ANNEXURE - SCHEME

SCHEME OF EXAMINATION FOR B.TECH DEGREE
Ist Semester Examination
(Common to all Branches)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule Theory	Sessional	Practical/ Viva	Total	Duration of Exam.
HUT-102	English Language									
	Or									
MET-102	Manufacturing Process									
HUT-104	Engineering Economics									
	Or									
ECT-103	Basic Electronics Engineering									
MAT-103	Mathematics-I									
PHT-104	Physics-I									
CHT-104	Chemistry-I									
ELT-105	Basic Electrical Engineering	2	2/2		3	50	50		100	3
	OR									
COT-102	Computer Engineering									
CET-102	Engineering Graphics-I									
PHT-105	Physics-I Practical									
CHT-103	Chemistry-I Practical									
ECT-105	Basic Electronics Engineering-Practical									
ELT-107	Basic Electrical Engineering Practical	-	-	3	3		60	40	100	3
	OR									
COT-105	Computer Lab.*									
MET-103	Workshop Practical-I									

*All Engineering Departments will share in teaching & Exams.
HUT-102 and HUT-104 will be offered to first half of the students strength, and
MET –102 and ECT-103 will be offered to second half of the students strength.
Similar Procedure for (ELT-102,ELT-104) and (COT-103,COT-105) will be adopted

SCHEME OF EXAMINATION FOR B.TECH DEGREE
2nd Semester Examination
(Common to all Branches)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule Theory	Sessional	Practical/ Viva	Total	Duration of Exam.
MET-102	Manufacturing Process									
	Or									
HUT-102	English Language									
ECT-103	Basic Electronics Engineering									
	Or									
HUT-104	Engineering Economics									
MAT-104	Mathematics-II									
PHT-106	Physics-II									
CHT-106	Chemistry-II									
*COT-102	Computer Engineering									
	OR									
ELT-102	Basic Electrical Engineering	2	2/2	-	3	50	50		100	3
MET-105	Engineering Graphics-II									
PHT-105	Physics-II Practical									
CHT-103	Chemistry-II Practical									
ECT-105	Basic Electronics Engineering-Practical									
MET-103	Workshop Practical-II									
COT-105	Computer Lab.*									
	OR									
ELT-103	Basic Electrical Engineering Practical	-	-	2/2	1		60	40	100	3

*All Engineering Departments will share in teaching & Exams.

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
THIRD SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit Points
MT-201	Mathematics-III	3	1	-	4	50	50	100	3.5
ET-201	Circuit Theory	3	1	-	4	50	50	100	3.5
ET-203	Analog Electronics	4	1	-	5	50	50	100	4.5
ET-205	Measurement & Instrumentation-I	3	1	-	4	50	50	100	3.5
ET-207	Electrical Machines-I	4	1	-	5	50	50	100	4.5
ET-209	Transmission & Distribution	3	1	-	4	50	50	100	3.5
ET-211	Electrical Machines Lab-I	-	-	3	3	40	60	100	1.5
ET-213	Measurements and Instrumentation Lab-I	-	-	2	2	40	60	100	1.0
ET-215	Analog Electronics Lab	-	-	2	2	40	60	100	1.0
ET-217	Computer Technique lab	-	-	2	2	40	60	100	1.0
	Total	20	6	9	35				

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
FOURTH SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit Points
Hut-201	Industrial Sociology	2	1	-	3	50	50	100	2.5
ET-202	Signals and Systems	3	1	-	4	50	50	100	3.5
ET-204	Electrical Machines-II	4	1	-	5	50	50	100	4.5
ET-206	Power Electronics-I	3	1	-	4	50	50	100	3.5
ET-208	Digital Electronics	3	1	-	4	50	50	100	3.5
ET-210	Fields and Waves	3	1	-	4	50	50	100	3.5
ET-212	Power Generation & Control	3	1	-	4	50	50	100	3.5
ET-214	Electrical Machines Lab-II	-	-	3	3	40	60	100	1.5
ET-216	Power Electronics Lab-I	-	-	2	2	40	60	100	1.0
ET-218	Digital Electronics Lab	-	-	2	2	40	60	100	1.0
	Total	21	7	7	35				

Note: Students shall devote 6 weeks to Practical Training after Fourth Semester Examination

