

## Draft Academic Regulations - M.Tech. 2017-18 (Important Points)



### **JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR Draft Academic Regulations for The Award Of Full Time M.Tech. P.G. Degree (WITH EFFECT FROM THE ACADEMIC YEAR 2017-18 ONWARDS)**

The Jawaharlal Nehru Technological University Anantapur shall confer M. Tech. Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

#### **1.0 ELIGIBILITY FOR ADMISSIONS:**

Admission to the above programmes shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each programme, from time to time.

**Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE/PGET score, subject to reservations prescribed by the University or Government policies from time to time.**

#### **2.0 COURSE WORK:**

- 2.1 A Candidate after securing admission must pursue the M.Tech. course of study for Four semesters duration.
- 2.2 Each semester shall be of 20 weeks duration including all examinations.
- 2.3 A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.
- 2.4 The medium of instruction shall be English for all theory and practical courses, examinations, Seminar, Teaching Assignments, Comprehensive Viva-Voce and project thesis/dissertation reports.

#### **3.0 ATTENDANCE:**

- 3.1 A candidate shall be deemed to have eligibility to write end semester examinations if he/she has put in atleast 75% of attendance on cumulative basis of all subjects/courses in the semester.
- 3.2 Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.
- 3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

- 3.4 If the candidate does not satisfy the attendance requirement he/she is detained for want of attendance and shall reregister for that semester. He/she shall not be promoted to the next semester.

#### 4.0. EVALUATION:

The performance of the candidate in each semester program shall be evaluated subject wise, with a maximum of 100 marks for theory and 100 marks for practical examination, on the basis of Internal Evaluation and End Examination.

- 4.1. There shall be five units in each of the theory subjects. For the theory subjects 60% of the marks will be for the End Examination and 40% of the marks will be for Internal Evaluation.
- 4.2. Two Internal Examinations shall be held during the semester for 20 marks. First internal examination shall be conducted for half of the syllabus and second internal examination shall be conducted for remaining half of the syllabus. In each internal exam, a student shall answer all three questions in 2 hours of time without seeking any choice. Final Internal marks for a total of 20 marks shall be arrived at by considering the marks secured by the student in both the internal examinations with 70% weightage to the better internal exam and 30% to the other.
- 4.3. For the remaining 20 marks in internal evaluation, the University shall conduct one online examination.
- 4.4. The following pattern shall be followed in the End Examination.
  - a) Five questions shall be set from each of the five units with either/or type for 12 marks each.
  - b) All the questions have to be answered compulsorily.
  - c) Each question may consist of one, two or more bits.
- 4.5. For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance.
- 4.6. For **Comprehensive Viva-Voce** and **Seminar** there will be an internal evaluation of 100 marks in each. A candidate has to secure a minimum of 50% (in each) to be declared successful. The assessment will be made by a board consisting of HOD and two senior internal experts at the end of **III** semester instruction.
- 4.7. For **Teaching Assignments** there will be an internal evaluation of 100 marks. A candidate has to secure a minimum of 50% to be declared successful. Student has to teach 10 Hours in his/her interesting subject/subjects in the entire **III** Semester instruction period for his juniors at PG level or Under Graduate students who are available on the campus. For each teaching hour maximum of 10 marks are allotted. The assessment will be made by the faculty allotted by the HOD.

- 4.8. Mandatory MOOCs course is introduced in III Semester as an elective without any credits. A student can choose any subject of his/her choice that has more than 30 hours duration from any MOOCs provider and should obtain satisfactory certificate. An Open Elective is introduced in III semester.
- 4.9. A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any of the subjects (as specified above) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.
- 4.10. In case the candidate does not secure the minimum academic requirement in any of the subjects (as specified in 4.9.) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

## **5.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:**

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

- 5.1 The candidate should have completed the course work and obtained examinations results for **I, II and III** semesters.
- 5.2 He should have passed all the subjects for which the Internal Evaluation marks secured are more than 50%.
- 5.3 Out of the subjects the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.
- 5.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.
- 5.5 For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the Registrar, JNTUA payable at Ananthapuramu along with the requisition through the Principal of the respective college.
- 5.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

## 6.0 EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/institute.

- 6.1 **Registration of Project work:** A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semester)
- 6.2 An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor and one internal senior expert shall monitor the progress of the project work.
- 6.3 The **first phase of the project work** on the project shall be initiated in the third semester and **second phase of the project work will be** continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.
- 6.4 The student must submit status report by giving seminar in three different phases (**one in III semester and another two in IV semester**) during the project work period. These seminar reports must be approved by the I.D.C before submission of the Project Report.
- 6.5 A candidate shall be allowed to submit the thesis/dissertation only after obtaining plagiarism report with less than 30% and passing in all the prescribed subjects (both theory and practical), and then take viva-voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.
- 6.6 Three copies of the Thesis/Dissertation certified in the prescribed format by the supervisor & HOD shall be presented to the HOD. One copy is to be forwarded to the University and one copy to be sent to the examiner.
- 6.7 The college shall submit a panel of three experts for a maximum of **five** students at a time. However, the thesis/dissertation will be adjudicated by one examiner nominated by the University.
- 6.8 If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis/dissertation. The board shall jointly report candidates work as:

- |                     |         |
|---------------------|---------|
| 1. Satisfactory     | Grade A |
| 2. Not satisfactory | Grade B |

If the report of the viva-voce is not satisfactory (Grade B) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for

the award of the degree unless the candidate is permitted to revise and resubmit the thesis.

## 7.0 GRADING

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Letter Grade	Marks Range	Grade Point
S	91-100	10
A	81-90	9
B	70-80	8
C	60-69	7
D	55-59	6
E	50-54	5
F	<50	0
Absent	Ab (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

### **Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):**

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \frac{\sum_{i=1}^n (C_i \times G_i)}{\sum_{i=1}^n C_i}$$

Where,  $C_i$  is the number of credits of the  $i^{\text{th}}$  subject,  $G_i$  is the grade point scored by the student in the  $i^{\text{th}}$  course and  $n$  is the no. of subjects.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \frac{\sum_{i=1}^n (C_i \times S_i)}{\sum_{i=1}^n C_i}$$

Where 'S<sub>i</sub>' is the SGPA of the  $i^{\text{th}}$  semester,  $C_i$  is the total number of credits in that semester and  $n$  is the no. of semesters.

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

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

**Grade Point:** It is a numerical weight allotted to each letter grade on a 10-point scale.

**Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters as mentioned in the above table.

## 8.0 AWARD OF DEGREE AND CLASS:

A candidate shall be eligible for the award of respective degree if he/she satisfies the minimum academic requirements in every subject and secures 'satisfactory' or higher grade report on his/her thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

<b>Class Awarded</b>	<b>CGPA Secured</b>
First class with Distinction	$\geq 8$
First class	$\geq 7$ and $< 8$
Second class	$\geq 5$ and $< 7$

## 9.0 WITH – HOLDING OF RESULTS:

If the candidate has not paid dues to the university or if any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

## 10.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 4.10 and 2.3 sections. Whereas they continue to be in the academic regulations they were first admitted.

