methods specific energy analysis. Minimum energy paths-consumption models-Case study.

Unit-II:

Electric Motors-Energy efficient controls and starting Efficiency. Motor Efficiency and Load Analysis. Energy efficient /high efficient Motors-Case study. Load Matching and selection of motors. Variable speed drives. Pumps and Fans-Efficient Control strategies. Optimal selection and sizing. Optimal operation and Storage: Case study.

Unit-III:

Transformer Loading/Efficiency analysis. Feeder/cable loss evaluation: Case study. Reactive Power Management. Capacitor Sizing-Degree of compensation. Capacitor losses-Location-Placement Maintenance, Case study.

Unit-IV:

Peak Demand controls- Methodologies.Types of Industrial loads-Optimal Load. Scheduling-case study. Lighting- Energy efficient light sources. Energy conservation in Lighting Schemes. Electronic ballast-Power quality issues. Uminaries: case study.

Unit-V:

Cogeneration-types and Schemes. Optimal operation of cogeneration plants-case study. Electric loads of Air conditioning & Refrigeration. Energy conservation measures. Cool storage. Types-optimal operation case study.

Unit-VI:

Electric water heating, Gysers, Solar Water Heaters. Power Consumption in Compressors. Energy conservation measures. Electrolytic Process. Computer Controls. Software-EMS.

Suggested reading:

1. Giovanni Petrecca,. "Industrial Energy Management: Principles and Applications", TheKluwer international series -207, 1999.
2. Anthony J. Pansini, Kenneth D. Smalling,. "Guide to Electric Load Management", Pennwell Pub;1998.
3. Handbook on Energy Audit and Environment Management , Y P Abbi and Shashank Jain, TERI, 2006.
4. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.

Course Outcomes:

Students will be able to:

1. Acquire the background required for engineers to meet the role of energy managers and to acquire the skills and techniques required to implement energy management.
2. Identify and quantify the energy intensive business activities in an organization.
3. Knowledge about standard methodologies for measuring energy in the workplace and energy audit instruments.
4. Knowledge about energy efficient motors, load matching and selection of motors.
5. Acquire knowledge about reactive power management, capacitor sizing and degree of compensation.

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.

MPED-152: ELECTRICAL MACHINES LABORATORY

List of experiments:

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.
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 circle diagram. Determination of performance parameters at different load conditions from 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.

METC-101: Research Methodology and IPR

Course Outcomes:
At the end of this course, students will be able to:
1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. 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.
6. 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-I:

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-II:

Effective literature studies approaches, analysis Plagiarism, Research ethics.

Unit-III:

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-IV:

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-V:

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

Unit-VI:

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:
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
4. Mayall , "Industrial Design", McGraw Hill, 1992.

5. Niebel , "Product Design", McGraw Hill, 1974.
6. Asimov , "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

SEMESTER-II

MPED-201: POWER ELECTRONIC CONVERTERS

Course Objectives: Students will be able to:
1. Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
2. Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Syllabus:
Unit I:
Analysis of power semiconductor switched circuits with R, L, RL, RC loads**,** D.C. motor load. Battery charging circuit.

Unit II: Single-Phase and Three-Phase AC to DC converters. Half controlled configurations-operating domains of three phase full converters and semi-converters. Reactive power considerations.

Unit III: Analysis and design of DC to DC converters. Control of DC-DC converters: Buck converters, Boost converters, Buck-Boost converters, Cuk converters.

Unit IV:
Single phase and three phase inverters. Voltage source and Current source inverters.Voltage control and harmonic minimization in inverters.

Unit V:
AC to AC power conversion using voltage regulators. Choppers and cyclo-converters. Consideration of harmonics, introduction to Matrix converters.

Unit VI:
Design aspects of converters, few practical applications.

Suggested reading

1. Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and design", John's Wiley and sons. Inc, Newyork.
2. M.H.Rashid, "Power Electronics", Prentice Hall of India 1994.

Course Outcomes:
Students will be able to:
1. To give a systematic approach for transient and steady state analysis of all power electronic converters with passive and active loads.
2. To know and carry out transient and steady state analysis of different power converters of different types of loads and switching sequences.