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
FIFTH SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit Points
ET-301	Network Analysis And Synthesis	4	1	-	5	50	50	100	4.5
ET-303	Power Electronics-II	3	1	-	4	50	50	100	3.5
ET-305	Power System Analysis	3	1	-	4	50	50	100	3.5
ET-307	Materials Components And Processes	2	1	-	3	50	50	100	2.5
ET-309	Control System	4	1	-	5	50	50	100	4.5
HuT-311	Business Management	3	1	-	4	50	50	100	3.5
ET-311	Power Electronics Lab-II	-	-	3	3	40	60	100	1.5
ET-313	Control System Lab	-	-	3	3	40	60	100	1.5
ET-315	Signals &Systems Lab	-	-	2	2	40	60	100	1.0
ET-317	Electrical Workshop	-	-	2	2	40	60	100	1.0
ET-319	Practical Training	-	-	-	-	40	60	100	3.0
	Total	19	6	10	35				

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
SIXTH SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit Points
ET-302	Electric Drives	3	1	-	4	50	50	100	3.5
ET-304	Microprocessors and Microcontrollers	4	1	-	5	50	50	100	4.5
ET-306	Analog and Digital Communication	3	1	-	4	50	50	100	3.5
ET-308	Switchgear and Protection	3	1	-	4	50	50	100	3.5
ET-310	Advanced Programming And Software Engg.	4	1	-	5	50	50	100	4.5
ET-312	Measurements and Instrumentation-II	3	1	-	4	50	50	100	3.5
ET-314	Microprocessors Lab	-	-	2	2	40	60	100	1.0
ET-316	Power System Lab	-	-	2	2	40	60	100	1.0
ET-318	Electric Drives Lab	-	-	3	3	40	60	100	1.5
ET-320	Measurements and Instrumentation Lab-II	-	-	2	2	40	60	100	1.0
	Total	20	6	9	35				

Note: Students shall devote 6 weeks Practical training after sixth semester examination outside the College Campus at approved works.

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
SEVENTH SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit points
ET-401	Computer Method in Power System	3	1	-	4	50	50	100	3.5
ET-403	Digital Signal Processing	3	1	-	4	50	50	100	3.5
ET-413,415,417,419	Deptt. Elective-I	3	1	-	4	50	50	100	3.5
ET-421,423,425,427	Deptt.Elective-I	3	1	-	4	50	50	100	3.5
	Open Elective-I	3	1	-	4	50	50	100	3.5
ET-405	Seminar-I	-	1	-	1	-	-	100	1.0
ET-407	Advance Programming & Software Engg.Lab	-	-	2	2	40	60	100	1.5
ET-409	Computer Methods in Power Systems Lab	-	-	2	2	40	60	100	1.5
ET-411	Minor Project	-	-	2	2	40	60	100	4.5
ET-429,431,433,435	Design Project-I	-	-	2	2				
ET-436,438,440,442	Major Project	-	-	1	1	40	60	100	4.5
ET-437	Inplant Training Report	-	-	-	-			100	3.0
	Total	15	6	9	30				

SCHEME OF EXAMINATION FOR B.TECH DEGREE COURSE
ELECTRICAL ENGINEERING
EIGTH SEMESTER EXAMINATION
(w.e.f. 2005-2006)

Course No	Subject	Teaching Schedule L	T	P/D	Total	Examination Schedule External	Internal	Total	Credit points
ET-402	System Engg. & Reliability	3	1	-	4	50	50	100	3.5
ET-404	High Voltage Engg.	3	1	-	4	50	50	100	3.5
ET-412,414,416,418	Deptt. Elective -III	3	1	-	4	50	50	100	3.5
ET-420,422,424,426	Deptt. Elective-IV	3	1	-	4	50	50	100	3.5
	Open Elective-II	3	1	-	4	50	50	100	3.5
ET-406	Seminar-II	-	1	-	1	-	-	100	1.0
ET-408	High Voltage Engg. Lab	-	-	3/2	3/2	40	60	100	1.0
ET-410	Reliability Engg. Lab	-	-	3/2	3/2	40	60	100	1.0
ET-428,430,432,434	Major Project	-	-	4	4	40	60	100	12.0
ET-436,438,440,442	Design Project -II	-	-	2	2	40	60	100	4.5
ET-444	Comprehensive Viva-voce	-	-	-	-			100	3.0
ET-446	General Fitness & Professional Aptitude	-	-	-	-			100	3.0