## 11.0 GENERAL:

- i. **The academic regulations should be read as a whole for purpose of any interpretation.**
- ii. **Disciplinary action for Malpractice/improper conduct in examinations is appended.**
- iii. **There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.**
- iv. **Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".**

- v. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- vi. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

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### **RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS**

	<b>Nature of Malpractices/Improper conduct</b>	<b>Punishment</b>
	<i>If the candidate</i>	
1.	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(a)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
(b)	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be
2.		

		cancelled and sent to the University.
3.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
6.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.
8.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

### **Malpractices identified by squad or special invigilators**

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
  - (i) A show cause notice shall be issued to the college.
  - (ii) Impose a suitable fine on the college.
  - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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**Note: Draft M.Tech Regulations will be followed for M.Pharm also**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR  
ANANTHAPURAMU (A.P.)**

**COURSE STRUCTURE AND SYLLABUS**

(For Affiliated Engineering Colleges w.e.f. 2017-18 Admitted Batch)

**M.TECH - POWER ELECTRONICS, POWER & INDUSTRIAL DRIVES, POWER ELECTRONICS & ELECTRICAL DRIVES and POWER ELECTRONICS AND DRIVES**

**M.Tech I Semester**

S.No	Subject Code	Subject	L	T	P	C
1.	17D54101	Advanced Power Semiconductor Devices	4	-	-	4
2.	17D49102	Machine Modeling and Analysis	4	-	-	4
3.	17D54102	Solid-State DC Drives	4	-	-	4
4.	17D54103	Applications of Power Electronics to Power Systems	4	-		4
5.	17D49105 17D49103 17D54104	<b>Elective-I</b> 1. Modern Control Engineering & Principles of Optimal Control 2. Optimization & Heuristic search Techniques 3. Advanced Digital Signal Processing	4	-	-	4
6.	17D54105 17D54106 17D54107	<b>Elective-II</b> 1. FPGA based Digital System Design 2. Solid-state Lighting and Control 3. Hybrid Electric Vehicle Systems	4	-	-	4
7.	17D54108	Power Electronics and Simulation Lab	-	-	4	2
<b>TOTAL</b>			<b>24</b>	<b>-</b>	<b>04</b>	<b>26</b>

**M.Tech II Semester**

S.No	Subject Code	Subject	L	T	P	C
1.	17D54201	Advanced Power Converters	4	-	-	4
2.	17D49202	Power Quality	4	-	-	4
3.	17D54202	Advanced Drives & Control	4	-	-	4
4.	17D54203	Renewable Energy Conversion Systems	4	-		4
5.	17D49205 17D54204 17D49207	<b>Elective-III</b> 1. Reactive Power Compensation and Management 2. Adaptive Control 3. HVDC & EHVAC Transmission Systems	4	-	-	4
6.	17D49208 17D54205 17D49210	<b>Elective-IV</b> 1. Distributed Generation & Micro Grid Control 2. Energy Efficient Electrical Systems 3. Intelligent Control Techniques	4	-	-	4
7.	17D54206	Electrical Drives and Simulation Lab	-	-	4	2
<b>TOTAL</b>			<b>22</b>	<b>-</b>	<b>04</b>	<b>26</b>

**M.Tech III Semester**

<b>S.No</b>	<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	17D20301 17D20302 17D20303	<b>Elective – V</b> 1. Research Methodology 2. Human Values and Professional Ethics 3. Intellectual Property Rights	4	-	-	4
2.	17D54301	<b>Elective - VI (MOOCS)</b>	-	-	-	-
3.	17D54302	Comprehensive Viva-Voce	-	-	-	2
4.	17D54303	Seminar	-	-	-	2
5.	17D54304	Teaching Assignment	-	-	-	2
6.	17D54305	Project Work Part – I	-	-	-	4
<b>TOTAL</b>			<b>04</b>	<b>-</b>	<b>-</b>	<b>14</b>

**M.Tech IV Semester**

<b>S.No</b>	<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	17D54401	. Project Work Part - II	-	-	-	12

**Project Viva Voce Grades:****A: Satisfactory****B: Not Satisfactory**

**(17D54101) ADVANCED POWER SEMICONDUCTOR DEVICES**

**COURSE OBJECTIVES:**

The student will be able:

- To understand the static and dynamic characteristics of current controlled power semiconductor devices.
- To understand the static and dynamic characteristics of voltage controlled power semiconductor devices.
- To enable the students for the selection of devices for different power electronics applications.
- To understand the control and firing circuit for different devices.

**SYLLABUS:**

**UNIT-I: Introduction:** Power switching devices, overview – Attributes of an ideal switch, application requirements, Device selection strategy – On-state and switching losses – Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

**UNIT-II: Current Controlled Devices:** BJT's – Construction, static characteristics, switching characteristics; Negative temperature co-efficient and secondary breakdown; Power darlington – Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy – concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation.

**UNIT-III: Voltage Controlled Devices:** Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady-state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT(Mos Controlled Thyristor ), FCT(Field Controlled Thyristor), RCT(Reverse Conducting Thyristor) .

**UNIT-IV: Firing and Protecting Circuits:** Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

**UNIT-V: Thermal Protection:**Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for heat sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design.

**Text books:**

1. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi.
2. B.W. Williams 'Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.

**Reference books:**

1. Advanced power electronics converters by Euzeli dos santos, Edison R. da silva.
2. Fundamentals of Power Semiconductor Devices by B. Jayanth Baliga, Springer Press, 2008.

## **COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Understand the static and dynamic characteristics of current controlled power semiconductor devices.
- Understand the static and dynamic characteristics of voltage controlled power semiconductor devices.
- Select the devices for different power electronics applications.
- Understand the control and firing circuit for different devices.

**(17D49102) MACHINE MODELING AND ANALYSIS**

**COURSE OBJECTIVES:**

The student will be able:

- To Identifying the methods and assumptions in modeling of machines.
- To recognize the different frames for modeling of AC machines.
- To write voltage and torque equations in state space form for different machines.

**SYLLABUS:**

**Unit I: Modeling and Analysis of DC Machine**

Magnetically coupled circuits, Machine windings and air-gap MMF, winding inductances and voltage equations - Separately excited dc generators, Separately excited dc motors, inter connection of machines, transfer functions of dc machines, dc series motor, dc shunt machines, dc compound machines, linearization techniques for small perturbations, cross field machines, transfer functions of cross field machines, Electric braking of dc motors.

**Unit-II: Reference Frame Theory:** Introduction to transformations, equations of transformations, change of variables, transformation to an arbitrary reference frame, commonly used reference frames, transformation between reference frames, Steady-state phasor relationships and voltage equations.

**Unit III: Modeling of Three Phase Induction Machines:** Voltage and torque equations in machine variables, Voltage and torque equations in arbitrary reference frame, Steady-state analysis and its operation. Free acceleration characteristics viewed from various reference frames, dynamic performance during sudden changes in load torque, dynamic performance during a three-phase fault at the machine terminals.

**Unit IV: Modeling of Synchronous Machine:** Voltage and torque equations in machine variables, Voltage equations in arbitrary and rotor reference frame, torque equations in in substitute variable, Steady-state analysis and its operation - Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria.

**Unit V: Modeling of Brushless DC Machines:** Voltage and torque equations in machine variables, Voltage and torque equations in rotor reference frame variables, Analysis of steady state operation, dynamic performance.