MPED-202: DIGITAL CONTROL OF POWER ELECTRONICS AND DRIVE SYSTEMS

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:

Unit I:
Review of numerical methods. 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.

Unit II:
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.

Unit III:
State space modelling and simulation of linear systems. Introduction to electrical machine modelling: induction, DC, and synchronous machines, simulation of basic electric drives, stability aspects.

Unit IV:
Simulation of single phase and three phase uncontrolled and controlled (SCR) rectifiers. Converters with self-commutated devices- simulation of power factor correction schemes.

Unit V:
Simulation of converter fed DC motor drives. Simulation of thyristor choppers with voltage. Current and load commutation schemes. Simulation of chopper fed DC motor.

Unit VI:
Simulation of single and three phase inverters with thyristors and selfcommutated devices. Space vector representation. Pulse-width modulation methods for voltage control. Waveform control. Simulation of inverter fed induction motor drives.

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 and systems.
2. The candidate will be able to simulate power electronic systems and analyse the system response.

PROFESSIONAL ELECTIVE COURSE-3 (PEC-3)

MPED-211: SWITCHED MODE AND RESONANT CONVERTERS

Course Objectives:
Students will be able to:

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

Syllabus:
Unit I:
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 and Solutions.

Unit II:
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 and Losses, Power Limits, Voltage Mode Control.

Unit III:
Classification of Resonant Converters. Basic Resonant Circuit Concepts. Load Resonant Converter, Resonant Switch Converter, Zero.Voltage Switching Clamped Voltage Topologies. 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.

Unit IV:
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.

Unit V:
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.)

Unit VI:
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 Resonant Converters.

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 Sons 2006.
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 such converters.

MPED-212: INDUSTRIAL LOAD MODELING AND CONTROL

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:
Unit I:
Electric Energy Scenario-Demand Side Management-Industrial Load Management. Load Curves-Load Shaping Objectives-Methodologies. Barriers; Classification of Industrial Loads Continuous and Batch processes -Load Modeling.

Unit II:
Electricity pricing – Dynamic and spot pricing –Models. Direct load control- Interruptible load control. Bottom up approach- scheduling- Formulation of loadmodels- Optimization and control algorithms - Case studies.

Unit III:
Reactive power management in industries-controls-power quality impacts application of filters Energy saving in industries.

Unit IV:
Cooling and heating loads- load profiling- Modeling. Cool storage-Types- Control strategies. Optimal operation-Problem formulation- Case studies.

Unit V:
Captive power units- Operating and control strategies- Power Pooling- Operation models. Energy banking-Industrial Cogeneration

Unit VI:
Selection of Schemes Optimal Operating Strategies. Peak load saving-Constraints-Problem formulation- Case study. Integrated Load management for Industries.

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, April 1981.
4. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Inter-science 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 planning in 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.

MPED-213: ADVANCED DIGITAL SIGNAL PROCESSING

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:
Unit I:
Discrete time signals, Linear shift invariant 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.

Unit II:
Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bilinear transformation method.

Unit III:
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 quantization effects in IIR and FIR filters.

Unit IV:
A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zeroInput limit cycles in IIR filters, Linear Signal Models.

Unit V:
All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals. Estimation of power spectrum of stationary random signals.

Unit VI:
Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters.

Suggested reading:
1. Sanjit K Mitra, "Digital Signal Processing: A computer-based approach ",TataMc Grow-Hill Edition 1998
2. Dimitris G .Manolakis, Vinay K. Ingle and Stephen M. Kogon, "Statistical and Adaptive Signal Processing", Mc Grow Hill international editions .-2000

Course Outcomes:
Students will be able to:
1. Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems
2. Study the design techniques for IIR and FIR filters and their realization structures.
3. Acquire knowledge about the finite word length effects in implementation of digital filters.
4. Knowledge about the various linear signal models and estimation of power spectrum of stationary random signals.
5. Design of optimum FIR and IIR filters

<center>**PROFESSIONAL ELECTIVE COURSE-4 (PEC-4)**</center>

<center>**MPED-221: ADVANCED MICRO-CONTROLLER BASED SYSTEMS**</center>

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:

Unit I:
Basic Computer Organization. Accumulator based processes-Architecture-Memory. Organization-I/O Organization.

