DELHI TECHNOLOGICAL UNIVERSITY

SCHEME OF EXAMINATION

AND

COURSE OF READING

FOR

B.Tech. (ELECTRICAL ENGINEERING)

Semester	**I**	**Examination**	**November, 2010**
Semester	**II**	**Examination**	**May, 2011**
Semester	**III**	**Examination**	**November, 2011**
Semester	**IV**	**Examination**	**May, 2012**
Semester	**V**	**Examination**	**November, 2012**
Semester	**VI**	**Examination**	**May, 2013**
Semester	**VII**	**Examination**	**November, 2013**
Semester	**VIII**	**Examination**	**May, 2014**

Syllabus applicable to the students seeking admission to the B.Tech. (Electrical Engineering) Course in the academic year 2010.

ELECTRICAL ENGINEERING DEPARTMENT

Summary of Scheme of Examination

Total Credits for B.Tech. Degree: 240

Semester wise: I-30, II-30, III-32, IV-32, V-28, VI-30, VII-30, VIII-28

Classification of Subjects:

Subjects	H	A	C
I	19	11	00
II	14	16	00
III	08	06	18
IV	04	06	22
V	00	00	28
VI	00	06	24
VII	04	02	24
VIII	04	06	18
Total Credits 240	53	53	134
Percentage Contents of H, A, C	22%	22%	56%

H Humanities, Social Studies and Basic Sciences

A Allied Engineering

C Core (include major project and practical training also)

Industrial training of 5 weeks durations during summer vacations after 5th semester and 10 weeks after 6th semester.

FACULTY OF ELECTRICAL ENGINEERING

(DELHI TECHNOLOGICAL UNIVERSITY)

SCHEME OF EXAMINATION

1. In addition to the conditions laid down in Ordinance, a candidate seeking admission to Electrical Engineering Courses of study for the Bachelor's Degree should satisfy the following conditions.

(a) Educational Qualifications:

A candidate passing any one of the following examinations and securing 60 percent or more marks in the aggregate of Physics, Chemistry And Mathematics shall be eligible for admission to the first Semester of Bachelor of Engineering Course provided he/she has passed in each subject separately ;

i. Senior Schools Certificate Examination (12 year course) of the Central Board of Secondary Education (C.B.S.E.), New Delhi.

ii. Indian School Certificate Examination (12 Year course) of the Council for Indian School Certificate Examination, New Delhi.

iii. B.Sc. (Gen.) Group 'A' final Examination of the University of Delhi or equivalent examination.

iv. B.Sc. (Hons.) Examination in Physics, chemistry and Mathematics of the University of Delhi with combination of Physics, Chemistry, Mathematics and equal weightage to the subsidiary subjects or equivalent examination.

v. Any other examination recognized as equivalent to the Senior School Certificate Examination of the C.B.S.E by the University of Delhi.

A candidate must additionally have passed English as a subject of study at the 12th class level (core or elective)

NOTE: There shall be no direct admission to any level of the Courses above the 1st Semester.

2. Under each B.TECH. Degree course certain subjects are offered which can be classified as Theory/ Practical/ Drawing/ Design/ Project/ Practical Training. Further classification is based on the relationship of the subjects with the degree courses admitted to, namely Humanities and Social Science/ Basic Sciences/ Allied engineering, Departmental, core, etc.

In addition to the above, a subject could be classified as a compulsory one or as one of the pre-requisite for another subject. The Committee of courses and Studies of the concerned Department shall do this classification.

3. A student who joins the first semester will be automatically, deemed to have registered for the subjects which are listed under the first Semester of the SUGGESTED SCHEME OF LEARNING. Every student is required to register for the subjects to be taught in the second and subsequent semesters. This process of registration shall start just before the start of next semester. The student will also indicate during registration of subject/ subjects of earlier Semester(s) in which he/ she desire to appear, if otherwise eligible. Such a student will be allowed to appear in the End Semester Examination and his/ her marks of mid terms activities will remain unaltered since attendance is compulsory, a student will be permitted to register for course/ courses which he can attend. The number of theory subjects permitted will not be more than six. The total duration of contact period should not ordinarily exceed thirty two hours per week.

4. B.TECH. Degree shall be awarded if a student has earned a minimum of 228 credits as specified in each degree program subject o break up and compulsory credit as mentioned there in. However, a student may register in subjects leading to a maximum of 240 credits in the entire course.

A student should keep a watch on his progress and register in those papers in which he must earn the credit to satisfy the above requirement of the particular degree.

If a student earns more than a specified minimum credit for degree the best marks in the minimum credits (satisfying the above conditions) will be considered for the purposes of classification of result.

6. Evaluation and Review

The committee of Courses & Studies in Electrical Department shall specify the following for the degree course.

(a) Suggested Science of Learning.

(b) Minimum credits needed for the degree course and break up in terms of classification of courses i.e

a. Humanities and Social Sciences

b. Basic Sciences

c. Allied Engineering

d. Departmental Core

e. Practical Training

f. Unspecified/ Elective and

g. Major Project.

The committee of courses & Studies in each Department shall appoint one or more Evaluation-cum-Review Committees each dealing with group of subjects. This E.R.C consist of the teachers who are likely to teach subjects in the group.

The E.R.C. has the following functions:

i. To recommend appointment of paper setters/ examiners of various examinations at the start of each Semester.

ii. To get prepared quizzes, assignments, test papers etc. for the mid-term and the end semester examination and to get them evaluated. Normally each concerned teacher, who is also a member of E.R.C., will do this job for his class. However, in exceptional circumstances any part the work will be entrusted to some other member of E.R. C.

iii. The mode of evaluation of the mid-term activities whose weightage shall be 30% and the end of term examination whose weightages shall be 70% (The mid-term activities will be one mid term test or 20% weightage which will be supplemented by assignments, quizzes etc. for a theory course with weightage of 10%). For a practical course, 30% weightage be given for internal evaluation and 70% for End Semester Examination. At the end of the Semester, the E.R.C. Chairman will send to the University the consolidated marks for the mid-term activities and the End Semester in separate column for tabulation and for declaration of results.

iv. To consider the individual representation of students about evaluation and take the remedial action if needed. After scrutinizing the E.R.C may alter the marks awarded upward/ downward. The decision of the ERC shall; be final. The candidate shall apply for the same on a prescribed Performa along with the evaluation fee prescribed the University from time to time only for the end Semester Examination within seven days from the date of declaration of result.

v. To moderate the quiz/ assignment test papers given by each concerned teacher in class with a view to maintain uniformity of standards and course coverage amongst various classes and to attain stipulated level of learning.

vi. To review and moderate the mid term and end of term results of each class with a view to maintain uniformity of standards and course coverage amongst various classes and to attain stipulated level of learning.

vii. To lay guidelines for teaching a subject.

6. Classification of Result:

A student has to secure 40% or more marks in a subject evaluation to earn the credits assigned to the subject. A student after having secured the minimum credit as needed for the degree course will be eligible for the award of degree. The final result will be evaluated as below:
Each subject will carry 100 marks.

$$\text{average marks} = \frac{\sum(\text{Credits} \times \text{Marks Secured})}{(\sum \text{Credits})}$$

- (See clause 5 for best grades in the minimum credits)

The final result will be classified based on the average marks as follows.

First Class with Distinction 75% or more

First Class 60% or more but less than 75%

Second Class 50% or more but less than 60%

Pass Class 40% or more but less than 50%

8. A student has to put in a minimum of 75% attendance separately in each subject for which he has registered. A relaxation up to a maximum of 25% may be given on the production of satisfactory evidence that:

(c) The student was busy in authorized activities.

(d) The student was ill.

Note: - (i) A student should submit the evidence to the above fact within three working days of resuming the studies. Certificates submitted later will not be considered.

(ii) No relaxation in attendance beyond 25% is permitted in any case.

(iii) The registration of a student stands cancelled if his attendance requirements are not satisfied in the subject.

9. The duration of the course is not less than 8 Semesters and the span is not more than 14 semesters.

A student who earn 15 credits or less at the end of the first semester will receive a warning for his/her poor performance, if he fails to earn at least 25 credits at the end of the second semester, he has to leave the course and institution.

In case a student has not earned a minimum of 100 credits at the end of eight semesters, his admission to the course and the institution stands cancelled. The admission stands cancelled at the end of 14 semesters in any case.

10. The Institution /University may cancel the registration of all the subjects in a given semester if:

    1. The student has not cleared the dues to the institution /hostel.

    2. A punishment is awarded leading to the cancellation.

    At discretion of the institution the result may be withheld even if the registration of the student stands.

11. There shall be a Central Advisory Committee consisting of the following:

    (a) Dean, Faculty of Technology, (Chairman of the Committee)

    (b) Heads, of the Institutions.

    (c) Heads of the Departments in the Faculty of Technology.

    This Committee shall have the following functions:

    (i) Lay guidelines for the process of registration.

    (ii) Give an interpretation of the rules in case of difference of opinion which shall be binding on all.

12. Under very exceptional conditions minor relaxations in rules may be allowed and implemented by the Central Advisory Committee. However, same relaxation in rules can not be granted in a subsequent semester. In case the conditions warrant such a relaxation again, the rules shall have to be amended.

GENERAL NOTES:

1. For all Theory Papers (Code: TH) there is one mid-semester test, 30 marks (20+10 Assignments) and an end-semester exam of 3 hours duration for 70 marks. The total marks for the Theory Paper is thus 100.

2. For all Practical Papers (Code: PR) there is semester assessment of marks and an end-semester exam of 3 or 4 hours duration for 70 marks. The total marks for the practical paper is thus 100.

3. For all evaluation of Sessional (Code: VS) there is semester assessment of 100 marks. There is no end-semester exam for these courses.

4. The examinations for Industrial Training after 5th & 6th semester, shall be conducted with 6th semester & 7th semester .There is assessment of Practical Training Reports by a duly constituted Board. The report is to be submitted by the student after Industrial Training undergone during summer/winter breaks. The total marks associated with each Practical Training Report is 100 marks of which 30 marks are awarded by the Department on the basis of supervision of Industrial Training.

5. At VIII semester level there is assessment of Project Report by a duly constituted Board. The report is to be submitted by the student of the Project Work performed at the VII and VIII semester levels. The total marks associated with the Project Report is 100 marks of which 30 marks are awarded by the department on the basis of guidance of Project Works.

6. The total credits in all scheme of Examinations to B.TECH. Courses up to VIII Semester will be 240 and the denominator for calculation of average marks for final result will be 228.

7. The Practical Training after V and VI semester and their evaluation examination in VI and VII semester and the Project are mandatory.

8. Candidates securing 236 to 240 credits are declared to have passed B.TECH. Final Examination.

9. Candidates securing 232 to 236 credits are declared to have passed B.TECH. Final examination provided they skip/fail in not more than 4 credits in CORE.

10. Candidates securing exactly 228 credits are declared to have passed B.TECH. final examination, provided they skip/fail in not more than 4 credits in CORE, not more than 4 credits in APPLIED ENGINEERING and not more than 4 credits in APPLIED SCIENCE & HUMANITIES.

This Committee shall have the following functions:

(i) lay guidelines for the process of registration.

(ii) give an interpretation of the rules in case of difference of opinion which shall be binding on all.

12. Under very exceptional conditions minor relaxations in rules may be allowed and implemented by the Central Advisory Committee. However, same relaxation in rules can not be granted in a subsequent semester. In case the conditions warrant such a relaxation again, the rules shall have to amended.

SCHEME FOR B.Tech. FIRST SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assignment	Mid-Sem	End -Sem		
TH1	MA 101	Mathematics-1	310	10	20	70	100	4H
TH2	HU 102	Communication skills	210	10	20	70	100	3H
TH3	PH 103	Applied Physics	310	10	20	70	100	4H
TH4	CH 104	Applied Chemistry	310	10	20	70	100	4H
TH5	EE 105	Electrical sciences	310	10	20	70	100	4A
TH6	IT 106	Fundamentals of Information Technology	210	10	20	70	100	3A
PR1	PH 107	Applied Physics Lab	002	10	20	70	100	2H
PR2	CH 108	Applied Chemistry Lab	002	10	20	70	100	2H
PR3	EE 109	Electrical Sciences Lab	002	10	20	70	100	2A
PR4	IT 110	Information Technology Lab	002	10	20	70	100	2A
	TOTAL	**Practice**	**30 hrs**				**1000**	**30**

SCHEME FOR B.Tech. SECOND SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assignment	Mid-Sem	End - Sem		
TH1	MA 111	Mathematics-II	310	10	20	70	100	4H
TH2	EN 112	Environmental Sciences	200	10	20	70	100	2H
TH3	AS 113	Applied Sciences	400	10	20	70	100	4H
TH4	AS 114	Engineering Materials	400	10	20	70	100	4H
TH5	ME 115	Mechanical Sciences	310	10	20	70	100	4A
TH6	COE 116	Principle of programming Language	200	10	20	70	100	2A
PR1	ME 117	Engineering Graphics	003	10	20	70	100	3A
PR2	ME 118	Mechanical Science Lab	002	10	20	70	100	2A
PR3	COE 119	Programming Languages Lab	002	10	20	70	100	2A
PR4	PE 120	Mechanical Workshop	003	10	20	70	100	3A
	TOTAL	**Practice**	**30 hrs**				**1000**	**30**

SCHEME FOR B.Tech. THIRD SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assignment	Mid-Sem	End - Sem		
TH1	*EE201	Electronic Devices and Circuits	310	10	20	70	100	4C
TH2	*EE202	Hydraulic and Thermal System	400	10	20	70	100	4A
TH3	*EE203	Network Analysis and Synthesis	310	10	20	70	100	4C
TH4	*EE204	Mathematics-III	310	10	20	70	100	4A
TH5	*EE205	Electrical and Electronic Measurement	300	10	20	70	100	3C
TH6	*EE206	Electrical Machines-I	300	10	20	70	100	3C
PR1	*EE207	Electronic Devices and Circuits Lab.	003	10	20	70	100	3C
PR2	*EE208	Electrical and Electronic Measurement Lab	002	10	20	70	100	2C
PR3	*EE209	Electrical Machines-I Lab.	002	10	20	70	100	2A
PR4	*EE210S	Term Paper	001	10	20	70	100	1A
	TOTAL		**30 hrs**				**1000**	**30**

Subjects mark with asterisk (*) are common with EEE

SCHEME FOR B.Tech. FOURTH SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assignment	Mid-Sem	End -Sem		
TH1	*EE 211	Linear Integrated Circuit	310	10	20	70	100	4C
TH2	*EE 212	Electromagnetic field Theory	310	10	20	70	100	4C
TH3	EE 213	Control System-I	310	10	20	70	100	4C
TH4	*EE 214	Power System –I	310	10	20	70	100	4C
TH5	*EE 215	Digital Circuits & Systems	300	10	20	70	100	3C
TH6	*EE-216	Electrical Machines-II	300	10	20	70	100	3H
PR1	*EE 217	Linear Integrated Circuit Lab	003	10	20	70	100	3C
PR2	*EE 218	Control System Lab	002	10	20	70	100	2C
PR3	*EE 219	Digital Circuits & Systems Lab	002	10	20	70	100	2C
VS2	*EE 220	Term Paper	001	10	20	70	100	1C
	TOTAL		**30 hrs**				**1000**	**30**

SCHEME FOR B.Tech. FIFTH SEMESTER (ELECTRICAL ENGINEERING)

S.No.	Course No.	Subject	LTP	Evaluation			Total Marks	Credit Type
				Assignment	Mid-Sem	End - Sem		
TH1	*EE301	Power Electronics	310	10	20	70	100	4C
TH2	EE 302	Modern Instrumentation Techniques	310	10	20	70	100	4C
TH3	*EE303	Power System-II	310	10	20	70	100	4C
TH4	EE304	Control Systems-II	310	10	20	70	100	4C
TH5	*EE305	Microprocessor and Applications	310	10	20	70	100	4C
PR1	EE306	Electrical Machines-II Lab	002	10	20	70	100	2C
PR2	EE307	Modern Instrumentation Lab	002	10	20	70	100	2C
PR3	*EE308	Power System Lab	002	10	20	70	100	2C
PR4	EE309	Minor Project-I		10	20	70	100	4C*
	Industrial Training (Durations 4 weeks in winter vacation at the end of V th semester)							
	TOTAL		**26 hrs**				**1000**	**30**

Note: VS credit is not included in the total Credits
Subjects mark with asterisk (*) are common with EEE

SCHEME FOR B.Tech. SIXTH SEMESTER (ELECTRICAL ENGINEERING)

S.No.	Course No.	Subject	LTP	Evaluation			Total Marks	Credit Type
				Assignment	Mid-Sem	End - Sem		
TH1	*EE311	Electrical Drives	310	10	20	70	100	4C
TH2	EE312	Flexible AC Transmission Systems	310	10	20	70	100	4C
TH3	*EE313	Microcontroller and Embedded System	310	10	20	70	100	4C
TH4	EE 314	Principles of Communication	310	10	20	70	100	4C
TH5	EE 315	Digital Signal Processing	310	10	20	70	100	4C
PR1	*EE316	Power Electronics and Electrical Drives Lab	002	10	20	70	100	2C
PR2	*EE317	Microprocessor and Microcontroller Lab	002	10	20	70	100	2C
PR4	*EE318	Viva- Voce Examination of V-Sem of Industrial Training	-	10	20	70	100	2A
VS1	EE 319	Minor project	002	10	20	70	200	4C
	Industrial Training (Durations 12 weeks in Summer vacation at the end of VIth semester)							
	TOTAL		**26 hrs**				**1000**	**30**