**References:**

1. **Analysis of Electric Machinery and Drive Systems**, Paul C.Krause , Oleg wasynezuk, Scott D.Sudhoff, 3<sup>rd</sup> Edition, WILEY-IEEE Press, 2013.
2. **Electrical Motor Drives: Modelling, Analysis and Control** by R. Krishnan, Prentice-Hall, 2001.
3. **Thyristor control of Electric Drives** by Vedam Subramanyam, TMH, 18<sup>th</sup> Re-print, 2008.

**COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Develop the mathematical models of various machines like, induction motor and Synchronous machines using modeling equations.
- Analyze the developed models in various reference frames.

**(17D54102) SOLID STATE DC DRIVES**

**COURSE OBJECTIVES:**

The student will be able:

- To understand steady state operation and transient dynamics of a motor load system
- To study and analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.
- To understand the implementation of control algorithms using microcontrollers and phase locked loop.

**UNIT-I: DC MOTORS AND DRIVE SYSTEMS:** DC motor- Types, induced emf, speed-torque relations; Speed control – Armature and field speed control; Ward Leonard control – Constant torque and constant horse power operation - Introduction to high speed drives and modern drives.

Characteristics of mechanical system – dynamic equations, components of torque, types of load; Requirements of drives characteristics – multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.

**UNIT-II: CONVERTER FED DC MOTORS CONTROL:** Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms, performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

**UNIT-III : CHOPPER FED DC MOTORS AND THEIR CONTROL:** Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control – Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

**UNIT-IV: CLOSED LOOP CONTROL OF DC DRIVES:** Modeling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feeds back elements - Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed d.c drive.

**UNIT-V: DIGITAL CONTROL OF D.C DRIVE:** Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing.

**TEXT BOOKS**

1. Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Yersey, 1989.
2. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

**REFERENCES**

- 1.Gopal K.Dubey, “Fundamentals of Electrical Drives”, Narosal Publishing House, New Delhi, 2001.
- 2.Bimal K.Bose “Modern Power Electronics and AC Drives”, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
- 3.Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw-Hill publishing company Ltd., New Delhi, 2002.
- 4.P.C Sen “Thyristor DC Drives”, John Wiley and sons, New York, 1981

## 5. Power Electronics By M. D. Singh

### **COURSE OUTCOMES:**

After completion of the course, the student will be able to:

- Understand steady state operation and transient dynamics of a motor load system
- Analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.
- Understand the implementation of control algorithms using microcontrollers and phase locked loop.

**COURSE OBJECTIVES:**

Student will be able:

- To develop the understanding of uncompensated lines and their behavior under heavy loading conditions.
- To understand the concept and importance controllable parameters of FACTS controllers.
- To emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.

**SYLLABUS:**

**UNIT I: General System considerations and FACTS:** Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, principles of series and shunt compensation, Basic Types of FACTS Controllers, Benefits from FACTS, Application of FACTS.

**UNIT II: Shunt Compensators:** Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static Var Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability, Enhancement and Power Oscillation Damping

**UNIT III: Series Compensators:** Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor controlled series capacitor, Thyristor controlled series capacitor, SSSC.

**UNIT IV: Combined Compensators:** Introduction, Unified power flow controller, basic operating principles, independent real and reactive power flow control, and control structure, basic control system for P and Q control.

**UNIT V: Mitigation of Harmonics:** Power quality problems, harmonics, harmonic creating loads, harmonic power flow, and mitigation of harmonics, filters, passive filters, active filters, shunt, series and hybrid filters.

**Text books:**

1. Narain G. Hingorani, Laszlo Gyugyi, Understanding FACTS, IEEE press
2. Roger. C. Dugan, Mark. F. McGranaghan, Surya Santoso, H.Wayne Beaty, Electrical Power Systems Quality, McGraw Hill,2003

**Suggested Reading:**

1. Y.H.Song, A.T.Johns, Flexible A.C.Transmission System, IEE, London, 1999

## **COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Choose proper controller for the specific application based on system requirements
- Understand various systems thoroughly and their requirements
- Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**M.Tech I year I Semester (PE, PID, PEED and PED)** **L    T    P    C**  
**(17D49105) MODERN CONTROL ENGINEERING & PRINCIPLES OF OPTIMAL** **4    0    0    4**  
**CONTROL (Elective – I)**

**COURSE OBJECTIVES:**

The student will be able to:

- Learn about concepts of controllability, observability and Pole placement design
- Understand concepts of full order and reduced order observer designs
- Learn about model decomposition and robust control
- Understand optimal control problem and various functional
- Learn about state regulator and Riccati equation

**Unit I**

Review of State-space representation, Controllability - Pole assignment using State feedback – Ackerman’s formula for feedback gain determination; Observability. Duality. Effect of state feedback on controllability and observability. Controllable subspace – decomposition of states into controllable and uncontrollable components.

**Unit II**

Design of full-order observer – Bass Gura algorithm. The separation principle - Combined observer – controller compensator. Design of reduced order observer. Unobservable subspace – decomposition of states into observable and unobservable components – Canonical decomposition theorem.

**Unit III**

Reducibility – realization of transfer function matrices. Model decomposition and decoupling by state feedback. Design of robust control system for asymptotic tracking and disturbance rejection using State variable equations. Transfer function interpretations – transfer function form of observer and state estimate feedback. State-space interpretation of internal model principle.

**Unit IV**

Introduction to optimal control, Calculus of variations: Fundamental concepts, functionals of single function, functional involving several independent functions, fixed end point problem, necessary and sufficient conditions for optimal control.

**Unit V**

Discrete-time linear state regulator – Algorithm for the solution, Use of observer in implementing the control law. Continuous-time linear state regulator – Matrix Riccati equation. Time invariant linear state regulator – the reduced matrix Riccati equation - An iterative method to solve the reduced matrix Riccati equation. Suboptimal linear regulator.

**Text Books:**

1. Modern Control Engineering, Katsuhiko Ogata, 5<sup>th</sup> Edition, Prentice Hall India, 1997
2. Modern Control System Theory, M. Gopal, Revised 2<sup>nd</sup> Edition, New Age International Publishers, 2005.
3. D.S. Naidu, Optimal control systems, CRC Press, First edition, 2002.

**References:**

1. Linear Systems, Thomas Kailath, Perntice Hall, 1980.
2. Control System Design, Graham C. Goodwin, StefanF. Graebe and Mario E. Salgado, Pearson Education, 2000.
3. Linear System Theory and Design, Chi-Tsong Chen, OXFORD University Press.
4. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 11<sup>th</sup> Edition, Pearson Edu India, 2009.
5. Donald E.Kirk, Optimal Control Theory an Introduction, Prentice - Hall Network series - First edition, 1970.

**COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Learn about concepts of controllability, observability and Pole placement design
- Understand concepts of full order and reduced order observer designs
- Learn about model decomposition and robust control
- Understand optimal control problem and various functional
- Learn about state regulator and Riccati equation

**COURSE OBJECTIVES:**

The student will be able to:

- Learn about optimization problem and basic optimization issues
- Understand the concept of linear programming
- Learn about transportation problem and solution
- Understand unconstrained optimization techniques
- Acquire knowledge about various heuristic optimization techniques

**UNIT – I : INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES:**

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

**UNIT – II : LINEAR PROGRAMMING**

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

**UNIT – III : TRANSPORTATION PROBLEM**

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems. One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method. Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**UNIT – IV: UNCONSTRAINED OPTIMIZATION TECHNIQUES**

Univariate method, Random Search methods, Grid Search method, Pattern Directions, Powell’s method, Simplex method, Gradient of a function, Steepest Descent (Cauchy) method, Conjugate Gradient (Fletcher-Reeves) method, Newton’s method.

**UNIT – V: HEURISTIC OPTIMIZATION TECHNIQUES**

Meta heuristic search methods: Genetic Algorithm based optimization, Simulated Annealing Techniques, Swarm Intelligent Algorithms, PSO, etc.

**TEXT BOOKS:**

1. “Modern Heuristic Optimization Techniques” by Kwang Y. Lee, Mohamed A. El-Sharkawi
2. “Engineering optimization: Theory and practice”-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
3. “Introductory Operations Research” by H.S. Kasene & K.D. Kumar, Springer(India), Pvt.LTd.

**REFERENCES:**

1. “Optimization Methods in Operations Research and systems Analysis” – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3 rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma.
3. “Operations Research: An Introduction” by H.A. Taha, PHI Pvt. Ltd., 6th edition
4. Linear Programming by G. Hadley

**COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Learn about optimization problem and basic optimization issues
- Understand the concept of linear programming
- Learn about transportation problem and solution
- Understand unconstrained optimization techniques
- Acquire knowledge about various heuristic optimization techniques

**(17D54104) ADVANCED DIGITAL SIGNAL PROCESSING**  
**(Elective – I)**

**COURSE OBJECTIVES:**

The student will be able to:

- Understand the basic concepts of digital signals and systems
- Learn about transformation techniques and Filter realizations
- Learn about design concepts of IIR and FIR filters
- Understand the concept of quantization and error analysis
- Learn about poly phase decomposition and various applications

**UNIT-I:**

Introduction, Analog-to-digital and Digital-to-Analog conversion, sampled and hold circuit, Continuous-time Fourier Transforms. Discrete-time signals and systems, Discrete-time Fourier transform- its properties and applications, Fast-Fourier Transform (in time-domain and Frequency domain) , IDFT and its properties.

**UNIT-II: z- Transforms**

Definition and properties, Rational z-transforms, Region of convergence of a rational z-Transform, The inverse z- Transform, z-Transform properties, Computation of the convolution sum of finite-length sequences, The transfer function. Digital Filter Structures, Block Diagram representation, Equivalent structures, Basic FIR Digital Filter structures, Basic IIR Digital Filter structures, Realization of Basic structures using MATLAB, All pass filters, Computational complexity of Digital filter structures.

**UNIT III: IIR Digital Filter Design:**

Preliminary considerations, Bilinear transformation method of IIR Filter design, Design of low pass IIR Digital filters, Design of High pass, Band pass and band stop IIR digital filters, Spectral Transformations of IIR filter, IIR digital filter design using MATLAB, Computer aided design of IIR digital filters.

**UNIT IV:FIR Digital Filter Design:**

Preliminary considerations, FIR filter design based on windowed Fourier series, Computer aided design of Equiripple Linear phase FIR filters, Design of Minimum phase FIR filters, FIR digital filter design using MATLAB, Design of computationally efficient FIR digital filters.

**UNIT V: Analysis of Finite word length effects:**

The quantization process and errors, quantization of Fixed point numbers, Quantization of floating point numbers, Analysis of coefficient quantization effects, Analysis of arithmetic round off errors, Low sensitivity digital filters, Reduction of product round off errors using error feedback, Round off errors in FFT algorithms. The basic sample rate alteration devices, Multi rate structures for sampling rate conversion, Multistage design of decimator and interpolator, The Polyphase decomposition, Arbitrary-rate sampling rate converter, Nyquist Filters and some applications of digital signal processing.

**Text Books:**

1. S.K. Mitra, **Digital Signal Processing-**, Tata McGraw-Hill, Third Edition, 2006.
2. B.P. Lathi, **Principle of Signal Processing and Linear Systems**, Oxford International Student Version, 2009

3. M. Mondal and A Asif, **Continuous and Discrete Time Signals and Systems**, Cambridge, 2007

**References:**

1. Li Tan, **Digital Signal Processing- Fundamentals and Applications-**, Indian reprint, Elsevier, 2008.

2. Alan V. Oppenheim, Ronald W. Schafer, and John R.Buck, **Discrete- Time Signal Processing-**, Pearson Edu, 2008.

**COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Understand the basic concepts of digital signals and systems
- Learn about transformation techniques and Filter realizations
- Learn about design concepts of IIR and FIR filters
- Understand the concept of quantization and error analysis
- Learn about poly phase decomposition and various applications

**(17D54105) FPGA BASED DIGITAL SYSTEM DESIGN**

**(Elective – II)**

**COURSE OBJECTIVES:**

The student will be able:

- To Design and optimize complex combinational and sequential digital circuits
- To Model combinational and sequential digital circuits by Verilog HDL
- To Design and model digital circuits with Verilog HDL at behavioral, structural, and RTL Levels
- To Develop test benches to simulate combinational and sequential circuits.
- To Understand the FPGA Architecture

**SYLLABUS:**

**Unit-I: Introduction to FPGAs**

Introduction, Field-programmable Gate Arrays, Programmability and DSP, History of the Microchip, Technology Offerings, Influence of Programmability, Challenges of FPGAs.

**Unit -II: Verilog HDL Coding Style :**

Lexical Conventions - Ports and Modules — Operators -Gate Level Modelling - System Tasks & Compiler Directives - Test Bench - Data Flow Modeling - Behavioral level Modeling -Tasks & Functions

**Unit III: Verilog Modeling of Combinational & Sequential Circuits :**

Behavioral, Data Flow and Structural Realization — Adders — Multipliers- Comparators - Flip Flops -Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO — Single port and Dual port RAM — Pseudo Random LFSR — Cyclic Redundancy Check

**Unit IV: Synchronous sequential circuit:**

State diagram-state table —state assignment-choice of flip-flops — Timing diagram —One hot encoding- Mealy and Moore state machines — Design of serial adder using Mealy and Moore state machines - State minimization — Sequence detection- Design of vending machine using One Hot Controller

**Unit V: FPGA and its Architecture:**

Types of Programmable Logic Devices- PLA & PAL- FPGA Generic Architecture. ALTERA Cyclone II Architecture — Timing Analysis and Power analysis using Quartus-II- SOPC Builder- NIOS-II Soft-core Processor- System Design Examples using ALTERA FPGAs — Traffic light Controller, Real Time Clock - Interfacing using FPGA: VGA, Keyboard, LCD.

**Text Books:**

1. S.Ramachandran," Digital VLSI System Design: A Design Manual for Implementation of Projects on FPGAs and ASICs Using Verilog" Springer Publication,2007

2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition, 2003
3. Roger Woods, John McAllister, Gaye Lightbody, Ying Yi " FPGA-based Implementation of Signal Processing Systems" John Wiley & Sons, Ltd, 2008.