Departmental Electives and Projects for Seven and Eight Semester B.Tech. Electrical Engineering

	Group A (Power Apparatus and Systems)	Group B (Computer Applications)	Group C (Information & Control)	Group D (Electronics & Instrumentation)
	ET-413	ET-415	ET-417	ET-419
Departmental Elective-I	Control Theory	Computer Organisation & Architecture	Information Technology	Digital System Design
Departmental Elective-II	ET-421 Electrical Machine Design	ET-423 Problem Solving. Data Structure & Algorithms	ET-425 Digital & Non-linear Control Systems	ET-427 Biomedical & Analytical Instrumentation
Departmental Elective-III	ET-412 Utilization of Elect rical Energy & Electric traction	ET-414 System Analysis & Data Base Management	ET-416 Data Communication & Networks	ET-418 Advanced Instrumentation
Departmental Elective-IV	ET-420 Electrical Machine-III	ET-422 Advances in Computers	ET-424 Optimal & Industrial Control	ET-426 Microprocessors & Microcontrollers-II
Design Project-I	ET-429	ET-431	ET-433	ET-435
Design Project-II	ET-428	ET-430	ET-432	ET-434
Major Project	ET-436	ET-438	ET-440	ET-442

LIST OF OPEN ELECTIVE-I FOR VII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-419	Hydro Electric Power Development	
2.	CET-421	Concrete Technology	
3.	CET-423	Environmental Engg.	
4.	CET-425	Machine Foundations	
5.	COT-471	Fundamentals of Software Engg.	
6.	COT-473	Fundamentals of Database Systems	
7.	COT-475	Fundamentals of Computer Hardware Technologies	
8.	COT-477	Artificial Intelligence	
9.	ET-461	Non-Conventional Energy Sources	
10.	ET-463	System Modeling and Control	Only for C and M
11.	ET-465	Fault Tolerance and Reliability Engg.	
12.	ET-467	Illumination Engg.	
13.	ET-469	Microprocessors and Applications	Only for C and M
14.	ET-431	Transducers and Applications	Only for C and M
15.	ECT-431	e – Business	
16.	ECT-433	Radio and TV Engineering	
17.	ECT-435	Acoustic Engineering	
18.	ECT-437	Measurement Systems	
19.	ECT-439	Basic Communications Engg.	
20.	MET-429	Industrial Robotics	
21.	MET-431	Cryogenic Engg.	
22.	MET-433	Industrial Noise and Control	
23.	MET-435	Computer graphics and product Design	
24.	MET-437	Piping Engg.	

25.	MET-439	Process Equipment Design	
26.	MET-441	Industrial Engg. And Organization	Not for M
27.	CHT-463	Metals and Alloys	
28.	HuE-461	Modern Trends in Management	
29.	HuE-463	Industrial Social Responsibility	
30.	HuE-467	Development and Planning in Indian Economy	
31.	HuE-475	Advanced Communication Sills in English	
32.	MaE-467	Advanced Mathematics-I	
33.	PhE-465	Lasers	
34.	PhE-467	Ultrasonics	

LIST OF OPEN ELECTIVE-I FOR VIII SEMESTER

Sr.	Course No.	Name of Subject	Remarks
1.	CET-414	River Mechanics & Flood Control	
2.	CET-416	Geosynthetics Engg.	
3.	CET-418	Introduction to Finite Element Method	
4.	CET-420	Transport Planning	
5.	COT-472	Fundamentals of Operating Systems	
6.	COT-474	Fundamentals of Computer Networks	
7.	COT-476	Object Oriented Software Engg.	
8.	COT-478	Expert Systems	
9.	COT-480	Security and Cryptography	
10.	ET-462	Energy Management and Conservation	(All except E)
11.	ET-464	Robotic Dynamics and Control	
12.	ET-466	Reliability Centered Maintenance	
13.	ET-468	Process Instrumentation & Control	
14.	ET-470	ANNs and Fuzzy logic	
15.	ET-472	Control and Guidance	
16.	ET-474	Artificial Intelligence and Expert Systems	
17.	ECT-436	IC Fabrication Processes	
18.	ECT-438	Op-amp Applications	
19.	ECT-440	Theory and Application of DSP	
20.	ECT-442	Mobile Communication	
21.	MET-428	Non-Conventional Energy Systems	
22.	MET-430	Value Engg.	
23.	MET-432	Pneumatics & Hydraulics Control	
24.	MET-434	Material Handling	
25.	MET-436	Computer Modeling & Software Engg.	