Note: VS credit is not included in the total Credits
Subjects mark with asterisk (*)are common with EEE

SCHEME FOR B.Tech. SEVENTH SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assign ment	Mid-Sem	End - Sem		
TH1	EE 401	Design of Electrical Systems	310	10	20	70	100	4C
TH2	EE 402	Switch Gear and Protection	310	10	20	70	100	4C
TH3	EE 403	Elective I	310	10	20	70	100	4C
TH4	EE 404	Open Elective I	310	10	20	70	100	4C
PR1	EE 406	Design of Electrical Systems Lab	003	10	20	70	100	3C
PR2	EE 407	Digital Signal Processing Lab	003	10	20	70	100	3C
PR3	EE 409	Viva Voce Examination of VI Industrial Training	-	10	20	70	100	4A
PR4	EE 410	Major Project (Part-I)		10	20	70	100	4C
	TOTAL		**18 hrs**				1000	30

Elective-I	**Open Elective I**
EE 403-1 Generalized Machines	**EE 404-1 Biomedical Instrumentation**
EE 403-2 Distributed Generation Systems.	**EE 404-2 2 Power System Stability**
EE 403-3 Power System Communication	**EE 404-3 Restructured Power System**
EE403-4 Electric Traction and Drives	**EE 404-4 Power Plant Engineering**
EE 403-5 High Voltage Engineering	**EE 404-5 Intellectual property rights and Entrepreneurship**
EE 403-6 Advanced control system	**EE 404-6 Database management System**

SCHEME FOR B.Tech. EIGHTH SEMESTER (ELECTRICAL ENGINEERING)

S.No.	*Course No.*	*Subject*	*LTP*	*Evaluation*			*Total Marks*	*Credit Type*
				Assignment	Mid-Sem	End - Sem		
TH1	EE 411	HVDC Transmission System	310	10	20	70	100	4C
TH2	EE 412	Elective II (Open)	310	10	20	70	100	4C
TH3	EE 413	Elective II	310	10	20	70	100	4C
PR1	EE 415	Switchgear and Protection Lab	003	10	20	70	100	3C
PR2	EE 416	Elective II Lab	003	10	20	70	100	3C
PR3	EE 417	Project (Part-II)		10	20	70	400	10C
PR4	EE 418	Seminar / Report		10	20	70	100	2C
	TOTAL		**18 hrs**				**1000**	**30**

Elective II	**Open Elective -II**
EE 412-1 Digital & Optical Communication Systems	**EE 413-1- Power System Planning**
EE 412-2 Telemetry & SCADA Systems	**EE 413-2 Soft Computing Techniques**
EE 412-3 Operating System Design	**EE 413-3 Optimal Control Theory**
EE 412-4 Computer Control of Processes	**EE 413-4 Active and Passive Network Synthesis**
EE 412-5 VLSI Design	**EE 413-5 Power Plant Instrumentation**
EE 412-6 Power System Dynamics and Control	**EE 413-6 Reliability Engineering**

B.Tech. I- Year, I Semester
Theory Paper – I (Common to all Branches)

MA-101 Mathematics – I

L	T	P	Credits
3	1	0	4

Unit I: Infinite series: Tests for convergence of series (comparison, ratio, root, integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence. (**5L**)

Unit II: Calculus of single variable: Taylor's & Maclaurin's expansion, Radius of curvature, applications of definite integral to area, arc length, surface area and volume (in Cartesian, parametric and polar co-ordinates).

Unit III: Calculus of several variables: Partial differentiation, Euler's theorem, total differential, Taylor's theorem, Maxima-Minima, Lagrange's method of multipliers, Application in estimation of error and approximation.

Unit IV: Multiple Integrals: Double integral (Cartesian and polar co-ordinates), change of order of integration, triple integrals (Cartesian, cylindrical and spherical co-ordinates), Gamma and Beta functions. Applications of multiple integration in area, volume, centre of mass, and moment of inertia.

Unit V: Vector Calculus: Continuity and differentiability of vector functions, Scalar and vector point function, Gradient, Directional Derivative, divergence, curl and their applications. Line integral, surface integral and volume integral, applications to work done by the force . Applications of Green's, Stoke's and Gauss divergence theorems.

Unit VI: Function of Complex Variable: Definition of complex function. Circular, Hyperbolic, and Logarithmic functions. Inverse of Circular, and Hyperbolic functions.

Suggested Readings:

1. Advanced engineering mathematics: Alan Jeffery ; Academic Press
2. Calculus and analytic geometry: Thomas/Finney; Narosa.
3. Advanced engineering mathematics: Kreyszig; Wiley.
4. Advanced engineering mathematics: Taneja ; I K international
5. Advanced engineering mathematics: Jain/Iyenger; Narosa.

B.Tech. I- Year, I Semester
Theory Paper –II (Common to all Branches)

HU-102 Communication Skills

L	T	P	Credit
2	1	0	3

Unit I: Functional English:

(A) Parts of speech; Tense and concord; Conditional clauses**;** Question tags & short responses; Punctuation; Common errors.(B) **Vocabulary and Usage: Synonyms & Antonyms; One word substitutions; Words often confused; Idioms / Idiomatic expressions.**

Unit II: Basics of Writing:
(A) Presentation of Technical Information: Technical description of simple objects, tools, appliances; Processes and operations; Scientific Principles; Definitions ; Interpretation of Visual Data (graph, charts etc)
(B) Writing of: Paragraph; Summary and Abstract; Taking and Making Notes.
(C) Comprehension of Unseen Passages based on reading exercises like Skimming, Scanning and Inference making.

Unit III: Oral Communication: Phonetics: Speech Sounds and their articulation; Phonemes, syllable, Stress, Transcription of Words and Simple Sentences; Presentation and Seminar; Language Lab Practice for Oral Communication

Unit IV: Texts for Appreciation and Analysis:

(A) *Wings of Fire* by APJ Abdul Kalam
(B) *The Fortune at the Bottom of the Pyramid by C.K. Prahalad.*
(C) *The Branded (Uchalya)* by Laxman Gaikwad
(D) *Geetanjali by Ravindranath Tagore.*

Suggested Readings:

1. Day, Robert A. *Scientific English: A Guide for Scientists and Other Professionals.* UP.
2. Maison Margaret , *Examine Your English*, New Delhi: Orient Longman.
3. Tikoo M.L., A.E. Subramaniam and P.R. Subramaniam. *Intermediate Grammar Usage and Composition.* Delhi: Orient Longman.
4. Weiss, Edmond H. *Writing Remedies: Practical Exercises for Technical Writing*. University Press.
5. Lesikar and Flatley. *Business Communications*. New Delhi, Biztantra Press.
6. O'Connor, *Better English Pronunciation,* Cambridge: Cambridge University Press.
7. Gaikwad, Laxman, *The Branded*, Delhi: Sahitya Akademi.
8. Kalam, APJ Abdul, *Wings of Fire,* Delhi: University Press.
9. *C.K. Prahalad, The Fortune at the Bottom of the Pyramid, Wharton School Publishing.10.* Rabindranath *Gitanjali, Filiquarian Publishing, LLC.*

B.Tech.I –year, I- Semester
Theory Paper – III (Common to all Branches)

PH-103 Applied Physics

L	T	P	Credits
3	1	0	4

Unit I: Relativity:

Review of concepts of frames of reference and Galilean transformation equation, Michelson – Morley experiment and its implications, Einstein's special theory of relativity, Lorentz transformation equations, Law of addition of velocities, Mass variation with velocity, Concept of energy and momentum, Mass energy relation.

Unit II: Oscillations, waves: Damped and forced oscillations, Resonance (amplitude and power), Q – factor, Sharpness of resonance. Equations of longitudinal and transverse waves and their solutions, Impudence, Reflection and transmission of waves at a boundary, Impudence matching between two medium.

Unit III: Physical optics: Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Frannhoffer diffraction, Zone plate, single slit and N-slit / grating, Resolving power of telescope, prism and grating.

Polarization by reflection and by transmission, Brewster's law, Double refraction, elliptically and circularly polarized light, Nichol prism, Quarter and half wave plates.

Unit IV: Optical Instruments: Cardinal points of co-axial lens systems, spherical and chromatic aberrations and their removal, Huygens and Ramsden's eyepiece.

Unit V: Laser optics: Coherence and coherent properties of laser beams, Brief working principal of lasers, Spontaneous and stimulated emission, Einstein's co-efficient, Ruby laser, He-Ne laser.

Optical Fiber:

Classification of optical fibers, Refractive index profile, Core cladding refractive index difference, Numerical aperture of optical fiber, Pulse dispersion in optical fiber (ray theory).

Suggested Readings:

1. Physics of vibrations and waves by H.J. Pain
2. Vibrations and waves by A.P. French
3. Perspective of Modern Physics by Authors Beiser
4. Optics by A. Ghatak
5. Berkley Physics Course Vol -- 1

B.Tech.I –year, I- Semester
Theory Paper – IV (Common to all Branches)

CH 104 : Applied Chemistry **L T P Credits**
3 1 0 4

Unit I: (a)Conventional Analysis: Volumetric Analysis, Types of titrations, Theory of indicators.**2L(b) Spectral Analysis:** Electromagnetic radiation, Lambert-Beer's Law, UV-VIS, IR, instrumentation & applications.

Unit II: Thermal Methods of Analysis: principle, working and applications of Thermogravimetry, Differential thermal analysis and Differential scanning calorimetry.

Unit III: (a) Polymers: Monomer & polymer, functionality and Degree of Polymerization. Mechanism of polymerization. Molecular weights of polymers. Methods of polymerization. Industrial production of PE and PF resins. Industrial applications of polymers. **Bio-molecules:** Classification, Structure, physical and chemical properties of Amino-acids, Peptides and Proteins, Carbohydrates, Cellulose and its derivatives, RNA, DNA. Introduction to Bio-degradable Polymers

Unit IV: Electrochemistry: Electrochemical cells: components, characteristics of batteries. Primary and Secondary battery systems: Zinc-Carbon cells, Lead storage and lithium batteries. Fuel Cells, Electro-

deposition: Electrical and chemical requirements. Electroplating bath and linings. Agitation, Circulation and filteration equipment. Plating of copper, gold and rhodium.

Unit V: Phase Equilibrium: Definitions of Phase, component and degree of freedom, Gibb's phase rule. One component systems: Water and sulphur. Two component systems: Pb-Ag and Cu-Ni system.

Unit VI: Green Chemistry: Introduction, Goals & Significance of Green Chemistry. Reagents, solvents and catalysts for green synthesis. Principles of Green Chemistry, Evaluation of feedstocks, reaction types and methods. Future trends in Green Chemistry.

Suggested Readings:

1. T. Hatakeyama, F.X. Quinn, Thermal Analysis; Wiley.
2. A.I. Vogel, Inorganic Quantitative analysis.
3. Skoog D.A., Instrumental method of analysis; HRW International.
4. P.T. Anastas & JC Warner, Green Chemistry: Theory & Practice, Oxford Univ Press.
5. Billmeyer, Polymer Science and Technology, John Wiley.
6. Fried, Polymer Science and Technology, Prentice Hall

B.Tech.I year, I Semester

Theory Paper-V (Common to all Branches)

EE – 105 Electrical Sciences

L	T	P	Credits
3	1	0	4

Unit I: Introduction: Role and importance of circuits in Engineering, concept of fields, charge, current, voltage, energy and there interrelationship. V-I characteristics of ideal voltage and ideal current sources, various types of controlled sources. Passive circuit components: V-I characteristics and ratings of different types of R, L, C elements.

Unit II: DC Network: Series circuits and parallel circuits, power and energy, Kirchoff's Laws. Delta-star conversion, Superposition Theorem, Thevenin's Theorem, Norton's theorem, Maximum Power Transfer Theorem, Tellgen Theorem.

Unit III: Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, complex representation of impedance, series and parallel circuits, concept of phasor, phasor diagram, power factor, power in complex notation, real power, reactive power and apparent power. Resonance in series and parallel circuits, Q-factor, bandwidth and their relationship, half power points.

Unit IV: Three-Phase AC Circuits: Three phase EMF generation, delta and Y connection, line and phase quantities. Solution of three phase circuits: balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits.

Unit V: Magnetic Circuits & Transformers: Amperes circuital law, B-H curve, concept of reluctance, flux, MMF, analogies between electrical and magnetic quantities solution of magnetic circuits. Hysteresis and eddy current losses, application of magnetic force, mutual inductance and dot convention. Single phase Transformer construction, principle of working, auto transformer and their applications.

Unit VI: Three Phase and Single Phase Induction Motor: Construction, Principle of operation, types of motors applications.

Unit VIII: Measuring Instruments: Analog indicating instruments, devices, Damping devices, PMMC ammeters and voltmeters, shunt and multipliers, Moving iron ammeter and voltmeters, dynamometer type wattmeters, multimeters, AC watt-hour meters. Digital electronic voltmeters, digital electronic ammeters and wattmeters.

Suggested Readings:

1. C.L. Wadhwa, Basic electrical Engineering, 4th Edition, New Age International.
2. Fitzereld, Higgenbotham & Grabel, Basic Electrical Engineering, McGraw hill International.
3. Vincent Deltoro, Electrical Engineering Fundamentals, Prentice Hall International (EEI).
4. Relevant Indian Electricity Supply rules & BIS codes.

B.Tech.I year, I Semester
Theory Paper-VI (Common to all Branches)

IT - 106 Fundamentals of Information Technology

L	T	P	Credits
2	1	0	3

Introduction to Information Technology

Unit – I : Fundamental Concepts of Information: Definition of information, Data Vs Information, Introduction to Information representation in Digital Media, Text, image, graphics, Animation, Audio, Video etc., Need, Value and Quality of information

Unit – II : Concepts in Computer & Programming: Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers, Memory, different types of memory, Computer Hardware - CPU, Various I/O devices, Peripherals, Firmware and Humanware.

Unit – III : Programming Language Classification & Program Methodology: Computer Languages, Generation of Languages, Translators, Interpreters, Compilers, Flow Charts, Dataflow Diagram, Assemblers, Introduction to 4GL and 5GL.

Unit – IV : Digital Devices and Basic Network Concepts: Digital Fundamentals: Various codes, decimal, binary, hexa-decimal conversion, floating numbers gates, flip flops, adder, multiplexes, Introduction to Data Transmission.

Unit – V : Data Communication & Networks: Computer Networks- Introduction of LAN, MAN and WAN. Network Topologies, Client-server Architecture.

Unit – VI : Internet and Web Technologies: Hypertext Markup Language, DHTML, WWW, HTTP, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email, Safety of Business Transaction on web. Elementary Concepts of E-Learning and E-Commerce, Electronic Payment Systems, Digital Signatures, Firewall.

Suggested Readings:

1. Using Information Technology: A Practical Introduction to Computers & Communications by William Sawyer & Hutchinson, Publisher: Tata McGraw-Hill.
2. Introduction to Computers by Peter Norton Tata McGraw-Hill.
3. Rajaraman, “Introduction to Computers “, PHI
4. Nelson, “Data Compression”, BPB
5. CIS Tems, “Internet, An introduction” Tata McGraw Hill.

6. Curtin, "Information Technology: Breaking News", TMH.
7. Leon & Leon "Fundamentals of Information Technology", Vikas.
8. Lehngart, "Internet 101", Addison Wesley.

B.Tech.I year, I Semester Examination Practical Paper I (Common to all Branches)
B.E.I year, I Semester Examination
Practical Paper I (Common to all Branches)

PH-107 Physics Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding PH-103

B.E.I year, I Semester Examination
Practical Paper II (Common to all Branches)

CH-108 Chemistry Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding PH-104

B.E.I year, I Semester Examination
Practical Paper III(Common to all Branches)

EE-109 Electrical Sciences Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding PH-105

B.E.I year, I Semester Examination
Practical Paper IV(Common to all Branches)

IT-110 Fundamental of IT Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding PH-106

B.TECH.I year, II Semester Examination
Theory Paper-I (Common to all Branches)

MA- 111 Mathematics-II

L	T	P	Credits
3	1	0	4

UNIT 1 Matrices: Rank inverse and normal form of a matrix using elementary transformation. Consistency of linear system of equations; subspaces, linear dependence / independence, basis, dimension, linear transformation, eigen-values and eigen vectors of a matrix, Caylay Hamilton theorem, diagonalization, properties of eigen values and eigen vectors of Hermitian, skew – Hermitian, and unitary matrices.

UNIT II Ordinary differential Equations: Exact equations, integrating factor, linear equations. Bernoulli's equation, Orthogonal trajectories. Existence and Uniqueness of solution. Second and higher order linear differential equation with constant coefficients, Wronskian, general solution of homogenous and non-homogenous equations, method of variation of parameters and undetermined coefficients, Euler-Cauchy equation. Simultaneous linear equations. Power series method, Lagendre equation, Lagendre polynomials Bessel equations properties of Bessel functions.