**References:**

1. Charles H Roth, Jr "Digital Systems design using VHDL", Thomson Books/Cole
2. Wayne Wolf, "FPGA Based System Design", Prentices Hall Modern Semiconductor Design Serie
3. Mark Balch, "Complete Digital design — A Comprehensive Guide to Digital Electronics and Computer system Architecture," Mc Graw Hill, 2007

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to:

- Design and optimize complex combinational and sequential digital circuits
- Model combinational and sequential digital circuits by Verilog HDL
- Design and model digital circuits with Verilog HDL at behavioral, structural, and RTL Levels
- Develop test benches to simulate combinational and sequential circuits.
- Understand the FPGA Architecture

**(17D54106) SOLID STATE LIGHTING AND CONTROL**  
**(Elective – II)**

**COURSE OBJECTIVES:**

The student will be able:

- To introduce the concept of Solid State Lighting and to impart the skills necessary for implementing light emitting diode in various sectors of illumination.
- To Redesigning an existing office and educational facility with LED luminaire,

**Unit-I: Fundamentals of lighting & terminologies**

Generation of radiation, CCT, CRI & CT, Review of Light sources, Solid State Lighting Photons emission in LEDs, Life cycle of photon, Overall, Internal, External & Extraction efficiency of photons in LEDs, Optical characteristics of LED, Light escape cone and its relevance in LED design & Numerical Lambertian Radiation pattern .

**UNIT-II : LEDs & White light generation :** Role of extraction efficiency & methods to increase it Materials used for LEDs , Different types of LEDs, manufacturing technology White light generation, Challenges & Issues, RGB LED – CIE x-y chromaticity diagram, Advantages & disadvantages , Electrical Characteristics of LED & dependence of photometry Driver circuits – linear regulators, resistive circuits & current mirror

**UNIT-III : Driving Circuits for LEDs :** Switching Regulators – Buck Converter

Boost Converter, Buck Boost Converter, SEPIC Converter, Numerical on Driver design for LEDs, Necessity of closed control loop & its considerations, closed loop control of LED, Dimming approaches.

**UNIT-IV : Design of LED luminaires**

Redesigning an existing office and educational facility with LED luminaire, Lighting quality and Energy conservation analysis of redesigned facility. OLEDs and its types, principle, advantages , disadvantages and application, AC LEDs and its challenges, Selecting components for drivers

**UNIT-V : Application of LEDs:**

Traffic lights, Automotive signage, Displays- Alphanumeric displays, Full color video displays, Medical Applications- phototherapy of neonatal jaundice, Photo dynamic therapy, photo synthesis- plant growing, photo bioreactors.

**Text Books:**

1. Arturas Zukauskus, Michael S. Shur and Remis Gaska, “Introduction to solid state lighting”, wiley interscience 2002.
2. Mohan Underland and Robbins, “ Power Electronic converters, Applications and Design”, John Wiley and sons, 1989

3. Patrick Mottier, “LEDs for Lighting Applications”, John Wiley & Sons, 2009

### **Reference Books**

1. E Fred Schubert, “ Light emitting Diodes” (2<sup>nd</sup> Edition), Cambridge University press, 2006
2. Gilbert Held, “Introduction to Light Emitting Diode Technology and Applications”, CRC press, 2009
3. Application Notes from Texas Instruments, National semiconductors, Hitachi

### **COURSE OUTCOMES:**

After completion of the course, the student will be able to:

- Understand the concept of Solid State Lighting
- Implement light emitting diode in various sectors of illumination.
- Redesigning an existing office and educational facility with LED luminaire.

**(17D54107) HYBRID ELECTRIC VEHICLE SYSTEMS**  
**(Elective – II)**

**COURSE OBJECTIVES:**

Objectives of this course are to:

- Introduce the fundamental concepts, principles, analysis and design of hybrid and electric vehicles
- Introduce the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc.

**SYLLABUS:**

**UNIT-I: Introduction to Hybrid Electric Vehicles:** Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

**UNIT-II: Hybrid Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**UNIT-III: Electric Propulsion unit:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**UNIT-IV: Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

**UNIT-V: Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

**TEXT BOOKS:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. Ali Emadi, Advanced Electric Drive Vehicles, ,CRC Press, 2017

**REFERENCE BOOKS:**

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. <http://nptel.ac.in/syllabus/108103009>

**COURSE OUTCOMES:**

After the completion of course, the student will be able to:

- Get knowledge on hybrid electric vehicles
- Compare the advantages and disadvantages of hybrid electric vehicles over conventional vehicles
- Compare the merits and demerits of hybrid electric trains over electrical trains
- Know the different energy storage techniques
- Discuss the electric population, motor drive technologies
- Analyze the different types of energy management strategies





- Understand Principle of Operation Advanced Power Converters.
- Develop and analyze various converter topologies.
- Describe the operation of multi level inverters with switching strategies for high power applications.
- Comprehend the design of resonant converters and switched mode power supplies.

**COURSE OBJECTIVES:**

To make the student learn about:

- Understand the different power quality and power frequency problems in the power system.
- Analyzing the types and causes of Electrical transients.
- Various types of Harmonics their causes and effects on Power System.
- The Concept of Electromagnetic Interference and its impacts Power Quality and Power System.

**SYLLABUS:**

**UNIT I: INTRODUCTION TO POWER QUALITY AND POWER FREQUENCY DISTURBANCE**

Introduction to Power Quality - Power Quality Issues - Susceptibility Criteria - Role of Power Suppliers and Users - Power Quality Standards. Introduction to Power Frequency Disturbances - Common Power Frequency Disturbances - Cures for Low Frequency Disturbances - Voltage Tolerance Criteria.

**UNIT II: ELECTRICAL TRANSIENTS**

Introduction to Transients - Transient System Model - Examples of Transient Models and Their Response - Types and Causes of Transients - Examples of Transient Waveforms – Three Phase unbalance – single phase faults – phase to phase faults – two phase to ground faults – seven tips of three phase unbalanced sag.

**UNIT III: HARMONICS**

Definition of Harmonics - Odd and Even Order Harmonics - Harmonic Phase Rotation and Phase Angle – Causes of Voltage and Current Harmonics – Individual and Total Harmonic Distortion - Harmonic Signatures - Effect of Harmonics on Power System Devices - Guidelines for Harmonic Voltage and Current Limitation - Harmonic Current Mitigation.

**UNIT IV: ELECTROMAGNETIC INTERFERENCE**

Introduction to EMI - Frequency Classification - Electrical Fields - Magnetic Fields - EMI Terminology - Power Frequency Fields - High Frequency Interference - EMI Susceptibility - EMI Mitigation - Health Concerns of EMI.

**UNIT V: POWER QUALITY PROBLEMS – EMI IMPACT**

Introduction to Power Quality Measurements - Power Quality Measurement Devices - Power Quality Measurements - Test Locations - Test Duration - Instrument Setup - Instrument Guidelines

**TEXT BOOKS:**

1. Power quality by C. Sankaran, CRC Press
2. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, 2<sup>nd</sup> Edition, TMH Education Pvt. Ptd.