Unit II:
Micro-Controllers-Intel 8051, Intel 8056- Registers, Memories. I/O Ports, Serial Communication. Timers, Interrupts, Programming.

Unit III:
Intel 8051 – Assembly language programming-Addressing-Operations- Stack & Subroutines,Interrupts-DMA.

Unit IV:
PIC 16F877- Architecture Programming. Interfacing Memory/ I/O Devices, Serial I/O and data communication.

Unit V:
Digital Signal Processor (DSP) - Architecture – Programming, Introduction to FPGA.

Unit VI:
Microcontroller development for motor control applications. Stepper motor control using micro controller.

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.

MPED-222: DISTRIBUTED GENERATION

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:
Unit I:
Need for Distributed generation. Renewable sources in distributed generation and current scenario in Distributed Generation.

Unit II:

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.

Unit III:
Technical impacts of DGs.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.

Unit IV:
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.

Unit V:
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.

Unit VI:
Transients in micro-grids, Protection of micro-grids, Case studies, Advanced topics.

Suggested reading:
1. H. Lee Willis, Walter G. Scott, "Distributed Power Generation – Planning and Evaluation", Marcel Decker Press.
2. M.GodoySimoes, 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

MPED- 223: SMART GRIDS

Course Objectives:
Students will be able to:
1. Understand concept of smart grid and its advantages over conventional grid.
2. Know smart metering techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Syllabus:
Unit I:
Introduction to Smart Grid, Evolution of Electric Grid. Concept of Smart Grid, Definitions, Need of Smart Grid. Concept of Robust &Self-Healing Grid, Present development & International policies in Smart Grid.

Unit II:
Introduction to Smart Meters, Real Time Prizing, Smart Appliances. Automatic Meter Reading (AMR). Outage Management System (OMS). Plug in Hybrid Electric Vehicles(PHEV). Vehicle to Grid, Smart Sensors. Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation.

Unit III:

Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro. Compressed Air Energy Storage. Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

Unit IV:
Concept of micro-grid, need & applications of micro-grid. Formation of micro-grid, Issues of interconnection. Protection & control of micro-grid. Plastic & Organic solar cells, Thin film solar cells. Variable speed wind generators, fuel-cells, micro-turbines. Captive power plants, Integration of renewable energy sources.

Unit V:
Power Quality & EMC in Smart Grid. Power Quality issues of Grid connected Renewable Energy Sources. Power Quality Conditioners for Smart Grid. Web based Power Quality monitoring, Power Quality Audit.

Unit VI:
Advanced Metering Infrastructure (AMI), Home Area Network (HAN). Neighbourhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication. Wireless Mesh Network.Basics of CLOUD Computing &Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

Suggested reading
1. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE,2011.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2009.

Suggested reading:
1. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 2011.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2009.
3. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications", Wiley 2012.
4. Stuart Borlas'e, "Smart Grid:Infrastructure, Technology and solutions "CRC Press.
5. A.G.Phadke , "Synchronized Phasor Measurement and their Applications",Springer.
Course Outcomes:
Students will be able to:
1. Appreciate the difference between smart grid & conventional grid.
2. Apply smart metering concepts to industrial and commercial installations.
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
4. Come up with smart grid solutions using modern communication technologies.

MPED-252: POWER ELECTRONICS LABORATORY

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cyclo-converter.
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor.
9. To study operation of IGBT/MOSFET chopper circuit.
10. To study MOSFET/IGBT based single-phase series-resonant inverter.
11. To study MOSFET/IGBT based single-phase bridge inverter.