UNIT III Laplace transformation: Basic properties, laplace transform of derivatives and integrals, Derivation and Integration of Laplace transform, convolution theorem Laplace of periodic function. Laplace transform solution of IVP and system of linear differential equations. Unit step function.

UNIT IV Fourier series, integrals and Transforms: Periodic functions fourier series, Functions of any period .Even and odd functions, Half range series, complex Fourier series, harmonic analysis. Fourier Transforms. Sine and Cosine Transforms. Transforms of derivatives and integrals convolution theorem and applications to boundary value problem in ordinary differential equations.

Suggested Readings:

1. Advanced engineering mathematics : Jain / Iyenger: Narosa
2. Advanced engineering mathematics : Kreyszig; wiley
3. Advanced engineering mathematics : Greenberg; pearson Education
4. Advanced engineering mathematics Vol. I & II ; Taneja I.K. International

B.TECH.I year, II Semester Examination
Theory Paper-II (Common to all Branches)

EN – 112 Environmental Sciences

L	T	P	Credits
2	1	0	3

UNIT I Bioenergetics and Metabolism : ATP cycle, glycol sis, Citric acid cycle, Electron transport, photosynthesis, amino acid metabolism. Enzyme classification and Kinetic, Genetic manipulations, recombinants etc.

UNIT II Ecology : Relevance of ecology, environmental deterioration in terms of water, air, land.

Ecological Principles : Ecosystem, production, consumption and decomposition, carbon, Nitrogen, Sulpher, Phosphorous Cycles.

UNIT III Organization and dynamics of ecological communities : Terrestrial ecosystem & aquatic ecosystem, structural and functional aspects of ecosystems, ecological succession.

Ecological strain due to human activity : Water pollution, Air pollution, land use etc. Used of Eco technological approach for pollution control.

Introduction to Disaster Management : Natural & Man made

UNIT IV Environmental Pollution: Definition- Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g)

Nuclear hazards – Soil waste management: Causes, effects and control measures of urban and industrial wasters- Role of an individual in prevention of pollution- pollution case studies- Disaster Management: floods, earthquake, cyclone and landslides. Field study of local polluted site- Urban / Rural / Industrial / Agricultural.

UNIT V Social Issue and the Environment: From unsustainable to sustainable development- Urban problems related to energy – Water conservation, rain water harvesting, watershed management- Resettlement and rehabilitation of people; its problems and concerns, case studies- Environmental ethics: Issues and possible solutions- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.- Wasteland reclamation- Consumerism and waste products- Environment production act- Air (Prevention and Control of Pollution) act – Water (Prevention and control of pollution) act – Wildlife protection act – Forest conservation act Issues involved in enforcement of environmental legislation – Public awareness.

Suggested Readings:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Eduction, 2004.
2. T.G. Jr. Miller, 'Environmental Science', Wadsworth Publishing CO.
3. C. Townsend, J. Harper and Michael Begon, Essentials of Ecology', Blackwell Science.
4. R.K. Trivedi and P.K. Goel, 'Introduction to Air Pollution', Techno-Science Publications.
5. Bharucha Erach, 'The Biodiverstiy of India', Mapin Publishing Pvt. Ltd., Ahmedabad India, mail:mapin@icenet.net.
6. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
7. Cunningham, W.P. Cooper, T.H. Gorhani, 'Envirnmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
8. K.D. Wager, 'Environmental Managemnt', W.B. Saunders Co., Philadelphia, USA, 1998.

B.TECH. I- Year, II- Semester Examination
Theory Paper- III, (Common to all Branches)

AS – 113 Applied Sciences

L	T	P	Credits
3	1	0	4

Section – A (Physics)

UNIT I Quantum Physics: Failure of classical physics, Compton effect, Pair production, de Broglie relation, wave function, probability density, Schrodinger wave equation operators, expectation values and eigen value equation., particle in a box, simple harmonic oscillator problem, concept of degeneracy and tunneling.

UNIT II Classical and Quantum Statistics: Statistical Physics: Microscopic and macroscopic systems, concepts of phase space basic postulates of statistical mechanics, Maxwell – Boltzmann distribution law. Quantum statistics: Fermi – Dirac and Bose – Einstein distribution, Fermi – Dirac probability function, Fermi energy level.

UNIT III Nuclear Physics: Nuclear properties, constituent of the nucleus, binding energy, stable nuclei, radioactive decay law α and β–spectrum, Q-value of nuclear reaction, nuclear models – Liquid drop and shell model, nuclear fission and fusion, Breeder reactors, Fusion reactor. Vibrations in nuclear reactor during fission, measurement of these vibrations.

Section-B (Bio-Technology)

UNIT IV DNA Structure: Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT & GC pairing, DNA model Genes, chromos, mutuation and cross over functions, input function of a gene, Cell-Cell variability in gen expression.

UNIT V Neuron Physiology, Cell Membrane Structure, Membrane Proteins, Membrane Strength, Sodium Pump, Cell Resting Potential, Action Potential (Cell Firing), The Axon, The Synapse, The Synapse as a Biocomputer, Types of Synapses, Developing Neuron (Forming Networks), Cell's Biological Memory.

Suggested Readings:

1. Stamatios. V.Kartalopoulos, Understanding Neural Networks & Fuzzy logic, Basic concepts & Application, IEEE Press 445 Hoes Lane, P.O. Box 1331 Piscataway, NJ 08855-1331
2. M.R. Srinivasan, Physics for Engineers, New Age International Publishers, 2001.
3. Erwin Kaplan, Nuclear Physics.

B.TECH. I- Year, II- Semester Examination
Theory Paper- IV, (Common to all Branches)

AS- 114 Engineering Materials

L	T	P	Credits
3	1	0	4

SECTION – A (Physics)

UNIT I Crystal Structure: Bravis lattices ; Miller indices ; Simple crystal structures, different kinds of bending.

Metallic Conduction: Energy distribution of electrons in a metal, Fermi level, conduction process.

UNIT II Semi Conductors: Band theory of solids. P and N type of semiconductors, statistics of holes and electrons, Hall effect, Effect of temperature on conductivity, Life time and recombination, draft and diffusion in PN junction Transistor action.

Magnetic Materials: Dia-para, Ferro-magnetism, Antiferro, ferri, ferro-magnetism ferrites.

SECTION – B (Chemistry)

UNIT III Composite Material: Introduction, Limitations of conventional engineering materials, role of matrix in composites, matrix materials, reinforcements, metal matrix composites, polymer matrix composites, ceramic matrix composites carbon-carbon composites. Environmental effects on composites, applications of composites.

UNIT IV Conducting Polymers: Introduction, different approaches for making conducting polymers, inherently conducting polymers, photo conducting polymers, applications of conducting polymers.

UNIT V Bio-Materials: Introduction, proteins, polynucleotides, polysachharides, cellulories, applications.

Nano-Materials: Introduction, properties of nanoparticles, carbon clusters, carbon nanotubes and their applications, nanocomposites.

Suggested Readings:

1. Wahab M.A. Solid State Physic@Narosa Publishing house, New Delhi, 1999.
2. Kittel, Solid State Physics, 7th Edition, J.W. & Sons Publication
3. Pillai S.O., Solid State Physics, New Age International Publication
4. Ali Omar M., Elementary Solid State Physic, Pearson Education(Singapore) Pvt. Ltd., India Branch, New Delhi, 2002.
5. Kenneth G. Budinski, Michel, K., Buinshi, Engineering Materials Properties and Selection. 7th Edition, Pearson, Singapore (Prentice Hall), 2002.
6. Wang M.N., Polymers for electronic and photonic applications, Wiley New York, 1994.

B.TECH. I- Year, II- Semester Examination

Theory Paper- V (Common to all Branches)

ME – 115 Mechanical Sciences

L	T	P	Credits
3	1	0	4

UNIT I

Review of Basic Laws:

Force, Moment of a force, couple, equivalent force system, equation of equilibrium, solution of simple plane trusses by analytical and graphical methods, frictional force, first moment and second moment of area.

UNIT II

Simple Stresses and Strains: Description of tensile, compressive shear and volumetric stresses and strains complementary shear stress, lateral strain and Poison's ratio.

Bending Moment and Shear Force Diagrams: Cantilevers and simply supported beams carrying various types of loads. Theory of Simple Bending. Determination of bending stresses: deflection of beams.

UNIT III

Fluid Mechanics: Fluid and flow, fluid properties. Pressure variation in a static fluid, Hydrostatic forces on plane and curved surfaces, Stability of submerged and floating bodies. General description of fluid motion, stream lines, continuity equation, particle acceleration, velocity gradient, rotation and rate of strain.

Manufacturing Process: Functions and principle of working of drilling, lathe, milling, shaper and universal lathe.

UNIT IV

Sheet Metal Work: Common Processes, tools and equipment; metals used for sheets; standard specification for sheets.

Bench Work and Fitting: Fitting sewing, chipping thread cutting(die), tapping, study of hand tools, marking and marking tools.

UNIT V Materials: Bearing metals, high temperature metals, cutting tool materials.

Casting processes: Principals of metal casting , pattern materials, types and allowance.

Smithy and Forging: Basics operations

Metal joining : Welding Principals, classification of welding techniques,.

B.TECH. I- Year, II- Semester Examination
Theory Paper- VI, (Common to all Branches)

COE– 116 Principles of Programming Languages

L	T	P	Credits
2	1	0	3

UNIT 1 INTRODUCTION :--The Role of Programming Languages :

Toward Higher-Level Languages, Problems of scale, Programming Paradigms, Language Implementation.

Language Description-Syntactic Structure: Expression Notation, Abstract Syntax Trees, Lexical Syntax, Context-Free Grammars, Grammars, for Expressions, Variants of Grammars.

UNIT II IMPERATIVE PROGRAMMING:-Statements: Structured Programming

The Need for Structured Programming, Syntax-Directed Control Flow, Design Considerations : Syntax, Handling Special Cases in Loops, Programming with Invariants, Proof Rules for Partial Correctness, Control flow in C.

Types : Data Representation : The Role of Type, Basic Types, Arrays: Sequences of Elements, Records : Named Fields, Unions and Variant Records. Sets, Pointers: Efficiency and Dynamic Allocation, Two String Tables, Types and Error Checking.

Procedure Activations: Introduction to Procedures, Parameter-Passing Methods, Scope Rules for Names. Nested Scopes in the Source Text. Activation Records, Lexical Scope: Procedures as in C, Lexical Scope: Nested Procedures and Pascal.

UNIT III OBJECT PROGRAMMING:-Groupings of Data and Operations: Constructs for program Structuring, Information Hiding, Program Design with Modules, Modules and Defined Types, Class Declarations in C++, Dynamic Allocation in C++, Templates: Parameterized Types, Implementation of Objects in C++.

Object Oriented Programming: What is an Object?, Object – Oriented Thinking, Inheritance, Object - Oriented Programming in C++, Derive Classes and Information Hiding, Objects in Small talk

UNIT IV FUNCTIONAL PROGRAMMING:

Elements of Functional Programming: A Little Language of Expression, Types: Values and Operations, Functions Declarations, Approaches to Expression Evaluation, Lexical Scope, Type Checking.

Functional Programming in a Typed Language: Exploring a List, Function Declaration by Cases, Functions as First – Class Values, ML : Implicit Types, Data Types, Exception Handling in ML (Meta Language).

Functional Programming with Lists: Scheme, a Dialect of Lisp, Structure of Lists, Lists Manipulation, A Motivating Example: Differentiation, Simplification of Expression, Storage Allocation of Lists.

B.TECH. I- Year, II- Semester Examination
Theory Paper- VI, (Common to all Branches)

ME– 117 Engineering Graphics

UNIT I General: Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols, rules of printing.

Projections of Points and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.

UNIT II Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points lines in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

UNIT III Projections of Plane Figures: Different cases of plane figure (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

Projection of Solids: Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.

UNIT IV Isometric and Orthographic: First and Third angle of system of projection sketching of Orthographic views from pictorial views and vice –versa principles and type of sectioning.

Development of Surface

Suggested Readings:

1. Narayana, K.L. and Kannaiah, P., "Engineering Graphics", Tata McGraw Hill, New Delhi,1988.
2. Bhatt N.D., "Elementary Engineering Drawing", Charotar Book Stall, Anand, 1998.
3. Lakshminarayaan, V. and Vaish Wanar, R.S., "Engineering Graphics", Jain Brothers, New Delhi, 1998.
4. Chandra, A.M. and Chandra Satish, "Engineering Graphics", Narosa, 1998.

B.TECH.I year, II Semester Examination Practical Paper II (Common to all Branches)

EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT/MEPE/SE/EEE/EP/AE/SE/EEE/EP/AE

B.Tech I year, II Semester Examination
Practical Paper-II (Common to all Branches)

ME-117 Engg. Graphics

L	T	P	Credits
0	0	2	2

Laboratory Practical Based on course work corresponding ME-117

B.Tech I year, II Semester Examination
Practical Paper-II (Common to all Branches)

ME-118 Mechanical Science Lab

L	T	P	Credits
0	0	2	2

Laboratory Practical Based on course work corresponding ME-115

B.Tech I year, II Semester Examination
Practical Paper-III (Common to all Branches)

COE-119 Programming Language

L	T	P	Credits
0	0	2	2

Laboratory Practical Based on course work corresponding COE-116

B.Tech I year, II Semester Examination
Practical Paper-IV (Common to all Branches)

PE-120 Mechanical Workshop

L	T	P	Credits
0	0	3	3

Practical on drilling, lathe, milling, shaping and etc

B.TECH. (EE) II-Year, III-Semester
Theory Paper I

EE-201, Electronic Devices & circuits

L	T	P	Credit
3	1	0	4

UNIT I Introduction to Electronics: Signals, frequency spectrum of signals, analog and digital signals, amplifiers, circuit models of amplifiers, frequency response, digital logic inverters.

Diodes: Ideal diodes, physical operation and terminal characteristics, small signal models, operation in reverse breakdown region, Zener diodes, rectifier circuits, limiting and clamping circuits etc.

UNIT II Bipolar Junction Transistors:

Physical structure and modes of operation, symbols, operation in active mode, , graphical representation of transistor characteristics, Analysis of transistor circuits at DC, Transistor as an amplifier and small signal model, Transistor biasing, CE, CC and CB amplifier configurations, Transistor as switch, Large signal model of the transistor, internal capacitances and second order effects

UNIT III MOSFETs and Field Effect Transistors:

Structure and physical operation of enhancement type MOSFET, current-voltage characteristics, depletion type MOSFET, MOSFET as an amplifier, Basic single stage MOSFET amplifiers, all NMOS amplifier stages, JFETs, etc.

Differential and Multistage amplifiers: BJT differential pair, small signal and operation, differential amplifiers with active loads, MOS differential amplifiers, Multistage amplifiers, etc.

UNIT IV Frequency Response: s-domain analysis of amplifier transfer function, low frequency response of CE and CS amplifier, high frequency response of CS and CE amplifier, CB, CG and cascade configurations and their frequency response, frequency response of CC-CE cascade, frequency response of the differential amplifier etc.

UNIT V Feedback amplifiers and Oscillators: Principles of freed back in amplifiers advantages of negative feedbacks effect of feedback on impedances, Nyquist criterion for stability, Burkhausen criterion for sinusoiodal oscillators, phase shift oscillator, weinbridge oscillator, resonant circuit oscillators, crystal oscillators, frequency stability.

Suggested Readings:

1. Sedra A. S. and Smith K. C , Microelectronic Circuits, Oxford university Press, (Fifth Edition)
2. Electronic Devices & Circuit Theory Robert L Boylestad Louis Nashelsky PHI
3. Jacob. Millman, Christos C.Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2003.
4. David A.Bell, 'Electronic Devices and Circuits', Prentice Hall of India Private Limited, New Delhi, 2003.

B.TECH. (EE) II-Year, III-Semester
Theory Paper II

EE-202 Hydraulic Machines and Thermal System

L	T	P	Credits
3	1	0	4

UNIT-I

Thermodynamic equilibrium, cyclic process, enthalpy, Zero, first and second laws of thermodynamics, carnot cycle, concept of entropy, properties of steam, processes involving steam in closed and open systems, Enthalpy.

Vapour Pressure Cycles: Rankine cycle, reheat cycle, Regenerative cycle

UNIT-II

Steam Turbine: Classification, impulse and reaction turbines their velocity diagrams and related calculations, work done and efficiencies, re-heat factor, staging, bleeding and governing of turbines.

Gas Turbine: Classification, Brayton cycle, working principle of gas turbine, gas turbine cycle with intercooling, reheat and regeneration, stage and polytrophic efficiencies.

UNIT-III

Compressors: Classification, single and multistage reciprocating compressors, isothermal and volumetric efficiencies, centrifugal and axial flow compressors, surging, choking and stalling.

I.C. Engines: Otto, Diesel . and Dual cycles, introduction to 2-stroke and 4-stroke SI and CI engines, indicator diagram and power measurement.