**REFERENCE BOOKS:**

1. Understanding Power quality problems by Math H. J. Bollen IEEE Press
2. Power quality enhancement using custom power devices by Arindam Ghosh, Gerard Ledwich, Kluwer academic publishers

**COURSE OUTCOMES:**

After completing the course, the student should be able to do the following:

- Understand the concepts of power quality and power frequency problems in the power system.
- Analyze different types of Electrical Transients and Harmonics along with their causes and effects.
- Understand the concept of Electromagnetic interference.
- Analyze the various effects of Electromagnetic Interference on Power Quality.

**(17D54202) ADVANCED DRIVES & CONTROL**

**COURSE OBJECTIVES:**

The student will be able:

- To understand principle operation of scalar control of ac motor and corresponding speed-torque characteristics
- To understand the vector control for ac motor drive (IM and SM)
- To explain the static resistance control and Slip power recovery drive
- To explain synchronous motor drive characteristics and its control strategies
- To understand the brushless dc motor principle of operation.

**UNIT-I: Induction Motor- An Overview**

Review of Steady-State Operation of Induction Motor, Equivalent Circuit Analysis, Torque-Speed Characteristics. Phase Controlled Induction Motor Drive, Stator Voltage Control of Induction Motor, Phase-Controlled Converter Fed Induction Motor, Power Circuit and Gating, Reversible Phase-Controlled Induction Motor Drive, Torque-Speed Characteristics.

**UNIT-II: Voltage Source Inverter Fed Induction Motor Drive**

Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive, Variable-Voltage Variable-Frequency Operation of Induction Motor, Constant E/f And V/f Control Schemes, Slip Regulation. Current Source Inverter Fed Induction Motor Drive, Stator Current and Frequency Control of Induction Motor, Auto Sequentially Commutated Inverter (ASCI), Power Circuit, Commutation, Phase Sequence Reversal, Regeneration, Steady-State Performance.

**UNIT-III: Rotor Side Control of Slip-Ring Induction Motor**

Slip-Power Recovery Schemes, Steady-State Analysis- Range of Slip, Equivalent Circuit, Performance Characteristics; Rating of Converters. Vector Control of Induction Motor, Principles of Vector Control, Direct Vector Control, Derivation of Indirect Vector Control, Implementation – Block Diagram, Estimation of Flux, Flux Weakening Operation.

**UNIT-IV: Control of Synchronous Motor Drives**

Synchronous Motor and Its Characteristics- Control Strategies-Constant Torque Angle Control- Power Factor Control, Constant Flux Control, Flux Weakening Operation, Load Commutated Inverter Fed Synchronous Motor Drive, Motoring and Regeneration, Phasor Diagrams.

**Unit-V: PMSM and BLDC Drives**

Characteristics of Permanent Magnet, Synchronous Machines With Permanent Magnet, Vector Control of PMSM- Motor Model and Control Scheme, Constant Torque Angle Control, Constant Mutual Flux Linkages, Unity PF Control. Modeling of PM Brushless Dc Motor, Drive Scheme, Commutation Torque Ripple, Phase Advancing.

**TEXT BOOK:**

1.R. Krishnan, **Electric Motor Drives Modeling, Analysis & control**, Pearson Education, 2001.

**REFERENCE BOOKS:**

1. B. K. Bose **Modern Power Electronics and AC Drives**, Pearson Publications-2001.
2. MD Murphy & FG Turn Bull, Pergaman press, **Power Electronics control of AC motors** 1st edition-1998.
3. G.K. Dubey **Fundamentals of Electrical Drives**, Narosa Publications -1995.

**COURSE OUTCOMES:**

After taking this course, student will be able to:

- Develop induction motor for variable speed operations using scalar and vector control techniques.
- Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
- Develop controllers for synchronous motor.

**COURSE OBJECTIVES:**

The student will be able:

- To create the awareness of energy conservation in students
- To identify renewable energy sources for electrical power generation
- To analyze different energy storage methods
- To have knowledge on environmental effects of energy conversion

**SYLLABUS:**

**UNIT I:**

**SOLAR PHOTO VOLTAIC POWER AND THERMAL SYSTEMS:** The PV cell, Module and array, equivalent electrical circuit, open circuit and short circuit current, i-v and p-v curves, array design. Energy collection, solar power plant, synchronous generator, commercial power plants

**UNIT II:**

**FUNDAMENTAL OF WIND TURBINES:** Historical back ground, power contained in wind, thermodynamics of wind energy, efficiency limit for wind energy conversion, maximum energy obtainable for a thrust-operated converter, types of wind energy conversion devices, some relevant definitions, aerodynamics, design of wind turbine rotor, power speed, torque-speed characteristics, wind turbine control systems, control strategy.

**UNIT III:**

**GRID CONNECTED SYSTEMS:** constant voltage, constant frequency generation, reactive power compensation, variable voltage, variable frequency generation, effect of wind generator on the network. Classification of schemes, operating area, induction generators, doubly fed induction generator, wound field synchronous generators, the permanent magnet generators.

**UNIT IV:**

**INTEGRATION OF WIND FORMS IN TO THE POWER SYSTEM:** Reactive power compensation-Static Var compensator- Static synchronous compensator-STATCOM and FSIG stability, HVAC connections, HVDC connections-LCC-HVDC, Vsc-HVDC, Multi terminal HVDC,HVDC Transmission-opportunities and challenges

**UNIT V:**

**ENERGY STORAGE AND HYBRID ENRGY SYSTEMS:** Battery, types of batteries, equivalent electrical circuit, performance characteristics, lead- acid battery, battery design, battery charging, charging regulators, battery management, flywheel. Diesel generator and photo-voltaic system, wind-diesel hybrid system, wind-Photo voltaic systems.

**References:**

1. “ Wind and solar Power Systems Design, analysis & Operation” Mukund R. Patel CRC Taylor & Fracis- 2<sup>nd</sup> edition
- 2.“Wind Electrical Systems” S.N.Bhadra, D. Kasta, S. Banerjee Oxford University press.
- 3 “Wind energy generation modeling and control”, . Anaya-Lara, Jenkins et al John Wiley & Sons ,Ltd

## **COURSE OUTCOMES:**

After completion of the course, the student will be able to:

- Find different renewable energy sources to produce electrical power
- Estimate conventional energy sources to produce electrical energy
- Role-play the fact that the conventional energy resources are depleted
- Arrange Stored energy and to avoid the environmental pollution

**(17D49205) REACTIVE POWER COMPENSATION & MANAGEMENT**  
**(Elective – III)**

**COURSE OBJECTIVES:**

The student will be able:

- To identify the necessity of reactive power compensation
- To describe load compensation
- To select various types of reactive power compensation in transmission systems
- To illustrate reactive power coordination system
- To characterize distribution side and utility side reactive power management.

**SYLLABUS:**

**UNIT-I: LOAD COMPENSATION**

Objectives and specifications – Reactive power characteristics – Inductive and capacitive approximate biasing – Load compensator as a voltage regulator – Phase balancing and power factor correction of unsymmetrical loads - Examples.

**UNIT-II: STEADY – STATE & TRANSIENT STATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM**

Uncompensated line – Types of compensation – Passive shunt and series and dynamic shunt compensation – Characteristic time periods – Passive shunt compensation – Static compensation - Series capacitor compensation – Compensation using synchronous condensers –Examples.