MPED-253: MICROCONTROLLER LAB

EXPERIMENTS ON ASSEMBLY PROGRAMMING
1. Write a program to multiplication and division using MUL and DIV instructions.
2. Write a program to transfer a block of data from internal memory to external memory.
3. Write a program to exchange two set of eight-byte data.
4. Write a program to find the sum of two numbers in decimal.
5. Write a program to convert decimal number to hexadecimal.
6. Write a program to add a number n, m number of times.
7. Write program to find the largest from a set of n numbers.
8. Write program for sorting the given set of numbers.

EXPERIMENTS ON 8051 INTERFACING
1. Write an assembly language program for generating a triangular wave.
2. Write a program to find the largest from a set of ten numbers and display it using LEDs.
3. Write a program to for displaying the decimal numbers in 7 Segment display.
4. Write a program to read the DIP switches for displaying the reading using 7 Segment display.
5. Write a program to rotate the given motor in clockwise direction.
6. Write a program to rotate the given motor in anticlockwise direction.
7. Write a program to generate a square wave.
8. Write a program to display a message in LCD display.

PROFESSIONAL ELECTIVE COURSE-5 (PEC-5)

MPED-311: SCADA SYSTEM AND APPLICATIONS

Course Objectives:
Students will be able to:
1. To understand what is meant by SCADA and its functions.
2. To know SCADA communication.
3. To get an insight into its application.

Syllabus:
Unit I:
Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies.

Unit II:
Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA.

Unit III:
Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems.

Unit IV:
SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –IEC 61850.

Unit V:

SCADA Communication: various industrial communication technologies-wired and wireless methods and fiber optics. Open standard communication protocols.

Unit VI:

SCADA Applications: Utility applications- Transmission and Distribution sector operations, monitoring, analysis and improvement. Industries - oil, gas**.** Case studies, Implementation, Simulation Exercises.

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 RelatedSystems", 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",PennWell 1999.

Course Outcomes:

1. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their Typical applications**.**
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of Each system.
3. Knowledge about single unified standard architecture IEC 61850.
4. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
5. Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

MPED-312: FACTS AND CUSTOM POWER DEVICES

Course Objectives:

At the end of this course, 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

Detailed Syllabus:

Unit I:

Reactive power flow control in Power Systems – Control of dynamic power unbalances in Power System. Power flow control -Constraints of maximum transmission line loading –Benefits of FACTS Transmission line compensation. Uncompensated line –Shunt compensation - Series compensation – Phase angle control. Reactive power compensation. Shunt and Series compensation principles – Reactive compensation at transmission and distribution level.

Unit II:

Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control. Comparison between SVC and STATCOM.

Unit III:

Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators –TCVR and TCPAR Operation and Control –Applications, Static series compensation – GCSC,TSSC, TCSC and Static synchronous. series compensators and their Control.

Unit IV:

SSR and its damping Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPF. Basic Principle of P and Q control- Independent real and reactive power flow control-Applications.

Unit V:
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, active filtering – shunt , series and hybrid and their control.
Voltage swells, sags, flicker, unbalance and mitigation of these problems by power line conditioners-IEEE standards on power quality.

Suggested Reading:
1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007**.**
2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control",Springer Verlag, 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 Power Systems.
2. Learn various Static VAR Compensation Schemes like Thyristor/GTO Controlled.
3. Reactive Power Systems, PWM Inverter based Reactive Power Systems and their controls.
4. To develop analytical modeling skills needed for modeling and analysis of such Static VAR Systems.

MPED-313: HVDC

Course Objectives:
Students will be able to:
1. Understand state of the art HVDC technology.
2. Learn the Methods to carry out modeling and analysis of HVDC system frontier-area power flow regulation.

Syllabus:
Unit I:
Development of HVDC Technology, DC versus AC Transmission, Selection of converter configuration.

Unit II:
Rectifier and Inverter operation, Digital Simulation of converters, Control of HVDC converters and Systems.

Unit III:
 Individual phase control, Equidistant firing controls, Higher level controls. Characteristics and non-characteristics harmonics filter design. Fault development and protection.

Unit IV:

Interaction between AC-DC power systems. Over voltages on AC/DC side, multi-terminal HVDC systems, control of MTDC systems.