UNIT-IV

Impact of Jet: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve), effect of inclination of jet with the surface.

Hydraulic Turbines: Classification, heads and efficiencies, construction, working, work done and efficiency of impulse and reaction turbines.

UNIT-V

Centrifugal Pump: Classification, construction, working, work-done, efficiencies, cavitations and priming; jet pump

Reciprocating Pump: Classification, construction, working, work-done, slip and coefficient of discharge.

Suggested Readings:

1. Onkar Singh "Applied Thermodynamics" New Age International, 2006
2. R.K.Rajput " A Text Book of Hydraulic Machines" S. Chand & Co.,2008.
3. P.L.Ballany "Thermal Engineering " Khanna Publishers, 2003
4. R.K.Bansal "A Text Book of Fluid Mechanics and Hydraulic Machines" Laxmi Publications, 2006.

B.TECH. (EE) II-Year, III-Semester
Theory Paper-III

EE 203 Network analysis and synthesis

L	T	P	Credit
3	1	0	4

UNIT I Introduction to continuous and discrete signals, their classification and types, periodic waveforms and signal synthesis, LTI systems and their properties; system modeling in terms of differential equations and transient response of R, L, C circuits for impulse, step, ramp, sinusoidal and exponential signals.

UNIT II Laplace Transform: Review of properties and applications of Laplace transform of complex waveform and transient response of R, L, C series, parallel, series-parallel circuits for all kinds of excitations.

UNIT III Two port networks – z, y, h, g, ABCD, inverse ABCD parameters , their inter conversion, interconnection of two 2-port networks, concept of transforms impedance.

UNIT IV Network theorems: Reciprocity, Superposition, Thevenin, Norton, Maximum Power Transfer, Miiler and its dual, Tellegen'

Network Topology and Graph theory : introductory concepts of network graphs, cut sets, loops, cutest and loop analysis.

UNIT V Elements of Network Synthesis: Positive real functions; definition & properties, Foster's I and II, Cauer's I & II forms, Synthesis of LC, RC, RL Networks, image parameters and basics of two-port synthesis

Suggested Readings:

1. Valkenburg, M.E.“ Network analysis” PHI, 2000.
2. Decarlo & Lin “Linear circuit Analysis Oxford Universit
3. Kuo, F. F. “Network analysis and synthesis” John Weily and Sons, 2nd Edition.
4. Hayt, Kemmerly & Durbin ,” Engineering Cuircuit Analysis. TMH
5. Desoer and Kuh, “Basic Circuit Theory” McGrawhill International Student Edition.

B.TECH. (EE) II-Year, III-Semester
Theory Paper-IV EE -204

EE-204 Mathematics III

L	T	P	Credits
3	1	0	4

Unit – I : Partial differential equation:
Solution of first order equations- Lagrange, non linear first order, higher order linear equations with constant coefficients. Separation of variables, Solution of Heat, Wave and Laplace equations

Probability distribution:
Conditional probability, Bayes theorem, expected value of a random variable. Properties and applications of Binomial, Poisson and Normal Distributions.

Unit II Function of Complex variable
Analytic function, C-R equations, Cauchy’s integral theorem, Cauchy’s integral formula for derivatives of analytic function, Taylor’s and Laurent’s series, singularities, Residue theorem, Evaluation of real integrals .

Unit – III : Statistical Techniques
Moments, Moment generating functions, Skew ness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non –linear and multiple regression analysis, Probability theory.

Unit – IV : Numerical Techniques – I
Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, difference tables, Newton’s forward and backward interpolation , Lagrange’s and Newton’s divided difference formula for unequal intervals.

Unit – V : Numerical Techniques –II
Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical differentiation, Numerical integration , Trapezoidal , Simpson’s one third and three-eight rules, Solution of ordinary differential (first order, second order and simultaneous) equations by Euler’s, Picard’s and forth-order Runge-Kutta methods.

Suggested Readings :-

1. Peter V. O’Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi , 2003.
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.,2000

B.TECH. (EE) II-Year, III-Semester
Theory Paper V EE- 205

EE-205 Electrical and Electronic Measurement

L T P	Credits
3 1 0	4

Unit-I

Electrical Measurements:

Standards of measurements, errors and their statistical evaluation. Parasitic effects of circuit components, calibration: Accuracy, precision, sensitivity, resolution, noise.

Unit- II

Measurement of circuits components:

Measurements of low, medium, high resistance, insulation resistance measurement, measurement of earth resistance. Ac & DC Potentiometers, Generalized theory a.c. bridges, Wien's bridges Schearing's bridge measurements of dielectric loss, Universal bridge, self balancing bridges transformer ratio bridges and screening, multiple earth and each loop, electrostatic and electromagnetic interference, grounding techniques, vibration galvanometer and null detecting devices.

Unit- III

Magnetic measurement:

Determination of B-H curve, measurement of iron losses, instrument transformer Analog and digital instruments for measurement of frequency and phase.

Unit- iV

Measuring devices and systems: Theory and design of D' Arsonval galvnometer, concept of multi range meters, Dynamometer type wattmeter, and Induction type energy meter.

Unit- V

Electronic Measuring devices:

CRO and its applications, active, passive and current probes storage oscilloscope Multimeter, Digital Volmeter, Electronic energy meter & Electronic Wattmeter.

Suggested Readings:

1. E.O. Doeblin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. A.J. Bouwens, ' Digital Instrumentation', Tata McGraw Hill, 1997.
4. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt. Ltd, 2003.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.
6. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
7. J.B. Gupta, 'A Course in Electronic and Electrical Measurements', S.K. Kataria & Sons, Delhi, 2003.

B.TECH. (EE) II-Year, III-Semester
Theory Paper VI, EE-206

EE -206 Electrical Machines- I

L	T	P	Credits
3	1	0	4

UNIT I Electromechanical Energy Conversion: Principles of Electromechanical energy conversion & types of rotating electrical machines, salient & non-salient poles with D.C. excitation, single phase & polyphase A.C. excitation voltage generated in electrical machines with concentrated & distributed windings; mmf and flux density wave forms and electromagnetic torque in electrical machines, condition for torque production.

UNIT II D.C. Machines:- Basic parts, methods of excitation, Armature windings –lop & wave connections, armature-reaction, compensating windings, commutation, interlopes, characteristics of various types of D.C. generators, interconnected D.C. generators, characteristics of D.C. motors & starting methods, speed control, losses & efficiency testing, braking and applications. Introduction to Crossed field DC machine, Constructional features , Principles & characteristic of matadyne, Amplydyne Rosenberg Generator & Application

UNIT III Transformers :- General constructional features, type of transformers concepts of coupled circuits, voltage, current and impedance relationships, equivalent circuits & phase diagrams. Voltage regulation, losses and efficiency, all day efficiency, auto transformer copper volume, testing.

UNIT IV Transformers in 3 phase circuits: vector groups, Phase conversions- 3-phase to 1 phase, 3-phase to 6-phase, 3-phase to 2-phase and 3 phase to 12 phase, parallel operation of transformers & load sharing. Induction regulators. Special constructional features – cruciform, alternative winding arrangements, tertiary winding, cooling methodology, conservators, breather, bushels relay, alternative phase connections. Special purpose transformers: pulse, isolation, welding, rectifier and high frequency transformers.

UNIT V Induction Machines:

General constructional features of poly phase induction motors, their type, principles of operation, motor and generator action. Equivalent circuit, circuit, performance calculation, determination of equivalent circuit parameters, torque-ship characteristics, current locus, and high torque cage rotors. Starting methods, speed control, braking, and power factor control of induction motors.

Suggested Readings:

1. Nagrath I. J and Kothari D.P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 1990.
2. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', McGraw Hill Books Company, 1992.
3. Syed A. Nassar, ' Electric Machines and Power system', Volume – I Electric Machines, McGraw Hill Inc., New York 1995.

B.Tech.(EE) II year, III Semester

EE-206 Electronics Devices and Circuits lab

	L	T	P	Credits
Based on course work corresponding EE-201	0	0	2	2

B.Tech.(EE) II year, III Semester

EE-207 Electrical and Electronic Measurement

	L	T	P	Credits
Based on course work corresponding EE-205	0	0	2	2

B.Tech.(EE) II year, III Semester

EE-208 Hydraulic Machines and Thermal System

	L	T	P	Credits
Based on course work corresponding EE-202	0	0	2	2

B.Tech.(EE) II year, III Semester

EE-209 Term Paper

L	T	P	Credits
0	0	1	1

B.TECH. (EE) II-Year, IV-Semester
Theory Paper I EE-211

EE-211 Linear integrated Circuits

LT P	CREDIT
3 1 0	4

ANALOG ELECTRONICS:

UNIT-I:

Special Diodes- LED, Varactor diode, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications. Transistors as a switch.

UNIT-II

Frequency Response:

Amplifier transfer function, low and high frequency response of common emitter and common source amplifiers.

Feedback: General feedback structure; properties of negative feedback; series-series, series-shunt, shunt series and shunt-shunt feedback amplifiers.

UNIT-III:

Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, tuned oscillators- Collpits and Hartley; Crystal oscillator

Integrated Circuits and Systems:

UNIT IV

Feedback Amplifiers: General feedback structure, properties of negative feesback, basic feedback topologies, determination of loop-gain, stability problem.

Power Amplifiers: Classification of output stages of amplifiers (Class A, B, AB and C, Power BJTs, IC Power amplifiers, MOS Power transistors.

UNIT V IC OP-AMP *applications:* OP-AMP fundamentals (Brief review of differential amplifier, current mirror, active load, level shifter, output stage; ac and dc characteristics) basic building blocks using Op-AMPS, inverting/non inverting VCVS, integrators, differentiators, CCVS, Instrumentation amplifiers, Biquad filter (LP, HP, BP and notch), Oscillators, A/ D & D/A convertors.

UNIT VI Non-linear Amplifiers: Logarithmic amplifiers, Log/antilog modules, Precision rectifier, Peak detector, Sample and Hold circuits.

Reference Books:

1. Taub & Schilling "Digital Electronics"- Tata Mc Graw Hill
2. Anil K. Maini, "Digital Electronics: Principles and Integrated circuits" Wiley India Ltd, 2008
3. Millman, J. and Grabel A, "Microelectronics" Mc Graw Hill

4. Anand Kumar, “Switching Theory and Logic Design” Prentice Hall of India, 2008.
5. Aloke. K. Dutta, “Semiconductor Devices and circuits”, Oxford University Press, 2008. Sedra A. S. and Smith K. C , Microelectronic Circuits, Oxford university Press, (Fifth Edition)
6.M. H. Rashid, Microelectronic Circuits : Analysis and Design, Oxford University Press

B.TECH. (EE) II-Year, IV-Semester

Theory Paper II EE-212

EE-212 Electromagnetic Field Theory

L T P	Credits
3 1 0	4

UNIT I

Mathematical Orientation: Review of gradient curl and divergence operations. Volume, surface and line integrals, vector identities, coordinate system and transformation of vectors in various coordinate systems, dirac delta function.

UNIT II

Static Electric Fields: Coulomb force, field due to number of charges, charge density functions, Dirac delts representation of charges, fields due to various sources, scalar potential, method of evaluating fields, fields in dielectrics, polarization, D and P vectors, electric dipole and dipole moment, concept of simple medium, boundary conditions, capacitors, energy stored in electric fields, solution of Laplace equation in various coordinate system by separation of variables. Field mapping and conformal transformation, statement and interpretation of Maxwell’s equations.

UNIT III

Steady Magnetic fields: Lorentz force equation, concept of magnetic intensity and magnetic field, Boit – Savart law, magnetic vector potential, force and torque between the current carrying conductors, loops, solenoid, magnetic material, magnetic dipole M vector, calculation of inductance for simple geometries, energy stored in a magnetic field, solution of magnetic static problems by separation of variables, field mapping and conformal transformation, magnetic circuits, statement and interpretation of Maxwell’s equations.

UNIT IV

Time Dependent Fields: Generalization of Maxwell’s equations in source free medium, plane waves and plane wave reflections at conductor and dielectric interfaces; wave propagation in conducting and dielectric media, concepts of surface impedance and skin effect. Poynting Vector and Poynting Theorem

UNIT V

Guided Waves: Waves Between Parallel Planes, Transverse Electric Waves (TE), Transverse Magnetic Waves (TM), Characteristics of TE and TM Waves, Transverse Electromagnetic Wave, Velocity of Propagation, Attenuation of Wave in Parallel Planes.

Suggested Readings:

1. John. D.Kraus, ‘Electromagnetic’, McGraw Hill book Co., New York, Fourth Edition, 1991.
2. William H. Hayt, ‘Engineering Electromagnetic’, Tata McGraw Hill edition, 2001.
3. Joseph. A. Edminister, ‘Theory and Problems of Electromagnetic’, Second edition, Schaum Series, Tata McGraw Hill, 1993.
4. I.J. Nagrath, D.P. Kothari, ‘Electric Machines’, Tata McGraw Hill Publishing Co Ltd, Second Edition, 1997.
5. Kraus and flesish, ‘Electromagnetic with Applications’, McGraw Hill International Editions, fifth Edition, 1999.
6. Sadiku, ‘Elements of Electromagnetic’, Second edition, Oxford University Press, 1995.

B.TECH. (EE) II-Year, IV-Semester
Theory Paper III EE-213

EE-213 Control System-I

L T P	Credits
3 1 0	4

UNIT I

Introduction to Control System:-Linear, Non Linear, Time Varying and Linear Time Invariant System, Servomechanism, Historical Development of Automatic Control and Introduction to Digital Computer Control, Mathematical Models of Physical Systems, Differential Equations of Physical Systems, Transfer Functions, Block Diagram Algebra and Signal Flow Graphs.

UNIT II

Feed Back Characteristics of Control Systems:-Feedback and Non-feedback Systems Reduction of Parameter Variations By Use of Feedback Control Over System Dynamics By Use of Feedback Control of Effects of Disturbance Single By Use of Feedback and Regenerative Feedback.

Control Systems And Components:-DC and AC Servomotors, Synchro Error Detector, Tacho Generator and, Stepper Motors etc.

UNIT III

Time Response Analysis, Design Specifications And Performance Indices:-Standard Test Signals, Time Response of First-order Systems, Time Response of Second-Order Systems, Steady-State Error and Error Constants, Effect of Adding a Zero to a System, P, PI and PID Control Action and Their Effect, Design Specifications of Second-Order Systems and Performance Indices.

UNIT IV

Concepts of Stability And Algebraic Criteria:-The Concept of Stability, Necessary Conditions for Stability, Hurwitz Stability Criterion, Routh Stability Criterion and relative Stability Analysis.

The Root Locus Technique:-The Root Locus Concept, Construction of Root Loci, Root Contours, Systems with Transportation Lag, Sensitivity of the Roots of the Characteristic equation, MATLAB : Analysis and Design of Control Systems.

UNIT V

Frequency Response Analysis:-Correlation Between Time and Frequency Response, Polar Plots, Bode Plots, and All Pass and Minimum-Phase Systems.

Stability In Frequency Domain:-Mathematical Preliminaries, Nyquist Stability Criterion, Definition of Gain Margin and Phase Margin, Assessment of Relative Stability Using Nyquist Criterion and Closed-Loop Frequency Response.

UNIT VI

Introduction to Design:-The Design Problem, Preliminary Considerations of Classical. Design, Realization of Basic Compensators, Cascade Compensation in Time Domain Cascade Compensation in Frequency Domain, Tuning of PID Controllers. MATLAB based Frequency domain analysis of control system.

Suggested Readings:

1. Nagrath , I. J. & Gopal M. 'Control Systems Engineering' New Age International. Publishers
2. Ogata, K., 'Modern Control Engineering' Prentice Hall of India.
3. Kuo, B. C. 'Automatic Control System' Prentice Hall of India.
4. Scheultz & Melsa 'Linear Control Systems'.
5. Nise, Norman, S., "Control System Engineering' John Wiley and Sons.

B.Tech II year, IV Semester Examination
Theory Paper-IV, EE-214

EE-214 Power System - I

L	T	P	Credits
3	1	0	4

Unit-I

Power System Components: Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator

Supply System : Different kinds of supply system and their comparison, choice of transmission voltage

Transmission Lines: Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect

Unit-II

Over Head Transmission Lines: Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit ,transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading

Unit-III

Corona and Interference: Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines

Overhead line Insulators: Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency

Unit-IV

Mechanical Design of transmission line: Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers

Insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables

Unit-V

Neutral grounding: Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices

Electrical Design of Transmission Line: Design consideration of EHV transmission lines, choice of voltage, number of circuits, conductor configuration, insulation design, selection of ground wires.

EHV AC and HVDC Transmission:

Introduction to EHV AC and HVDC transmission and their comparison, use of bundle conductors, kinds of DC links, and incorporation of HVDC into AC system

Suggested Readings:

1.W. D. Stevenson, "Element of Power System Analysis", McGraw Hill,
2.C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition
3.Asfaq Hussain, "'Power System", CBS Publishers and Distributors,
4.B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
5.M. V. Deshpande, "Electrical Power System Design" Tata Mc Graw Hill.
6.M. V. Deshpandey, "Elements of Power System Design", Tata McGraw Hill,
7.Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons,
8.S. L. Uppal, "Electric Power", Khanna Publishers
9. S.N.Singh, " Electric Power Generation, Transmission& distribution." PHI Learning

B.Tech II year, IV Semester

Theory Paper-V,EE -215

EE-215 Digital Circuits and System

L	T	P	Credits
3	1	0	3

UNIT I

Review of number system; types and conversion, codes. Boolean algebra : De-Morgan's Theorem, switching functions and simplification using K-maps & Quine McCluskey method.