**UNIT-III: REACTIVE POWER COORDINATION & DEMAND SIDE MANAGEMENT**

Objective – Mathematical modeling – Operation planning – Transmission benefits – Basic concepts of quality of power supply – Disturbances - Steady – state variations – Effects of under Voltages – Frequency – Harmonics, radio frequency and electromagnetic interferences. Load patterns – Basic methods - load shaping – Power tariffs - KVAR based tariffs - penalties for voltage flickers and Harmonic voltage levels.

**UNIT-IV: DISTRIBUTION & USER SIDE REACTIVE POWER MANAGEMENT**

System losses – Loss reduction methods – Examples – Reactive power planning – Objectives – Economics - Planning capacitor placement – Retrofitting of capacitor banks - KVAR requirements for domestic appliances – Purpose of using capacitors – Selection of capacitors – Deciding factors – Types of capacitors, characteristics and Limitations.

## **UNIT-V: REACTIVE POWER MANAGEMENT IN ELECTRIC TRACTION SYSTEMS AND ARC FURNACES**

Typical layout of traction systems – Reactive power control requirements – Distribution transformers - Electric arc furnaces – Furnaces transformer – Filter requirements – Remedial measures – Power factor of an arc furnace.

### **TEXT BOOKS:**

1. J.E.Miller, Reactive Power Control in Electric Power Systems, John Wiley and Sons, 1982 (Units I to IV).
2. D.M.Tagare, Reactive power Management, Tata McGraw Hill, 2004 (Units V toVIII).

### **COURSE OUTCOMES:**

After completion of the course, the student will be able to:

- Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
- Observe various compensation methods in transmission lines
- Construct model for reactive power coordination
- Distinguish demand side reactive power management & user side reactive power management

**(17D54204) ADAPTIVE CONTROL**  
**(Elective – III)**

**COURSE OBJECTIVES:**

The student will be able to:

- Understand the concept of adaptive control problem, basic models of adaptive control
- Learn about Self Tuning Regulator
- Learn about STR control mechanisms and LQG control
- Understand the concept of MRAS
- Learn about SOAS and Gain scheduling

**Unit – I**

Introduction, Block Diagram of an Adaptive System, Effects of Process Variations on System Performance, Types of Adaptive Schemes, Formulation of the Adaptive Control Problem, Least Squares Method and Regression Models for Parameter Estimation, Estimating Parameters in Models of Dynamic Systems, the Finite Impulse Response Model, The Transfer Function and Stochastic Model.

**Unit – II**

Block Diagram of Deterministic Self Tuning Regulator (STR), Pole Placement Design – Process Model, Causality Conditions. Indirect STRs – Estimation, Continuous - Time STRs, Direct STRs – Minimum Phase Systems, Adaptive Control Algorithm, Feed Forward Control, Non Minimum Phase Systems – Adaptive Control Algorithm, Algorithm For Hybrid STR.

**Unit – III**

Design of Minimum Variance and Moving - Average Controllers, Stochastic STR – Indirect STR, Algorithm for Basic STR, Theorems on Asymptotic Properties. Unification of Direct STRs, Generalized Direct Self Tuning Algorithm, Self Tuning Feed Forward Control. Linear Quadratic STR – Theorems on LQG Control, Algorithms for Indirect LQG – STRs Based on Spectral Factorization and Riccati Equation.

**Unit –IV**

Model Reference Adaptive System (MRAS), The MIT Rule, Block Diagram of an MRAS for adjustment of Feed Forward Gain based on MIT Rule. Adaptation Gain – Methods for determination. Design of MRAS using Lyapunov Theory – Block Diagram of an MRAS based on Lyapunov Theory for a First Order System. Proof of The Kalman – Yakubovich Lemma, Adjustment Rules for Adaptive Systems, Relation between MRAS and STR.

**Unit – V**

Gain Scheduling – Principle, Block Diagram, Design of Gain Scheduling Controllers, Nonlinear Transformations, Block Schematic of a Controller based on Nonlinear Transformations. Application of Gain Scheduling for Ship Steering, Flight Control. Self Oscillating Adaptive System (SOAS) – Principle, Block Diagram, Properties of The Basic SOAS, Procedure for Design of SOAS. Industrial Adaptive Controllers and applications.

**Text books:**

1. K.J.Astrom and Bjorn Wittenmark, Adaptive control, Pearson Edu., 2<sup>nd</sup> Edn.
2. Sankar Sastry, Adaptive control.

**References**

1. V.V.Chalam, Adaptive Control System - Techniques & Applications, Marcel Dekker Inc.
2. Miskhin and Braun, Adaptive control systems, MC Graw Hill
3. Karl Johan Åström, Graham Clifford Goodwin, P. R. Kumar, Adaptive Control, Filtering and Signal Processing.
4. G.C. Goodwin, Adaptive control.
5. Narendra and Anna Swamy, Stable Adaptive Systems.

**COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Understand the concept of adaptive control problem, basic models of adaptive control
- Learn about Self Tuning Regulator
- Learn about STR control mechanisms and LQG control
- Understand the concept of MRAS
- Learn about SOAS and Gain scheduling

**(17D49207) HVDC & EHVAC TRANSMISSION SYSTEMS**  
**(Elective – III)**

**COURSE OBJECTIVES:**

To make the student learn about:

- HVDC and EHVAC systems and their applications.
- Different Harmonics suppression filters and their role in power systems.
- Various theories like Electrostatic field and Travelling Wave Theory
- How to control the Voltage in various systems for effective and efficient system.

**SYLLABUS:**

**UNIT- I: INTRODUCTION TO HVDC SYSTEMS**

Introduction, Basic means of control-power reversal-constant current versus constant voltage control- Desired features of control- Actual control characteristics - Constant minimum ignition angle control - constant current control - Constant extinction angle control-stability of control - Tap changer control - Frequency control.

**UNIT - II: HARMONICS SUPPRESSION FILTERS, INTERACTION BETWEEN AC AND DC SYSTEMS**

Characteristic Harmonics-troubles caused by harmonics-definitions of wave distortion or ripples –means of reducing harmonics-design of AC filters –Dc side filters- Voltage interaction –DC power modulation – Power frequency control-Large signal modulation – active and reactive power coordination.

**UNIT – III: EHVAC TRANSMISSION SYSTEM**

Introduction to EHVAC, Line inductance and capacitances – Sequence inductances and capacitances – Modes of propagation – Ground return – Examples. Electrostatics – Field of sphere gap – Field of line charges and properties – Charge – potential relations for multi-conductors – Surface voltage gradient on conductors – Distribution of voltage gradient on sub-conductors of bundle – Examples.

**UNIT – IV: ELECTRO STATIC FIELD & TRAVELING WAVE THEORY**

Electrostatic field: calculation of electrostatic field of EHV/AC lines – Effect on humans, animals and plants – Electrostatic induction in unenergised double circuit line - Electromagnetic interference - Examples. Traveling wave expression and solution - Source of excitation - Terminal conditions - Open circuited and short circuited end - Reflection and refraction coefficients - Lumped parameters of distributed lines - Generalized constants - No load voltage conditions and charging current.