Unit V:
Modelling of HVDC systems, per unit system, Representation for power flow solution, representation for stability studies.

Unit VI:
Introduction to relevant national and international standards, safe clearances for HV, Study regulations for HV tests, Digital techniques in HV measurements.

Suggested reading:
1. J. Arrillaga, "High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1990.
3. E. W. Kimbark, "Direct Current Transmission", Vol. I, Wiley Interscience, 1971.
4. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2004.

Course Outcomes:
Students will be able to:
1. To expose the students to the state of the art HVDC technology.
2. Knowledge of modelling and analysis of HVDC system for inter-area power flow regulation.
3. Study of Neetishatakam will help in developing.

OPEN ELECTIVE CURSE (OEC)

MPED-001: Business Analytics

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

Syllabus:
Unit1:
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

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.

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.

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.

Unit 5:

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6:

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

COURSE OUTCOMES:
1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.
Reference:
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

MPED-002: Industrial Safety

Syllabus:
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 and methods.

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 combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

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 and importance

Reference:
1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MPED-003: Operations Research

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 continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

Syllabus:
Unit-I:
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

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

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

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

Unit-V:
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 India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MPED-004: Cost Management of Engineering Projects

Syllabus:

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:
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MPED-005: Composite Materials

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 isostatic pressing. 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 Composite Materials-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.

MPED-006: Waste to Energy

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 and applications.

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.

MANDATORY COURSES (MC)

AUDIT I and II:

METC-111/METC-211: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Syllabus:
Unit I:
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II:
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit III:
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit IV:
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.

Unit V:
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.

Unit VI:
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

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

METC-112/METC-212: 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 conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Syllabus:

Unit I:

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit II:

Repercussions of Disasters and Hazards :Economic Damage, Loss Of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit III:

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.

Unit IV:

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.

Unit V:

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.

Unit V:

Disaster Mitigation: Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

Suggested reading:

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

METC-113/METC-213: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
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 I: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit II: Order, Introduction of roots, Technical information about Sanskrit Literature.

Unit III: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Suggested reading:
1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.
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

METC-114/METC-214: VALUE EDUCATION

Course Objectives:
Students will be able to:
1**.** Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus:
Unit I:
Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation, Standards and principles, Value judgments.

Unit II:
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.

Unit III:
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. 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.
Unit IV:
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.

Suggested reading:
1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.
Course outcomes:
Students will be able to:

1. Knowledge of self-development.
2. Learn the importance of Human values.
3. Developing the overall personality.

METC-115/ETC-215: 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. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus:

Unit I:
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

Unit II:
Philosophy of the Indian Constitution: Preamble Salient Features.

Unit III:
Contours of Constitutional Rights & Duties: Fundamental Rights: 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.

Unit IV:
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.

Unit V:
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.

Unit VI:
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.

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 of 1956.

METC-116/METC-216: 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:
Unit I:
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.

Unit II:
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit III:
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.

Unit IV:
Professional development: alignment with classroom practices and followup Support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Unit V:
Research gaps and future directions: Research design, Contexts, Pedagogy Teacher education, Curriculum and assessment, Dissemination and research impact.

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. Akyeampong K, Lussier K, 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?

METC-117/METC-217: STRESS MANAGEMENT BY YOGA

Course Objectives
1. To achieve overall health of body and mind.
2. To overcome stress.

Syllabus:
Unit I: Definitions of Eight parts of yog. (Ashtanga)

Unit II: Yam and Niyam.
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit III: Asan and Pranayam
i) Various yog poses and their benefits for mind & body.
ii)Regularization of breathing techniques and its effects-Types of pranayam.

Suggested reading:
1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama. (Publication Department), Kolkata.

Course Outcomes:
Students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve efficiency.

METC-118/METC-218: 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 I:
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)

Unit II:

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.

Unit III:

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. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

- Chapter 4-Verses 18, 38,39

- Chapter18 – Verses 37,38,63

Suggested reading:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

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 in life.

2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity.

3. Study of Neetishatakam will help in developing versatile personality of students.