UNIT II

Design of Logic gates, subtractor, comparators, code converters, encoders, decoders, multiplexers and de-multiplexers. Function realization using gates & multiplexers.

UNIT III

Flip flops –

SR, D, JK and T. Analysis of synchronous sequential circuits ; design of synchronous sequential circuits – Counters, state diagram ; state reduction ; state assignment – Shift Registers. Analysis of asynchronous sequential machines, state assignment, asynchronous design problem..

UNIT IV Memories:

ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

Suggested Readings:

1. M. Morris Mano, " Digital Design', Prentice Hall of India,2002.
2. John M. Yarbrogh, 'Digital Logic, Application & Design'.
3. Charles H. Roth, 'Fundamentals Logic Design', Jaico Publishing. IV edition, 2002.
4. Floyd, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
5. John F. Wakerly, 'Digital Design Principals and Practice'. 3rd edition , Pearson Education, 2002.

B.TECH. III Year, V – Semester
Theory Paper VI EE- 215

EE-216 Electrical Machines-II

L	T	P	Credits
3	1	0	4

Unit I

Synchronous Machines:

General constructional features, methods of excitation, flux and mmf relationship, phasor diagram, non-salient pole machine, generator and motor action, salient-pole synchronous machine, two-reaction theory, phasor diagram, steady state equivalent circuit determination of synchronous reactance, effect of saturation, load characteristics effect of variation of excitation, regulation of an alternator, steady-state power flow, power-angle characteristics.Interconnected synchronous generators, control of active power by additional field winding, D.W.R., starting phenomena of synchronous motor, armature winding, solid state control of synchronous machines.

Unit II

Single phase Induction Motor:

Construction, double revolving field theory and cross field theory, starting methods, speed torque characteristics, equivalent circuits, phasor diagram and condition for maximum torque determination of equivalent circuit parameters, applications.

Unit-IV

Induction generators:

Self excited induction generator, self excitation phenomenon, selection of excitation capacitor, voltage regulation and reactive power compensation. Grid connected induction generators, doubly excited machine as induction generator for application to wind energy.

Unit- V

Electrical Transients and Dynamics of Electrical Machines:

Electrical Transients in synchronous machines, synchronous machine reactance's and time constants, Dynamics of synchronous and induction machines.

Unit –VI

Single phase AC Commutator Motors:

Single phase series motor, compensated and uncompensated motors, universal motor characteristics single phase repulsion, motors principles of operation and operating principles, characteristics and applications.

Suggested Readings:

1. Nagrath, I.J. and Kothari, D.P. 'Electric Machines', T.M.H. Publishing Co. Ltd., New Delhi 1990.
2. Fitzgerald, A.E. Charles Kingsley Jr. Stephen D. Umans, 'Electric Machinery', McGraw Hill Book Company, 1992.
3. Syed A. Nassar, 'Electric Machines and Power System', Volume I, McGraw Hill Inc., New York, 1995.

B.Tech. (EE) II year, IV Semester Practical Paper I,

EE-217 Linear integrated Circuits lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-211

B.Tech. (EE) II year, IV Semester Practical Paper II

EE-218 Control System Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-213

B.Tech (EE) II year, IV Semester Practical Paper III

EE-219 Digital Circuits and System Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-215

B.Tech. (EE) II year, IV Semester Practical Paper IV

EE-220 Term paper

L	T	P	Credits
0	0	1	1

B.TECH. III Year, VI Semester

Theory Paper – I EE-301

EE – 301 Power Electronics

L	T	P	Credit
3	1	0	4

Unit- I

Power Semiconductor Devices (PSD):

Power Diodes, Enhancement of Reverse blocking capacity, Reverse Recovery Silicon Controlled Rectifier (SCR) Structure, v-I characteristics, turn ON and turn OFF characteristic, ratings, control circuits design and protection circuits. Gate turn off thyristor (GTO) v- characteristic, turn ON, turn OFF characteristic, limitation of power handling capability, GTO snubber consideration exc., Triac and its application, power MOSFETs, operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi saturation state.

Insulated Gate Bipolar Transistors (IGBT) Basis structure, V-I characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.

Introduction to emerging devices and circuits, MOS controlled thyristors, integrated Gate Commutated Thyristor (IGCT), Power Integrated Circuits (PIC's) and smart power control chips.

Unit- II

Power Electronic Converters:

Single phase and three phase uncontrolled and controlled AC to DC converters analysis, DC to AC converters (inverters) single phase half bridge, full bridge and switch mode inverters, three phase inverter with 120^{o} and 180^{o} mode of control, Series inverter and parallel inverters, Choppers principle, first quadrant, second quadrant and multi quadrant and multi quadrant choppers and their analysis. Switch mode converters AC to AC converters, cyclo-converters topology and structure of matrix power electronics converters, converter protection and future converter applications.

Unit- III

Pulse width Modulation for Power Electronics Converters:

PWM methods, voltage control PWM, SPWM, selected harmonic elimination, minimum ripple current , current control PWM, Adaptive hysteresis band method, space vector method, performance criterion, open loop and closed loop PWM schemes etc.

Unit- IV

Motor Drives Applications:

Criterion for selecting drive components, DC motor drives, rectifier control of DC motors, chopper control of DC drives, Multi-quadrant control of chopper fed motors, closed loop control of DC drives, Introduction to Induction motor drives: Comparison of variable frequency drives. Field orientation control principles for induction motors, Introduction to synchronous motors drives and PMBLDC drives.

Unit- V

Electric Utility Applications:

Brief introduction to UPS, HVDC, Static Var compensators and STATCOM, Active filters etc.

Suggested Readings:

1. Power Electronic, Converters, Applications and Design Ned Mohan, Tore M. Undeland and William P. Robbins, John Wiley & Sons, Singapore.

2. Modern Power Electronics and Variable Frequency Drives B.K. Bose, Pearson Education, India.

3. Fundamental of Power Electronics, Robert W. Erickson and Dragon Maksimovie, Springer International Edition.

4. Modern Power Electronics, Evolution, Technology and Applications, Edited by B.K. Bose, A JAICO Book.

5. Power Semiconductor Controlled Drives, Gopal K. Dubey, Prentice Hall, Englewood cliffs, New Jersey.

6. Power Electronics and Motor Control, Shepherd, W. University Press, Cambridge.

B.TECH. III Year, V – Semester
Theory Paper II EE-302

EE-302 Modern Instrumentation Techniques

L	T	P	Credits
3	1	0	4

Unit 1

Introduction to a general instrumentation system:

1. Single line diagram and introduction to various components of a general instrumentation system.

Unit II

Signals and noise in instrumentation:

1. Introduction to deterministic and random signals.
2. Statistical representation of random signals (probability density, power spectral density and auto/ cross co-relation functions.
3. Effect of noise and interference on measurement circuits.
4. Noise sources and coupling mechanism.
5. Methods of reducing effects of noise and interference.

Unit -III

Sensing elements (transducers):

1. Potentiometers, resistance thermometers, strain gauges.
2. Capacitive sensing elements: variable, separation, area & dielectric type.
3. Inductive sensing elements: variable reluctance, LVDT and displacement sensors.
4. Velocity sensors/speed sensors.
5. Thermocouples.
6. Force, torque, acceleration, pressure sensors.
7. Piezoelectric, piezoresistive sensing elements.
8. Electrochemical sensors.

Signal conditioning in instrumentation system:

1. General properties of amplifiers.
2. Differential amplifiers.
3. Operational amplifiers: characteristics of an ideal operational amplifier, various linear circuit applications like, addition, subtraction, different ation, integration, and filtering applications (LP, BP, HP, Notch & all pass filters) IC universal filters.
4. Non linear circuit applications like, A/D, D/A conversion, S/H circuits voltage controlled as oscillators, precision rectification, peak detection voltage comparators, log/antilog amplifiers.
5. Analog multipliers, phased lock loops, IC power amplifiers, instrumentation amplifiers, etc.
6. Tran conductance amplifiers.

Unit IV

Wave form generators:

IC 555 timer, crystal controlled oscillators.

1. Triangle wave & saw tooth generator.
2. Sine wave generators.
3. Function generator (multiple op-amp type), IC function generator.

Unit –V

IC regulated power supplies

Data acquisition and communication:

1. AC carrier systems.
2. Current transmitters
3. Time division multiplexing
4. Typical DAS
5. Serial and parallel digital signal
6. Error detection and correction
7. FSK
8. Communication system for measurement different buses like, IEEE-488,

Suggested Readings:

1. Principles of measurement systems, 3rd J.P. Bentley, Pearson education.
2. Elements of electronic instrumentation and measurement, 3d. Ed. J.J. Carr, Pearson Education.
3. Students reference manual for Electronic instrumentation laboratory Stanley wolf & R.F.M. smith, PHI, 1990
4. Design and Application of analog integrated circuits Sidney soclof, PHI
5. Applications and design with analog integrated circuits, J.M. Jacob, PHI
6. Electrical & Electronic Measurement and Instrumentation, A.K. Sawhney, Dhanpat Rai & Sons.

B.TECH. III Year, V – Semester
Theory Paper III EE- 303

EE – 303 Power System II **L T P Credit**
3 1 0 4

Unit-I

Representation of Power System Components: Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit System

Symmetrical components: Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Symmetrical fault analysis: Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions

Unit-II

Unsymmetrical faults: Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Zbus using singular transformation and algorithm, computer method for short circuit Calculations

Unit-III

Load Flows: Introduction, bus classifications, nodal admittance matrix (*BUS Y*), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method

Unit-IV

Power System Stability: Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement

Unit-V

Travelling Waves:

Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipments and line against traveling waves

Unit –VI

Economic Operation of Power Systems:

Optimum generator allocations without and with transmission losses, transmission loss coefficients and their calculations, automatic load dispatching. Tie-line bias control. Introduction to load frequency control.

Suggested Readings:

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.2. C.L. Wadhwa, "Electrical Power System", New Age International.
2. Chakraborthy, Soni,Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press,2007.
5. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International
6. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
7. D.Das, " Electrical Power Systems" New Age International, 2006.
8. J.D. Glover, M.S. Sharma & T.J.Overbye, "Power System Analysis and Design" Thomson, 2008.
9. P.S.R. Murthy " Power System Analysis" B.S. Publications,2007.
10. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill
11. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.
12. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.

B.TECH. III Year, V – Semester
Theory Paper IV

EE-304 Control Systems-II

L	T	P	Credits
3	1	0	4

Unit –I

Introduction to Control System:

Linear, Non Linear, Time Varying and Linear Time Invariant System, Servomechanism, Historical Development of Automatic Control and Introduction to Digital Computer Control, Mathematical Models of Physical Systems, Differential Equations of Physical Systems, Transfer Functions, Block Diagram Algebra and Signal Flow Graphs.

Unit –II

Feed Back Characteristics of Control Systems:

Feedback and Non-feedback Systems Reduction of Parameter Variations By Use of Feedback Control Over System Dynamics By Use of Feedback Control of Effects of Disturbance Single By Use of Feedback and Regenerative Feedback.

Unit- III

Control Systems And Components:

DC and AC Servomotors, Synchro Error Detector, Tacho Generator and, Stepper Motors etc.

Unit- IV

Time Response Analysis, Design Specifications And Performance Indices: Standard Test Signals, Time Response of First-order Systems, Time Response of Second-Order Systems, Steady-State Error and Error Constants, Effect of Adding a Zero to a System, P, PI and PID Control Action and Their Effect, Design Specifications of Second-Order Systems and Performance Indices.

Unit – V

Concepts of Stability And Algebraic Criteria:

The Concept of Stability, Necessary Conditions for Stability, Hurwitz Stability Criterion, Routh Stability Criterion and relative Stability Analysis.

Unit – VI

The Root Locus Technique:

The Root Locus Concept, Construction of Root Loci, Root Contours, Systems with Transportation Lag, Sensitivity of the Roots of the Characteristic equation, MATLAB : Analysis and Design of Control Systems.

Unit- VII

Frequency Response Analysis:

Correlation Between Time and Frequency Response, Polar Plots, Bode Plots, and All Pass and Minimum-Phase Systems.

Unit- VIII

Stability In Frequency Domain: Mathematical Preliminaries, Nyquist Stability Criterion, Definition of Gain Margin and Phase Margin, Assessment of Relative Stability Using Nyquist Criterion and Closed-Loop Frequency Response.

Unit – IX Introduction to Design: The Design Problem, Preliminary Considerations of Classical.Design, Realization of Basic Compensators, Cascade Compensation in Time Domain Cascade Compensation in Frequency Domain, Tuning of PID Controllers. MATLAB based Frequency domain analysis of control system.

Suggested Readings:

1. Nagrath & Gopal 'Control Systems Engineering' New Age International. Publishers
2. Ogata 'Modern Control Engineering'.
3. Kuo B.C. 'Automatic Control System'.
4. Scheultz & Melsa 'Linear Control Systems'.
5. D' Azzo & Houpis 'Linear Control Systems' Analysis & Design.

B.TECH. III Year, V – Semester

Theory Paper V

EE-305 Microprocessor and Applications

L T P Credits

3 1 0 4

Unit- I Microprocessor Architecture:

Functional block diagram, signals, buses, memory and its interfacing, I/O ports and mapping, Timing diagram, interrupts structure, concepts of data transfer. Basic idea regarding fetching and execution of simple programmers from CPU.

Unit- II Programming in assembly Languages:

Instruction format and addressing modes, assembly language format, and data transfer, data manipulation and control instructions, programming for loop structure with counting and indexing application of look up table, subroutine, stack operation, polling and interrupt based control transfer.

Unit- III Peripheral interfacing:

Hard shaking bidirectional data transfer, study of architecture and programming peripheral interface, 8255 PP1,8251 USART, 8279 keyboard and display controller, 8253 timer/counter interface. A/D and D/A converter interfacing, serial communication.

Unit- IVArithmetic operators and algorithms:

Fixed point, floating point and fractional arithmetic operations (Addition, substation, Multiplication and division), signed arithmetic, overflow conditions, Boolean algorithm.

Unit V Applications:

Keyboard & display interface, stepper motor control application to measurement & instrumentation, distributed data acquisition system, assessment of power factor, real & reactive power.

Suggested Readings:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi, 1995.
2. Muhammad Ali Mazidi & Janice Gilli Mazdi, 'The 8051 Micro Controller and Embedded Systems', Pearson Eduction, 5th Indian reprint, 2003.
3. William Kleitz, 'Microprocessor and Micro Controller Fundamental of 8085 and 8051 Hardware and Software', Pearson Education, 1998.

B.TECH. III year, V – Semester Practical Paper I

EE-306 Electrical Machines – II Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-216

B.TECH. III year, V – Semester Practical Paper II

EE-307, Instrumentation Techniques Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-302

B.TECH. III year, V – Semester Practical Paper III

EE-308, Microprocessor and Applications Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE-305

B.TECH. III year, V – Semester Practical Paper IV

EE-309 Minor Project

L	T	P	Credits
0	0	2	4

B.TECH. III Year, VI Semester
Theory Paper – I

EE – 311 Electrical Drives

L	T	P	Credit
3	1	0	4

Unit- I

Synchronous Reluctance Motors:

Constructional features-Types – Axial and radial air gap motors – Operating principle – Reluctance – Phasor diagram – Characteristics – Vernier motor.

Unit- II

Stepping Motors:

Constructional features –Principle of operation – Variable reluctance motor –Hybrid motor –Single and multi stack configurations –Theory of torque predictions – Linear and Non linear analysis – characteristics – Drives circuits.

Unit- III

Switched Reluctance Motors:

Constructional features – Principle of operation – Torque prediction – power controllers – Non liners analysis – Microprocessor based control – Characteristics – Computer control.

Unit- IV

Permanent Magnet Synchronous Motors:

Principle of operation – EMF and torque equations – Reactance – phasor diagram – Power controllers – converter – volt – ampere requirements – torque speed characteristics – Microprocessor based control.

Suggested Readings:

1. T.J. E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drivers', Clarendon Press, Oxford, 1989.
2. P.P. Aearmley, 'Stepping Motors, - A guide to Motor Theory and Practice', Peter Perengrinus, London, 1982
3. T. kenjo, ' Stepping Motors anad Their Microprocessor controls', Clarendon Press London, 1984
4. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988

B.TECH. III Year, VI Semester
Theory Paper – II

EE-312 Flexible AC Transmission Systems

L	T	P	Credit
3	1	0	4

Unit- I

Economics of Generation, Transmission and Utilization:
Fixed and running charges, tariffs, load factor, diversity factor and their influence on the energy cost; load curves, load duration curves; Kelvin's Law, selection of transmission voltages, generation of corona currents, losses, propagation etc.