**UNIT –V: VOLTAGE CONTROL**

Introduction to Voltage Control - Power circle diagram and its use – Voltage control using synchronous condensers – Cascade connection of shunt and series compensation – Sub synchronous resonance in series capacitor – Compensated lines – Static VAR compensating system.

**TEXT BOOKS:**

1. R. D. Begamudre, EHVAC Transmission Engineering, New Age International (p) Ltd.
2. S. Rao, HVAC and DC Transmission.
3. HVDC power Transmission systems by K.R.Padiyar 2<sup>nd</sup> edition, Wiley Eastern limited.

**REFERENCE BOOKS:**

1. High voltage direct current transmission by J.Arrilaga, IEE power engineering series.
2. Direct current transmission by E.W.Kimbark, Vol-1, Wiley inter science-New york.

**COURSE OUTCOMES:**

After completing the course, the student should be able to do the following:

- Understand the basics of HVDC and EHVAC systems and their characteristics.
- Analyze different types of Harmonic suppression Filters and also the interaction between AC and DC Systems due to the presence of harmonics.
- Analyze the impacts of electrostatic field and travelling wave on the system.
- Understand the different methods to Control the Voltage of the system at various points of power system.

**(17D49208) DISTRIBUTED GENERATION & MICROGRID CONTROL**  
**(Elective – IV)**

**COURSE OBJECTIVES:**

The student able to learn about:

- Able to know about the concept of distributed generation, distribution network & the concept of Microgrid, its configuration, advantages & limitations.
- Able to understand the basic concepts in combined heat and power, Wind energy conversion systems, solar photovoltaic systems & other renewable energy sources.
- Able to analyze the impact of Microgrid & Active distribution network management system on various factors.
- Able to know the effect of SCADA & understand the concept of Power quality disturbances, improvement technologies & issues of premium power in DC integration.

**SYLLABUS:**

**UNIT I: INTRODUCTION TO DISTRIBUTED GENERATION AND MICROGRID CONCEPT**

Introduction to distributed generation - Active distribution network - Concept of Microgrid - Microgrid configuration - Interconnection of Microgrids - Technical and economical advantages of Microgrid - Challenges and limitations of Microgrid development - Management and operational issues of a Microgrid - Dynamic interactions of Microgrid with main grid – low voltage DC grid.

**UNIT II: DISTRIBUTED ENERGY RESOURCES**

Introduction - Combined heat and power (CHP) systems: Micro-CHP systems - Wind energy conversion systems (WECS): Wind turbine operating systems - Solar photovoltaic (PV) systems: Classification of PV cell - Small-scale hydroelectric power generation - Other renewable energy sources - Storage devices.

**UNIT III: MICROGRID AND ACTIVE DISTRIBUTION NETWORK MANAGEMENT SYSTEM**

Introduction - Impact on heat utilisation - Impact on process optimisation - Impact on market - Impact on environment - Impact on distribution system - Impact on communication standards and protocols - Network management needs of Microgrid - Microsource controller - Central controller.

**UNIT IV: SCADA AND ACTIVE DISTRIBUTION NETWORKS**

Introduction - Existing DNO SCADA systems - Control of DNO SCADA systems - SCADA in Microgrids - Human-machine interface (HMI) - Hardware components - Communication trends in SCADA - Distributed control system (DCS) - Sub-station communication standardization - SCADA communication and control architectures - Communication devices.

## **UNIT V: IMPACT OF DG INTEGRATION ON POWER QUALITY AND RELIABILITY**

Introduction - Power quality disturbances - Power quality sensitive customers - Power quality improvement technologies - Impact of DG integration - Issues of premium power in DG integration.

### **TEXT BOOK:**

1. S. Chowdhury, S.P. Chowdhury and P. Crossley, "Microgrids and Active Distribution Networks", The Institution of Engineering and Technology, 2009.

**COURSE OUTCOMES:** Student acquire knowledge about:

- Understand the concept of distributed generation, distribution network & the concept of Microgrid, its configuration, advantages & limitations.
- Understand the basic concepts in combined heat and power, Wind energy conversion systems, Solar photovoltaic systems & other renewable energy sources.
- The impact of Microgrid & Active distribution network management system on various factors is known.
- Understand the effect of SCADA & understand the concept of Power quality disturbances, improvement technologies & issues of premium power in DC integration.



4. Energy Efficiency for Engineers and Technologists, First Edition, 1990, by TD Eastop and DR Croft, Longman Group UK Ltd.
5. [www.bee-india.nic.in](http://www.bee-india.nic.in) (Guide on Energy Efficient room Air conditioners)

**COURSE OUTCOMES:**

- Analysed the concept of Electricity billing and electrical load management.
- Understand the types of electrical products and how the systems can lose energy.
- Measuring of energy loss is known.
- Understand how to select and size equipment for the application.



3. N.K. Bose and P.Liang, Neural Network Fundamentals with Graphs, Algorithms and Applications, Mc - Graw Hill, Inc. 1996.
4. Yung C. Shin and Chengying Xu, Intelligent System - Modeling, Optimization and Control, CRC Press, 2009.
5. N.K.Sinha and Madan M Gupta, Soft computing & Intelligent Systems - Theory & Applications, Indian Edition, Elsevier, 2007.
6. John Yen and Reza Langari, Fuzzy logic Intelligence, Control, and Information, Pearson Education, Indian Edition, 2003.
7. Witold Pedrycz, Fuzzy Control and Fuzzy Systms, Overseas Press, Indian Edition, 2008.

### **COURSE OUTCOMES:**

After completion of the course, student will be able to:

- Learn about basic concepts of AI
- Understand concepts of ANN and various learning algorithms
- Learn about Genetic Algorithm, ACO and Tabu search concepts
- Understand the concepts of Fuzzy
- Learn about Fuzzy logic controller and design using MATLAB



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M.Tech III semester (PE, PID, PEED and PED)**

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**(17D20301) RESEARCH METHODOLOGY**

**(Elective V-OPEN ELECTIVE )**

**UNIT I**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

**UNIT II**

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.

Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

**UNIT III**

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

**UNIT IV**

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

## **UNIT V**

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

### **Text Books:**

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2<sup>nd</sup> Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1<sup>st</sup> Edition,Excel Books,New Delhi.

### **REFERENCES:**

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)
2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

**(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS**

**(Elective V-OPEN ELECTIVE )**

**Unit I:**

**HUMAN VALUES:** Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

**Unit II:**

**ENGINEERING ETHICS:** Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg’s theory- Gilligan’s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

**Unit III :**

**ENGINEERING AS SOCIAL EXPERIMENTATION:** Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

**UNIT IV:**

**ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK:** Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

**UNIT V:**

**GLOBAL ISSUES:** Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

**Text Books :**

1. “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.
4. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
5. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

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**M.Tech III semester (PE, PID, PEED and PED)**

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**4 0 0 4**

**(17D20303) INTELLECTUAL PROPERTY RIGHTS**

**(Elective V-OPEN ELECTIVE )**

**UNIT – I**

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

**UNIT – II**

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

**UNIT – III**

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

**UNIT – IV**

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

**UNIT – V**

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

## **TEXT BOOKS & REFERENCES:**

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learning.
2. Intellectual Property Right – Nileshmy The Knowledge Economy, Prabuddha Ganguli,  
Tate Mc Graw Hill Publishing Company Ltd.,