Unit- II

Inter connected Operation:
Role of pumped storage station in an interconnected system, hydro-thermal economic operations.

Unit- III

System representation:
Single line representation per unit system, modeling of Power System Components.

Unit- IV

Load flows:
Establishing the basic load flow equations including voltage regulated bus, numerical techniques for the solution of load flow equations.

Suggested Readings:

1. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. C.L.Wadha, Electric Power Systems, New Age International Publications(p) Ltd., New Delhi
3. I.J.Nagrath, D.P.Kothari, Power System Engineering, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
4. Hadi Saadat, Power System Analysis, Tata Mc-Graw Hill Publishing Co., Ltd.
5. D.P.Kothari, I.J.Nagrath, Modern Power System Analysis, Tata Mc Graw Hill Publishing Co., Ltd.
6. Allen J.Wood, B.TECH.Wollegberg, Power Generation Operation and Control, Johan Willey and Sons
7. Soni, Gupta, Bhatnagar, A Course in Electrical Power Dhanpat Rai and Sons, New Delhi

B.TECH. III Year, VI Semester
Theory Paper – III

EE – 313 Microcontroller and Embedded System

L	T	P	Credit
3	1	0	4

Unit- I

8051 Architecture:
Basic organization – 8051 CPU structure – Register file – Interrupts – Timers – Port circuits – Instruction set – Timing diagram – addressing modes – Simple Program and Applications.

Unit- II

Peripherals and Interfacing of 8051:
Typical Bus structure – Bus – memory organization – Timing characteristics – Extended Model and Memory Interfacing – Polling – Interfacing Basic I/O devices – Analog and Digital interfacing – PWM mode operation – Serial port application.

Unit- III

Peripherals and Interfacing of 8096:
Analog Interface – Serial Ports – Watch dog timers – Real Time Clock – Multitasking – Bus control – Memory Timing – External ROM and RAM expansion – PWM control – A/D interfacing.

Unit- IV

Case Study Using 8051 and 8096:
Real Time clock – DC Motor Speed Control – Generation of Gating Signals for Converters and Inverters – Frequency Measurement – Temperature Control. Organization of a microprocessor, register organization, C.P.U. Description of timing and control units, interfacing memory & I/O devices Synchronous & Asynchronous data transfer, Interrupt, Polling, DMA, Introduction to Pentium and Pro-Pentium microprocessor. Basic organization of 8051, 8097, MC68HC11, PIC16CXX, SLK-51 microcontrollers, instruction set- timing diagram, address modes, simple program and applications.

Unit- V

Embedded system :
Embedded system and their components, categories of embedded systems. Stand alone, Real time Networked and Mobile etc., Requirements of embedded systems. Reliability, cost effectiveness, low power consumption, efficient use of processing power, efficient use of memory, approximate execution time, challenges and issues in embedded software development. Co design operating system, efficient I/O testing and debugging. Hardware Architecture for embedded systems. Embedded Applications.

Suggested Readings:

1. John B. Peatman, "Design with micro – controllers", McGraw Hill International Ltd, Singapore, 1989.
2. Intel manual on 16 bit embedded controllers, Santa Clara, 1991.
3. Myko Predko. 'Programming and customizing the 8051 micro controller', Tata McGraw Hill, 1999.
4. Muhammad Ali Mazidi, Janice Gillispie mazidi. 'The 8051 Microcontroller and Embedded systems', Pearson Education, 2004.
5. Michael Slater, "Microprocessor based design', A Comprehensive guide to effective hardware design, Prentice Hall, New Jersey, 1989
6.

B.TECH. III Year, VI Semester
Theory Paper – IV EE- 314

EE-314 Principles of Communication

L	T	P	Credits
3	1	0	4

UNIT I

Introduction to Electronic Communication systems: Introduction, Electronic communication system, Types of communication system: Frequency spectrum of EM waves, Modulation, Bandwidth and information capacity, Transmission

Noise: Internal noise (Thermal, shot , Transit time Miscellaneous); External noise (Atmospheric , Industrial , Extra Terrestrial); Noise calculations; Noise figure; Noise temperature.

UNIT II Amplitude Modulation systems: Transmission (Principle, spectrum, efficiency, power and current calculation); AM envelop; AM Modulator circuits; AM transmitters; QAM; AM Receivers: Receiver Parameters; (Selectivity, sensitivity, dynamic range, fidelity); TRF Receiver; Superhetrodyne receiver, Low noise Amplifier, Mixer / converter, Noise limiter, Automatic Gain Control circuit

UNIT III Single sideband communication systems: Single Sideband system, AM SSB full carrier, AM SSB reduced carrier, AM SSB suppressed carrier, AM independent sideband, AM vestigial sideband, Comparison of single sideband transmission to conventional AM, Single sideband generation methods; Single sideband transmitter.

UNIT IV Angle Modulation system: Mathematical Analysis, Deviation sensitivity, Waveforms, Phase deviation and modulation index, Frequency analysis of angle modulated system, Bandwidth requirement of angle modulated system; Noise and angle modulation, Pre-emphasis and de-emphasis, Generation of FM waves, Demodulation of FM waves, Angle Modulation vs. amplitude modulation.

UNIT V Pulse Analog Modulation-Nyquist theorem: Practical sampling, PAM, PWM and PPM generation and detection.

Noise in CW modulation: Noise calculation in communication system, Noise in Amplitude modulation system, Noise in Angle modulated system, Narrow band noise.

Suggested Readings:

1. B. P. Lathi, " Modern Digital and Analog Communication System" Oxford University Press – 3rd Edition.
2. Taub Schilling, "Principles of Communication Systems" TMH, 2nd Edition.
3. Simon Haykin , "Communication Systems" John Wiley & Sons Inc, 4th Edition
4. W. Tomasi, " Electronic Communication Systems" Pearson Education, 5th Edition

B.TECH. III Year, VI Semester
Theory Paper – V EE -315

EE – 315 Digital Signal Processing

L	T	P	Credit
3	1	0	4

UNIT I

Introduction:

Classification of Systems : Continuous , discrete , Linear , Casual Stable Dynamic recursive , time variant Classification of Signals : Continuous and discrete Energy and Power; Mathematical representation of Signals, Spectral density , Sampling Techniques, Quantization, Quantization error, Nyquist state and Aliasing Effect.Digital Signal Representation, Analog to Digital Conversion

UNIT II

Discrete Time System Analysis:

Z transform and its properties Inverse Z Transform; Difference equation-Solution by Z transform Application to Discrete System, Stability Analysis, Frequency response , convolution – Fourier transform of Discrete Sequence , Discrete Fourier Series

Unit III

Discrete Fourier Transformer & Computation:

DFT Properties , magnitude & phase representation ,Computation of DFT using –DIT & DIF – FFT using radix 2 – Butterfly structure

Unit IV

Digital filter design:

FIR & IIR filter realization – parallel & cascade forms . FIR design Windowing Techniques – need And choice of windows – liner phase characteristics . IIR Design , Analog filter design – Buttervorth & chevyshev approximation ; digital design using impulse and variant and bilinear transformation-Warping , pre warping – frequency transformation

Unit-V

Programmable DSP Chips:

Architecture and features of TMS320C54 Signal Processing Chip- Quantization effects designing digital Filters

Suggested Readings:

1. John G. Proakis, D.G. Manolakis, Digital Signal Processing.
2. Ashok Ambardar, Analog and Digital Signal Processing.
3. L. R. Rabiner, B. Gold , Theory and Applications of Digital Signal Processing, PHI, 1975
4. Richard G. Lyons, Understanding Digital Signal Processing.
5. Roman Kuc , Introduction to Digital Signal Processing.
6. V. Oppenheim, R. W. Schafer, Discrete-Time Signal Processing.
7. S.K Mitra "Digital Signal Processing – A Computer based Approach" Tata Mcgraw Hill New Delhi

B.TECH. III Year, VI Semester Practical Paper – I

EE – 316 Power Electronics & Drives Lab

L	T	P	Credit
0	0	2	2

Based on course work corresponding EE – 311 & 314

B.TECH. III Year, VI Semester Practical Paper – II

EE – 317 Microprocessor and Microcontroller Lab

L	T	P	Credit
0	0	2	2

Based on course work corresponding EE – 313

B.TECH. III Year, VI Semester Practical Paper – III

EE – 318 Minor Project

L	T	P	Credit
0	0	2	4

B.TECH. III Year, VI Semester Practical Paper – IV

EE – 319 Viva Voce examination of V Semester Industrial Training

L	T	P	Credit
0	0	2	2

B.TECH. IV Year, VII- Semester
Theory Paper I

EE-401 Design of Electrical Systems

L	T	P	Credits

3 1 0 4

Unit –I

General Theory

Line Diagram from generating station to consumers end, including substation and transmission line. Need of substation, budgeting and financing, site acquisition, traditional and innovative substation design, construction and commissioning process.

Unit- II

Gas insulated and air insulated substations:

Interface between automation and substation, substation integration and automation, substation grounding and substation fire protection.

Unit- III

Seismic considerations and oil containment

Unit – IV

Thermal Problems:

Generation, flow and dissipation of heat losses, thermal capacity, temperature – rise curves, ratings of machines; cooling media, ventilation types of cooling; standard enclosures.

Unit – V

Factors in Design:

Specifications for machines, out-put equation: limitations in design; electric and magnetic loadings, space, winding and other factors and their effects on machine performance; mechanical and high speed problems.

Unit- VI

Design of Single and three phase Transformers and Induction machines

Unit – VI

Polyphase Induction Machines:

Details of construction; stator design, output equation, separation of D and L, specific loadings, leakage reactance, rotor design, slip ring and squirrel cage motors, harmonic, effects and slot combination, magnetizing current and losses; circle diagram from design data and prediction of characteristics.

Suggested Readings:

[1] **A.K.Sawhney**, 'A Course in **Electrical Machine**. **Design**', Danpat Rai & Co., 1998

(2) Principles Of **Electrical Machine Design** by **R. K.** Agarwal **.... R** Birla Publications (regd), Paperback - 2006, ISBN 8186270302

B.TECH. IV Year, VII- Semester
Theory Paper II

EE-402 Switchgear & Protection

L	T	P	Credits
3	1	0	4

Unit- I

Fault calculations:

Calculation of symmetrical and unsymmetrical fault currents in power system networks using the symmetrical components, use of current limiting reactors.

Unit- II

Introduction to protective schemes:

Principles and need for protective schemes, zones of protection and essential quantities of protection, protection scheme. Operating principles of relays universal relays: torque equation R-X diagram. Electromagnetic relays – over current, directional distance and differential negative sequence relays – static relays – amplitude and phase comparators. Microprocessor and PC based relaying.

Unit- III

Apparatus protection:
Transformer generator, motor, protection of bus bars and transmission lines current.

Unit – IV

Switch gear:

Classification of switch gear, arcing phenomenon and principal of are interruption AC and DC circuit breaker different types of circuit breakers and their construction. Features of Air blast, vacuum, SF6 CBs, Testing and selection of circuit breakers.

Suggested Readings:

1. B. Racindranath, and N. Chander, Wiley Eastern Ltd., New Delhi
2. C. Russel Mason, Art and Science of Protective Relaying, Wiley Eastern Ltd., New Delhi
3. Sunil S. Rao, Power System Protection, Khanna Publications, New Delhi
4. P.M. Anderson, Power System Protection, IEEE Press
5. Power System Protection (Vol.1-IV)IEE Press
6. B. Ram, DH Vishwakarma, Power System Protection and Switchgear, Tata McGraw Hill Publishing Co. Ltd., New Delhi

B.TECH. IV Year, VII- Semester
Theory Paper III
EE-403, Elective I (1 to 6)

L	T	P	Credits
3	1	0	4

Elective I

Elective-I
EE 403-1 Generalized Machines
EE 403-2 Distributed Generation Systems.
EE 403-3 Power System Stability
EE403-4 Electric Traction and Drives
EE 403-5 High Voltage Engineering
EE 403-6 Advanced control system

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-403-1 Generalized Machines

L	T	P	Credits
3	1	0	4

Unit - I

Basic of the generlised theory, basic two pole machines, convention, per unit systems, Kron's primitive machine, leakage flux in machines with more than two windings: voltage and torque equations.

Unit- II

Transformations- invariance of power, transformation from 3 - phase to two phase, transformation from rotating axes to stationary axes, transformed impendance marix, torque equations.

Unit - III

Application of the theory to d.c. machine – d.c. generator with sudden short circuits, transfer functions of d.c. machines – Linearization techniques for small perturbations, electric braking of d.c. motors.

Unit -IV

Application to 3 – phase Synchronous machine- Transient analysis, sudden reactive loading, Reactances and time constants from equivalent circuits. Sequence reactances measurement of parameters, reactances and time-constants from short circuit oscillogram. Application to polyphase induction motor – transformation, induction motor with unbalanced supply voltage, effect of space harmonics on 3-phse inductance motor performances.

Unit - V

Application to a.c commutators machines, series motor repulsion motor, scharge motor.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-403-2, Distributed Generation Systems

L	T	P	Credits
3	1	0	4

Unit – I

Distributed Generation

Electricity Generation in Transition, Distributed Generation with Fossil Fuels, Concentrating Solar Power (CSP) Technologies, Biomass for Electricity, Micro-Hydropower Systems, Fuel Cells and Wind Energy based Generation.

Unit – II

Asynchronous Generators and Generator Drives

Unit – III

Control of Wind Energy Systems

Overview of Wind Turbine Control Systems, Typical Grid-connected Turbine Operation, Supervisory Control Overview and Implementation and Dynamic Control Theory and Implementation

Unit- IV

Solar Photovoltaic Power System, Solar Commercial Power Plants

Unit – V

Energy Storage

Various Batteries and their Equivalent Electrical Circuit, Performance Characteristics

Battery Charging, Battery Management, Flywheel, Compressed Air and Superconducting Coil

Unit- VI

Stand-Alone System

PV Stand-Alone, Wind Stand-Alone, Hybrid System, Hybrid with Diesel, Hybrid with Fuel Cell, Mode Controller, Load Sharing, System Sizing, Power and Energy Estimates, Battery Sizing, pv Array Sizing, Wind Farm Sizing

Unit – VII

Grid-Connected System

Interface Requirements, Synchronizing with Grid, Inrush Current, Synchronous Operation, Load Transient, Safety, Operating Limit, Voltage Regulation, Stability Limit, Energy Storage and Load Scheduling, Utility Resource Planning Tool.

Unit – VII

Electrical Performance

Voltage Current and Power Relations, Component Design for Maximum Efficiency, Electrical System Model, Static Bus Impedance and Voltage Regulation, Dynamic Bus Impedance and Ripple, Harmonics

Unit – VIII

Power, Harmonic Distortion, Voltage Transients and Sags, Voltage Flickers, Renewable Capacity Limit, Systems Stiffness, Interfacing Standards, Lightning Protection

Unit – IX

Economics of Distributed Resources

Unit- X

UPS & Battery Energy Storage Systems

Uninterruptible Power Supplies, Applications of UPS Systems , Distributed Approach, Centralized Approach, Power Factor Correction in UPS Systems, Battery Energy Storage Systems, Grid Synchronization, Storage & Power Conditioning modes. Wind and Solar Power Systems

Suggested Readings:

1. Wind and Solar Power Systems: Mukund R. Patel,
2. Renewable and Efficient Electric Power Systems: **Gilbert M. Masters**
3. VARIABLE SPEED GENERATORS:- ION BOLDEA

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-403-3 Power System Stability

L	T	P	Credits
3	1	0	4

Unit- I

The Stability Problem:

Origin of the stability problem, definition of stability terms, power angle diagrams.

Unit- II

Steady State Stability:

The steady state power limits of simple systems with synchronous loads-analytical and graphical methods, methods of improving steady state stability limits, elementary aspects of dynamic stability.

Unit- III

Transient Stability:

Review of the laws of mechanics, swing equation for a single machine connected to an infinite bus, net-work reduction techniques, equal areas criterion of stability, solution of wing equation by numerical methods (step by step solution), Runge kutta method. Critical clearing angle and time, analysis of two finite machine system and multimachine systems, effect of grounding on stability, methods of improving the transient stability.

Unit- IV

Voltage and angle stability:

Angle Stability, Reactive Power Flow, Reactive Power Transmission, Voltage Stability, P-V Curves methods of improving stability, HVDC Operations, Introduction to FACTS devices, and Enhancement of stability by application of FACTS devices.

Suggested Readings:

1. P.Kundur. ' Power System Stability and Control, Tata McGraw Hill, Publication, Co., New Delhi
2. Hadi Saadat. 'Power System Analysis', Tata McGraw Hill Publishing Company, New Delhi
3. I.J. Nagrath, D.P. Kothari, Power System Engineering, Tata McGraw Hill Publishing Co., Ltd.
4. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', McGraw Hill International Edition
5. E.W. Kimbark, Power System Stability Vol I-III John Wiley and Sons
6.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-403-4 Electric Traction and Drives

L	T	P	Credits
3	1	0	4

Unit- I

Dynamics of Electric Drives – Types of loads, quadrantal diagram of speed time characteristics, Basic and modified characteristics of dc and ac motors.

Unit- II

Starting of Electric Motor – Acceleration time, energy loss during starting, Electric Braking – braking of motors during lowering of loads, braking while stopping, dynamics of braking.

Unit- III

Rating and heating of Motors – Loading conditions and classes of duty, determination of power ratings of electric motors, effect of load interia, load equalization, environmental factors.

Unit- IV

Industrial Applications – Description of devices for steel, paper, cement and textile mills etc Drives for Numerically controlled machines.

Unit- VI

Electric Traction: Speed time curves and machines of train movement, traction systems and power supply, systems of current collection. Overhead equipment, Traction motor control, Electric signally, Train

Suggested Readings:

1. E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt.Ltd, 2003.
2. B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (P) Ltd, New Delhi, 2003.
3. H. Partab, 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Co, New Delhi, 2004.
4. .Gopal.K.Dubey, 'Fundamentals of Electrical Drives', Narosa Publishing House, New Delhi, 2002.
5. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt.Ltd, 2003.
6. J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K.Kataria and Sons, 2002.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-403-5 High Voltage Engineering

L	T	P	Credits

3 1 0 4

Unit- I

High Voltage Laboratory Testing:

Generating H.V.A.C, by case- caded transformers, resonance transformers, generation of H.V.D.C. by rectifier circuits, electrostatic generators, generation of impulse voltage using Marx's circuits, construction operation and mathematical analysis of simple impulse circuits, use of sphere gaps for the measurement of high voltages, use of high speed C.R.O. brief description of continuously evacuated and sealed off C.R.O., recurrent surge oscillographs and relevant techniques for their measurements.

Unit- II

Over Voltages:

Origin and characteristic of over voltage (surges) on transmission systems, reflection and refraction of traveling waves, lattice diagram, modern theories about lightning, instruments for the measurement of lightning discharge.

Unit- III

Corona:

Critical disruptive voltage, factors affecting Corona loss, advantages and disadvantages.

Unit- IV

Electrical Discharges:

Elementary ideas of dielectric breakdown, breakdown of air, discharge in gases, Townsend's mechanism, streamer process, conditions of spark over, mechanism of wet spark over, use of condenser bushings.

Unit- V

Problem of Insulation :

Brief details of the high voltage testing of insulators, transformer, and cables, use of high voltage Schering Bridge.

Unit- VI

H.V.D.C. Transmission :

Advantages and drawbacks, modern trends in H.V.D.C. transmission, use of ground return, circuit breaking and problem of KVAR.

Suggested Readings:

1. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Publishing Co., Ltd., New Delhi
2. E. Kuffel and W.S. Zeengl, 'High Voltage Engineering Fundamentals', Pergamon press, Oxford, London, 1984.
   C.L. Wadhwa, High Voltage Engineering, New Age International publishers (P) Ltd., New Delhi.

BTECH. IV Year, VII- Semester
Theory Paper III

EE-403-6 Advanced Control System

L	T	P	Credits
3	1	0	4

Unit- I

Systems:

Liner and non-linear system, Linearization of Physical Systems.

Unit – II

State Space Analysis:

Realization of state models, solution of state equation, state transition matrix and its properties, free and forced responses, Properties, controllability and observability. Design of state feedback – pole assignment technique.

Unit- III

None Linear Systems:

Types of non-linearity, typical examples, equivalent linearization, phase plane analysis, limit cycle, describing functions lP, PI, PID Ratio Control & Cascade Control Z – Transformation, Sampling and hold pulse transfer function & state variable approach.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404, Open Elective I

Open Elective I
EE 404-1 Biomedical Instrumentation
EE 404-2 Power System Communication
EE 404-3 Restructured Power System
EE 404-4 Power Plant Engineering
EE 404-5 Intellectual property rights and Entrepreneurship
EE 404-6 Database management System

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-1 Open Elective I

Bio- Medical Instrumentation

L	T	P	Credit
3	1	0	4

UNIT I

Introduction: Specifications of bio-medical instrumentation system, Man-Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body.

UNIT-II

Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials –ECG, EEG, EMG, ERG, EOG and Evoked responses

UNIT-III

Electrodes and Transducers: Electrode theory, Biopotential Electrodes – Surface electrodes, Needle electrodes, Microelectrodes. Biomedical Transducer

UNIT IV

Cardiovascular Measurements: Electrocardiography –ECG amplifiers, Electrodes and Leads,ECG recorders –Single channel, Three channel, Vector Cardiographs,ECG System for Stresses testing,Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators.

UNIT-V

Patient Care & Monitoring: Elements of intensive care monitoring, displays, diognosis, Calibration & Reparability of patient monitoring equipment.

UNIT VI

Respiratory system Measurements: Physiology of Respiratory system .Measurement of breathing mechanism – Spirometer.Respiratory Therapy equipments: Inhalators, Ventilators &Respirators, Humidifiers, and Nebulizers & Aspirators.

UNIT-VII

Nervous System Measurements: Physiology of nervous system, Neuronal communication, Neuronal firing measurements.

UNIT VIII

Ophthalmology Instruments: Electroretinogram, Electrooculogram, Ophthalmoscope, Tonometer for eye pressure measurement.

UNIT- IX

Diagnostic techniques: Ultrasonic diagnosis, Ecocardiography, Eco-encephalography, Ophthalmic scans, X-ray & Radio-isotope diagnosis and therapy, CAT-Scan, Emission computerized tomography, MRI.

UNIT X

Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring.

UNIT-XI

Prosthetic Devices and Therapies: Hearing Aides, Myoelectric Arm, Dia-thermy, Laser applications in medicine.:

Suggested Readings:

1. Khandpur R.S.- Biomedical Instrumentation- TMH
2. Venkata Ram,S.K.-Bio-Medical Electronics&Instrumentation (Revised)- Galgotia.
3. Cromwell- Biomedical Instrumentation and Measurements- PHI
4. Webster,j.g. –Bio- Instrumentation ,Wiley (2004)
5. Ananthi.S.–A Text Book of Medical Instruments-2005-New Age International
6. carr&Brown –Introduction to Biomedical Equipment Technology –Pearson
7. Pandey & Kumar-Biomedical Electronics and Instrumentation. – Kataria

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-2, Open Elective I

Power System Communications

L	T	P	Credit
3	1	0	4

UNIT I

Introduction, coks requirement for telemetry, teleprotection.

UNIT II

Analog and digital communication- speed and requirements.

UNIT III

Noise in power systems, communication link, PLCC microwave, telephone line, satellite, fibre optic channels.

UNIT IV

Requirements of various communication equipments used in power systems. Computer networking in power systems.

Suggested Readings:

1. Stallings, W., Data & Computer Communications, PHI, India.
2. Haykin, S., Communication System, John Wiley.
3. Dostert, K. and Franzis V., Power line Communications Springer.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-3, Open Elective I

Restructured Power Systems **L T P Credit**
3 1 0 4

UNIT I

Fundamentals of restructured system, market architecture, load elasticity, social welfare maximization.

UNIT II

OPF: Role in vertically integrated systems and in restructured markets, congestion management, optimal bidding, risk assessment and hedging, transmission pricing and tracing of power.

UNIT III

Ancillary services, standard market design, distributed generation in restructured markets, developments in India,

UNIT IV

IT applications in restructured markets, working of restructured power systems, PJM.

Suggested Readings

1. I. Philipson and H. Lee Willis, Understanding Electric Utilities and Deregulation, Marcel Dekker," 1998.
2. Kankar Bhattacharya , Math Bollen and J.E. Daadler, Operation of restructured Power Systems," Kluwer, 2001.
3. M. Shahidepour and M. Alomoush, "Restructured Electrical Power Systems", Marcel Dekker, 2001 .

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-4 Open Elective I

Power Plant Engineering **L T P Credits**
3 1 0 4

UNIT I

Rankine Cycle:

Application of Rankine Cycle to power genetation. Effect of steam pressure temperature and back pressure on the efficiency. Reheating and Regenerative feed water heating cycle.

UNIT II Steam Turbines :

Flow of steam through nozzles. Critical pressure ratio. Determination of throat and exit areas, classification of steam Turbines Compounding of Steam Turbine, Velocity diagrams, Condition for maximum efficiency in Impulse and Reaction Turbines Governing of Steam Turbines. Construction and Working of different types of condensers, Air leakage, Vacuum efficiency, Cooling towers, Feed water treatment.

UNIT III Steam Generators:

Storage of coal at plant site, In-plant handling, coal feeding, burning methods and related equipments. Pulverised fuel firing system, Pulverised fuel burners.Ash handling systems. Gravitational separators, cyclone swparator, Electrostatic precipitators Circulation Boilers and their characteristics and applications Location of heating surfaces like evaporator, Superheater, Reheater and Economiser.

UNIT IV Controls:

Important instruments on steam generators, combustion control and superheater ttemperature control.

Other Power Plants:

Diesel plants, Gas turbine plants, Hydro Electric Plants, Nuclear Plants, Fields of application as Base load, Peak load and stand-by units.

Suggested Readings:

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. Power Plant Engineering: P.K. Nag Tata McGraw Hill second Edition 2001.
3. An introduction to power plant technology by G.D. Rai-Khanna Publishers, Delhi – 110005.

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-5 Open Elective I

Intellectual Property Rights and Entrepreneurship **L T P Credit**

3 1 0 4

UNIT I Basic Principles and acquisition of Intellectual Property Rights

Philosophical Aspects of Intellectual Property Laws , Basic Principles of Patent Law, Patent Application Procedure, Drafting of a Patent Specification, Understanding Copyright Law, Basic Principles of Trade Mark, Basic Principles of Design Rights, International Background of Intellectual property.

UNIT II Ownership and Enforcement of Intellectual Property Rights Patent – Objectives, Rights, Assignments, Defenses in case of Infringement.

UNIT III Entrepreneurship

Entrepreneurial perspective, Start - up strategies, business idea evaluation, business plan writing, introduction to entrepreneurial finance and venture capital, managing growth and delivering innovative products, entrepreneurial opportunities, technologies, business models and personalities, benefit and /or negative impact to creating the new business? (risk tolerances, comfort in low data situations, ability to sell), (judgment, ability to coordinate with many), (scope, risk, return expectation).

B.TECH. IV Year, VII- Semester
Theory Paper III

EE-404-6, Open Elective I

DATA BASE MANAGEMENT SYSTEM **L T P Credit**
3 1 0 4

UNIT-I

Introduction: An overview of database management system, database system Vs file system, Database system concept and architecture, data model schema and instances, data independence and database language and interfaces, data definitions language, DML, Overall Database Structure.

UNIT-II

Data Modeling using the Entity Relationship Model:

ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationship of higher degree.

Unit-III

Relational data Model and Language: Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

UNIT-IV

Introduction on SQL: Characteristics of SQL, advantage of SQL. SQl data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

Unit-V

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

Unit-VI

Transaction Processing Concept: Transaction system, Testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

Distributed Database: distributed data storage, concurrency control, directory system.

Unit-VII

Concurrency Control Techniques: Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction, case study of Oracle.

Books

1. Date C J, " An Introduction to Database Systems", Addision Wesley
2. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
3. Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley
4. O'Neil, Databases, Elsevier Pub.
5. Leon & Leon,"Database Management Systems", Vikas Publishing House
6. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
7. Majumdar & Bhattacharya, "Database Management System", TMH
8. Ramkrishnan, Gehrke, " Database Management System", McGraw Hill
9. Kroenke, " Database Processing Fundamentals , Design and Implementation" Pearson Education

B.TECH. IV Year, VII- Semester Practical Paper - I

EE-406, Design of Electrical System Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE - 401

B.TECH. IV Year, VII Semester Practical Paper – II

EE – 407, Digital Signal Processing Lab

L	T	P	Credit
0	0	2	2

Based on course work corresponding EE – 315

B.TECH. IV Year, VII Semester Practical Paper – III

EE – 407, Major Project (Part - I)

L	T	P	Credit
0	0	2	4

B.TECH. IV Year, VII Semester Practical Paper – IV

EE – 408, Viva Voce Examination of VI Semester Industrial Training

L	T	P	Credit
			2

B.TECH. IV Year, VIII – Semester
Theory Paper I

EE-411, H.V.D.C Transmission

L	T	P	Credits
3	1	0	4

Unit- I

DC Power Transmission Technology:
General aspects of AC and DC power Transmission, Comparison, Applications, Planning and Description of HVDC transmission.

Unit- II

Power Switching Devices for HVDC Systems:
Thyristor value, construction, design, firing and control units protection value tests. Introduction to GTO and IGBT as power switch.

Unit- III

Analysis of HVDC Converters:
Pulse number, choice of converter configuration, simplified analysis of Graetz converter circuit, two and three value, three and four value conduction modes converter bridge characteristics 12, 24, 48 Pulse converter arrangements, characteristics of 12, 24, 48 Pulse converters, capacitor commutated converters, analysis and characteristics.

Unit- IV
HVDC Systems and Control:

Schemes and configuration of HVDC systems, principles of DC link control, converter control characteristics, Firing angle controls, currents and extinction angle control, Starting and stopping of DC link, Frequency and power control, stabilization of AC Tie lines, Emergency control, Reactive power control, Sub synchronous damping control, telecommunication requirements.

Unit- V

Faults and Protections:

Converter faults, protection against over currents, over voltages and their protection, transient over voltages, smoothing reactor, corona effects, radio interference, Anaible noise, line insulators, line faults, DC breakers, Effect of proximity of AC and DC transmission lines.

Unit- VI

Reactive Power Control and Harmonic Compensation:

Reactive power requirement of HVDC systems, Sources of reactive power, Static for systems, introduction to STATCOM, Reactive power control during transients, Generation of harmonics, AC and DC tilters.

Unit- VII

Multiterminal DC Systems:

Types and applications of MTDC systems, control and their protection.

Unit- VIII

HVDC Based on Voltage Source Converters:

Voltage source converters, concepts of bidirectional power flow, control of converters, independent control of real and reactive power, DC bus regulation, Multiterminal configuration, application with Distributed power generation.

Suggested Readings:

1. Padiyar, K.R., HVDC Power transmission system, Wiley Eastern Limited, New Delhi 1990. First edition.
2. Erieh Uhlmann, Power Transmission by Direct Current, Springer International Edition
3. C. Adamson and N.G. Hillgorani, High Voltage DC current Power Transmission, (London) Garraway 1960
4. J. Arrillaga, High Voltage DC current Transmission(London) Peter Peregrinus, 1983

B.TECH. IV Year, VIII – Semester
Theory Paper II

EE-412, ELECTIVE- II (Open)

L	T	P	Credits
3	1	0	4

Elective II
EE 412-1 Digital & Optical Communication Systems
EE 412-2 Telemetry & SCADA Systems
EE 412-3 Operating System Design
EE 412-4 Computer Control of Processes
EE 412-5 VLSI Design
EE 412-6 Power System Dynamics and Control

B.TECH. IV Year, VIII- Semester
Theory Paper II

EE-412-1 Digital & Optical Communication System

L	T	P	Credits
3	1	0	4

Unit- I

Digital Communication System

Signal representation, statistical decision theory, introduction to digital communication, sampling theorem, random signals and noise, signal to noise ratio. PCM, quantization noise, bandwidth, advantages over analog communication, PCM system, differential PCM, digital modulation, digital multiplexing, TDMA. CDMA and of DM.

Unit- II

Optical communication system:

Types of optical fibers – step index and graded index, multimode and single mode, attenuation and dispersion in fibres, optical transfers LEDs & laser diode, cellular and mobile communication.

B.TECH. IV Year, VIII- Semester
Theory Paper II

EE-412-2, Telemetry & SCADA Systems

L	T	P	Credits
3	1	0	4

UNIT-1

SCADA

Concept of Supervisory control & Data Acquisition System, Component and types of SCADA systems, CT, PT, Voltage to current, current to voltage converters, RTUs etc. Supervisory and control functions, man-machine communication, operator console, VDU display and its use, operator dialogues, mimic diagram functions, printing facilities etc. SCADA system structures, system classes, system interactions, performance criteria, software and hardware considerations, data bases, reliability and simulations, technical realizations, local system,

UNIT-II

Communication system, central system, control system supervision & system maintenance. Application functions-real time network modeling, security management, production control and training simulators. Introduction to communication systems, Hotline, PLCC, Mobile, Satellite, Microwave & Optical fibre communications. Transputerised SCADA system, SCADA on embedded FPGA.

Suggested Readings:

1. Krishana Kant, “Computer-based Industrial Control”, PHI Publication.
2. Liptak, “Process Control”, CRC Publication.
3. Madiseth & Williams, “Digital Signal Processing”, CRC Press, IEEE Press.

4. Kissel, "Industrial Electronics", PHI Publication.

B.TECH. IV Year, VIII- Semester
Theory Paper II

EE-412-3, Operating System Design

L	T	P	Credits
3	1	0	4

Unit- I

Operating System – An Overview

What is an OS? – Mainframe systems – Desktop systems – Multiprocessor systems – Distributed systems – Clustered systems – Real time systems – Handheld systems. Computer system operation – I/O structure – Storage structure –storage hierarchy – Hardware protection – Network structure. System components – Operating system services – System calls – System programs – System structure – Virtual machines – System design and implementation – System generation.

Unit- II

Process Management

Process concept – Process scheduling – Operating on processes – cooperating processes – inter process communication – communication in client – server systems. Threads – Overview – Multithreading models – Threading issues, Basics concepts – Scheduling ceiteria – Scheduling algorithms – Multiple – processor scheduling – real time scheduling – process scheduling models. The critical section problem – Synchronization hardware - Semaphores – Classic problems of synchronization – critical regions – Monitors - Atomic transactions. System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from dead lock.

Unit- III

Storage Management:

Background – swipping – contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Background – Demand paging – Process creation – Page replacement – allocation of frames – Thrashing,. File concept: Access methods – Directory structure – File system mounting – File sharing – Protection. File system structure - file system implementation – Directory implementation – Allocation methods – free – space management – Efficiency and performance – Recovery.

Unit- IV

I/O Systems:

I/O hardware - Application I/O interface – Kernel I/O subsystem – Transforming I/O to hardware operations – Streams – Performance. Disk structure – Disk scheduling – Disk management – Swap-space management – RAID structure – Disk attachment – Stable - Storage implementation – Tertiary storage structure.

Unit- V

Distributed Systems

Background – Topology – Network types – Communication – communication protocols – Robustness – Design issues. Naming and transparency – Remote file access – Stateful versus stateless service – File replication. Event ordering – Mutual exclusion – Atomicity – Concurrency control – Deadlock handling – Election algorithms –Reaching agreement.

Suggested Readings:

1. Abrabham Silberschatz, peter Baer Galvin and Greg Gagne, 'Operating System concepts', Sixth Edition, Window XP update, John Wiley & Sons (ASIA) Pvt. Ltd, 2002.
2. Harvey M Deitel, ' Operating Systems', Second Edition, Pearson Education Pvt. Ltd., 2002
3. Andrew S. Tanenbaum, 'Modern Operating Systems', 2nd Edition, Pearson Education, 2000 / PHI
4. William Stallings, ' Operating System', Pearson Education, 4th Edition, 2003 / PHI

B.TECH. IV Year, VIII- Semester

Theory Paper II

EE-412-4 Computer Control of Processes

L	T	P	Credits
3	1	0	4

Unit 1

Introduction to Process Control

Introduction to process control, basic control action – on / off, P, PI, PID, floating control and Electronic controller, tuning. Line diagram from process plant to computer system, loose coupled system and Tight coupled system, communication media and bus. Protocol and Architectures: Evolution of data networks, network architecture.

Protocols- layered approach-OSI model-DoD model-Hierarchical Approach-Local Network Technology-Bus/Tree topology-Ring topology-medium access protocols-Details of IEEE 802, X.25, datagram, HDLC standards.

Signals from process instrumentation, signal conditioning for the control computer, signal transmission, time division multiplexing, signal termination, impedance matching filtering, Numerical filtering, correction for non-linearities. The computer control system. CPU, relationship of word length to performance, peripheral devices,.

Unit- 2

Programmable Logic Controllers:

Evolution of PLC – Sequential and Programmable controllers – Architecture – Programming of PLC – Relay logic and Ladder logic – Functional blocks – Communication Networks for PLC, field bus such as profi-bus, mod-bus etc.

Unit 3

Distributed Control System:

Evolution of DCS – Architecture – Local control unit – Operator interface – Engineering interface.

Suggested Readings:

1. George Stephanopolus, "Chemical Process control", Prentice Hall India?
2. Harriot P., "Process control", Tata McGraw-Hill. New Delhi,1991.
3. Norman A Anderson, "Instrumentation for process measurement and control" CRC Press LLC, Florida, 1998.
4. Dale E. Seborg, Thomas F Edgar, Duncan A Mellichamp, "Process dynamics and control", Wiley John and Sons, 1989.
5. Marlin T.E., "Process control", second edition McGraw hill, New York, 2000.
6. Balchan J.G. and Mumme G., "Process control structures and applications", Van Nostrand Renhold Co., New York, 1988.
7. Lucas M.P, "Distributed Control System", Van Nostrand Reinhold Co. NY 1986.
8. Pertrezeulla, "Programmable Controllers", McGraw-Hill, 1989.
9. Kevin M. Daugherty, "Analog – to – Digital conversion – A Practical Approach", McGraw Hill International Editions, 1995.
10. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice – Hall of India Pvt. Ltd., 2003.

11. Krishna Kant, “Computer – based Industrial Control”, Prentice – Hall of India Pvt. Ltd., 1997.
12. H.S. Kalsi, “Electronic Instrumentation”, Technical Education Series (TES)/TMH, New Delhi.
13. Buchanan., “Computer busses”, Arnold, London, 2000.
14. Andrew S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice Hall of India, 2003.
15. Achyut S. Godbole, “Data Communications and Networking”, Tata McGraw Hill, 2002.
16. W. Stallings, “Data and Computer Communication”, 2nd Edition New York, Macmillan, 1998.

B.TECH. IV Year, VIII Semester
Theory Paper II

EE-412-5, VLSI Design

L	T	P	Credits
3	1	0	4

Unit 1
Basic MOS Transistor
Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – second order effects – MOS Transistor Model.
Unit –II

NMOS & CMOS Invertor and Gates
NMOS & CMOS inverter – Determination of pull up / pull down ratios – stick diagram – lambda based rules – super buffers – BiCMOS & steering logic.
Unit III
Sub System Design & Layout
Structred design of combination circuits – Dynamics Cmos & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.
Unit- IV
Design of Combination Elements & Regular Array Logic: NMOS PLA – Programmable Logic Devices –Finite state Machine PLA – introduction to FPGA.
Unit V
VGDL Programming:
RTL Design – combinational logic – Types – Operators – Packages – Sequential circuit – Sub programs – Test benches (Examples: address, counters, flipflops, FSM, Multiplexers/ Demltiplexers).

Suggested Readings:

1. D.A. Pucknell, K. Eshraghian, ‘Basic VLSI Design’, 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Eugene D. Fabricius, ‘Introduction to VLSI Design ‘, Tata McGraw Hill, 1990.
3. N.H. Weste, ‘Principles of CMOS VLSI Design’, Pearson Education, India, 2002.
4. Charles H. Roth, ‘Fundamentals of Logic Design’, Jaico Publishing House, 1992.
5. Zainalarsed in Navabi, ‘ VHDL Analysis and Modelling of Degital Systems’, 2nd Edition, Tata McGraw Hill, 1998.
6. Douglas Perry, ‘VHDL Programming By Example’, Tata Mcgraw Hill, 3rd Edition.

B.TECH. IV Year, VIII- Semester

Theory Paper II

EE-412-6 Power System Dynamics and Control

L	T	P	Credits
3	1	0	4

Unit 1.

Introduction:

Load characteristics and modeling, power systems interconnection un integrated and integrated operation. Hydroelectric plant

Unit 2.

Automatic Generation Control:

Fundamentals of speed governing – control of generating unit Power output – composite regulating characteristic of Power Systems – Response rates of turbine – governing systems – fundamentals of automatic generation control – Implementation of AGC – development of state variable model for a two area Power Systems for use in simulation of AGC. Under frequency Load Shedding And computation of setting for under frequency relays.

Unit 3.

Reactive Power and Voltage Control:

Modelling of AVR loops: Components – stability compensation – Production and absorption of reactive Power – methods of voltage control – shunt reactors – shunt capacitors – series capacitors – synchronous condensers – static var systems – Principle of transmission system compensation – modeling of reactive compensating devices – Application of tap changing transformer ULTC control systems.

Unit 4

Security Control of Power Systems:

System operating states by security control functions – monitoring, evaluation of system state by contingency analysis – corrective controls (Preventive, emergency and restorative) – Energy control center – SCADA system – function – monitoring, data acquisition and controls – EMS system

Unit 5.

State Estimation:

Maximum likelihood Weighted Least Squares Estimation:- Concepts – matrix formulation – Example for Weighted Least Squares state estimation; State estimation of an AC network: development of method – Typical results of state estimation on an AC network – State Estimation by Orthogonal Decomposition algorithm – Introduction to Advanced topics: Detection and Identification of Bad Measurements, Estimation of Quantities not Being Measured, Network Observability and Pseudo – measurements – Application of Power Systems State Estimation.

Unit 6.

Power System Control under Deregulated Environment:

New system structures under competition – Classification of operational tasks in today's power industry – Temporal decomposition within the real time operation – classification of operational tasks in the competitive industry – meeting predicted demand in today's industry – meeting demand in the new industry – balancing supply and demand in real time – Load frequency control under deregulated environment.

Suggested Readings:

1. Elgerd O.I, "Electric Energy System Theory – an Introduction", Tata McGraw Hill, New Delhi – 2002
2. Kundur. P., "Power System Stability and Control", EPRI Publications, California , 1994.

3. Allen J. Wood and Bruce. F. Wollenberg, “Power Generation Operation and Control’, John Wiley & sons, New York, 1996.
4. Mahalanabis A.K., Kothari. D.P. and Ahson. S.I., “Computer Aided Power System Analysis and Control”, Tata McGraw Hill publishing Ltd, 1984.
5. Marija Ilic, F. Galiana, L. Fink, “Power System Restructuring : Engineering and Economics”, Kluwer Academic Publishers, 2000.
6. Vaibhav Donde, M.A. Pai & Ian A. Hiskens – “Simulation & Optimization in an AGC system after deregulation”, IEEE transactions on Power Systems Vol: 16, No. 3, Aug. 2001.

excitations.

EE-413, B.TECH. IV Year, VIII – Semester
Theory Paper III

L T P Credits
3 1 0 4

Elective -II
EE 413-1 Power System Planning
EE 413-2 Soft Computing Techniques
EE 413-3 Optimal Control Theory
EE 413-4 Active and Passive Network Synthesis
EE 413-5 Power Plant Instrumentation
EE 413-6 Reliability Engineering

B.TECH. IV Year, VIII- Semester
Theory Paper III

EE-413-1 Power System Planning

L T P Credits
3 1 0 4

Introduction-Power planning, power system development and growth, power sources, planning tools, Electricity regulations. Electricity Forecasting. Generation Planning. Transmission and distribution network planning. New operation and planning policies. Allocation of reserve. Demand side bidding. Pricing schemes. Competitive electricity markets. Environment effects. Technology and Innovation (Modern Trends).

Suggested Readings:

1. Sullivan-Power System Planning.
2. Pabla, A.S., Electric Power System Planning, Macmillan, India.

B.TECH. IV Year, VIII- Semester
Theory Paper III

EE-413-2 Soft Computing Techniques

L T P Credits
3 1 0 4

UNIT-I

INTRODUCTION

Introduction to crisp set and fuzzy sets. Operations on fuzzy sets. Fuzzy relations, fuzzy measures, uncertainly and information, uniqueness of uncertainty measures, applications of fuzzy logic in intelligent control system design. Mamdani controllers, Takagi- Sugeno controller.

UNIT- II

Introduction to neural Network.

Learning process correlation matrix memory. The perception. Least-mean-square algorithm multilayer perception, radial basis, function networks. Self organizing systems Neuro-dynamics. Temporal processing, application of neural network in process control.

UNIT-III

Fuzzy Controllers and Evolutionary Algorithms:

Evolution Strategies, Genetic Algorithms, Evolutionary Algorithms for Optimising Fuzzy Controllers, A Genetic Algorithm for Learning a TSK Controller, applications.

Suggested Readings:

1. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. KOSKO,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.
3. KLIR G.J. & FOLGER T.A. "Fuzzy sets, uncertainty and information", Prentice-Hall of India Pvt. Ltd., 1993.
4. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
5. Driankov, Hellendron, "Introduction to Fuzzy Control", Narosa Publishers.

B.TECH. IV Year VIII- Semester

Theory Paper III

EE-413-3, Optimal Control Theory

L	T	P	Credits
3	1	0	4

UNIT-I

Introduction:

Statement of optimal control problem-Problem formulation and forms of optimal control-Selection of performance measures. Necessary conditions for optimal control -Pontryagin's minimum principle – State inequality constraints - Minimum time problem.

UNIT-II

LQ Control Problems and Dynamic Programming:

Linear optimal regulator problem - Matrix Riccatti equation and solution method – Choice of weighting matrices – Steady state properties of optimal regulator – Linear tracking problem – LQG problem – Computational procedure for solving optimal control problems – Characteristics of dynamic programming solution – Dynamic programming application to discrete and continuous systems – Hamilton Jacobi Bellman equation.

UNIT-III

Numerical Techniques for Optimal Control:

Numerical solution of 2-Point boundary value problem by steepest descent and Fletcher Powell method solution of Ricatti equation by negative exponential and interactive methods.

UNIT-IV

Filtering and Estimation:

Filtering – Linear system and estimation – System noise smoothing and prediction – Gauss Markov discrete time model – Estimation criteria – Minimum variance estimation – Least square estimation – Recursive estimation.

UNIT-V

Kalman Filter and Properties:

Filter problem and properties – Linear estimator property of Kalman Filter – Time invariance and asymptotic stability of filters – Time filtered estimates and signal to noise ratio improvement – Extended Kalman filter.

Suggested Readings:

1. Krik D.E., "Optimal Control Theory – An introduction", Prentice hall, N.J., 1970.
2. Sage, A.P., "Optimum System Control", Prentice Hall N.H., 1968.
3. Anderson, BD.O. and Moore J.B., "Optimal Filtering", Prentice hall Inc., N.J., 1979.
4. S.M. Bozic, "Digital and Kalman Filtering", Edward Arnould, London, 1979.

B.TECH. IV Year, VIII- Semester
Theory Paper III

EE-413-4, Active and Passive Network Synthesis

L	T	P	Credits
3	1	0	4

UNIT-I

Network functions: Network function for one port and two port ,Calculation of network functions (i) Ladder networks (ii) General networks.

Poles and zero of network functions, restrictions on pole and zeros locations for driving point functions and for transfer functions. Time domain behavior from poles and zero plot; stability of achieve.

UNIT-II

Networks: Elements of Reliability Theory. sensitivity and stability , Positive real function Elementary synthesis procedures.

UNIT-III

Synthesis of one port networks with – two kinds of elements:

Properties of L- C immittance functions, synthesis of L-C Driving point impedances, properties of R-C impedances or R-L , admittances properties of R-L impedances and R-C admittances synthesis of certain R-L-C functions.

UNIT-IV

Passive network Synthesis:

Positive real function, driving point and Transfer impedance function, necessary conditions for driving pt & transfer function L-C network, synthesis of dissipative network, two terminal RL and RC networks.

UNIT-V

Active networks:

State Variable theory, operation of amplifier circuits, Active RC synthesis, stability of active network, filter design.

Suggested Readings:

a. Acive Integrated circuit synthesis, By:- Robert W. Newcomb.
b. Network Analysis & Synthesis, By:- Franklin F. Kuo.

B.TECH. IV Year, VIII- Semester
Theory Paper III

EE-413-5, Power Plant Instrumentation

L	T	P	Credits
3	1	0	4

UNIT – I

General scope of Instrumentation – Measurements on Boiler Plant, Turbo – generator Plant and nuclear Reactors.

UNIT- II

Fuel Measurement and various types of weighters – Pressure Measurement – capsules, Bellows and Diaphragm gauges – The Boundon Tube Pressures gauge – Pressure Transducers.

UNIT-III

Temperature Measurements – Steam and waterflow measurements – Gas analysis Meters – smoke Measurements of in purities in feed water and steam.

UNIT- IV

Transducers for remote position and control. Calibration and testing of Instrumentation and connected equipment, Data loggers and computers.

B.TECH. IV Year, VIII- Semester
Theory Paper III

EE-413-6, Reliability Engineering

L	T	P	Credits
3	1	0	4

UNIT- I

Basic probability theory, review of concepts, probability distributions. Markov processes, State Transition Matrix and state Transition Diagram.

UNIT- II

Definition of Reliability, general reliability function, evaluation of reliability using state enumeration. Tie set and cut set method. Reliability indices from state transition matrix and state transition diagrams .

UNIT- III

Models for generation system reliability evaluation, loss of load indices, energy indices, frequency and duration methods . Reliability evaluation of two area interconnected system. Conditional probability approach for reliability evaluation of a generation-transmission system .

UNIT-IV

Transmission system reliability evaluation using average interruption rate method and frequency and duration methods . Evaluation of interruption indices for radial distribution systems .

Introduction to protective system reliability evaluation.

Suggested Readings:

1. Billington, Ringley & Wood, Power System Reliability Calculation, MIT Press.
2. Endeerny, J, Reliability Modelling in Power System, John Wiley, NY.

B.TECH. IV Year, VIII- Semester Practical Paper - I

EE-414, Switchgear and Protection Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE – 402

B.TECH. IV Year, VIII- Semester Practical Paper - II

EE-415, Elective II Lab

L	T	P	Credits
0	0	2	2

Based on course work corresponding EE - 412

B.TECH. IV Year, VIII Semester

EE – 416, SEMINAR

L	T	P	Credit
0	0	2	2

B.TECH. IV Year, VIII Semester

EE – 417 Major Project (Part -II)

L	T	P	Credit
0	0	2	10