26.	MET-438	Air Pollution and its Control
27.	ChT-464	Polymer Technology
28.	HuE-462	Entrepreneurship
29.	HuE-464	Human Resource Management
30.	HuE-466	Intellectual Property Rights
31.	MaE-468	Advanced Mathematics-II
32.	PhE-468	Non-Destructive Testing
33.	PhE-470	Transducers & their Applications

ANNEXURE - SYLLABUS

B.TECH ELECTRICAL ENGINEERING
1st /2nd SEMESTER
ELT-105 BASIC ELECTRICAL ENGINEERING

L T P
2 2/2 2/2

Time 3 Hrs.

Electric Circuits: Review of KCL,KVL and D.C. circuit analysis. Signals And wave forms, phasor representation of sinusoidal voltages and currents, power, power factor, analysis of series, and parallel circuits, resonance in series and parallel circuits

Balanced three-phase systems, star- and delta- connections, relation between line and phase quantities (voltages and currents) in the two types of connection, analysis of three phase circuits, power in three phase circuits, measurement of power by two wattmeter method.

Magnetic Circuits: Ampere turns, magneto motive force, permeability, reluctance, composite magnetic circuits, comparison with electric circuits.

DC Machines: Generators and motors, production of voltage and torque, characteristics of D.C generators and motors, speed control of dc shunt motor, application of dc generators and motors (only qualitative analysis)

Single phase transformers :Principle of working, construction equivalent circuit, open circuit and short circuits tests, losses and efficiency.

Three-phase induction motors: Principle of working, production of torque, torque-slip curve and applications. Introduction to single phase induction motors (only qualitative analysis)

SUGGESTED BOOKS:

1. V. Del Toro, "Principles of Electrical engineering," ,PHI.
2. E. Huges, " Electrical Technology," ,ELBS.
3. A.E. Fitzerald, D.E. Higginbotham and A.Grabel , " Basic Electrical Engineering",MGH.
4. S.A.Nasar and C.R. Paul, "Introduction to Electrical Engineering" ,MGH.

B.TECH ELECTRICAL ENGINEERING
3rd SEMESTER
ET-201 CIRCUIT THEORY

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

Classification of circuits, sources and signals, standard signals, source transformations.

Network topology, graph matrices, formulation and solution of circuit equations based on graph theory using different analysis techniques- circuit, cut set and mixed. Concept of duality.

Network theorems and their applications- Superposition, reciprocity, Thevenin, Norton, Maximum power transfer, Millman, Substitution, Compensation and Tellegan's theorem.

Analysis of circuits subject to periodic and non-periodic excitations using Fourier series and Laplace transforms. Concept of free and forced response of circuits. Time constants and Transient response under d.c. and a.c. excitation. Analysis of magnetically coupled circuits.

Series and parallel resonance circuits, bandwidth and Q-factor, response with variation in parameters and frequency.

Introduction to non-linear circuits and their analysis. Analysis of circuits with dependent sources.

SUGGESTED BOOKS-

1. Desoer & Kuh, " Basic Circuit theory", McGraw Hill.
2. Van Valkenberg , "Network Analysis", PHI.
3. Valkenberg & Kinariwala , "Linear Circuits", PHI.
4. Trick , "Introduction to circuit Analysis", Wiley.
5. Roy Choudhary , "Networks & systems", Wiley.
6. Iyer, "Circuit Analysis", TMH.
7. Aatre , "Network Theory & Filter Design", New Age.

ET-203 ANALOG ELECTRONICS

L	T	
4	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

Transistor biasing circuits: Base bias, Emitter-feedback bias, collector-feedback bias, Voltage-divider bias, emitter bias.
CE, CC & CB amplifiers, Darlington amplifier.
h-parameters, CE, CC and CB analysis.
Class A, B, C, D and S power amplifiers. Push-pull operation.
JFET: Gate bias, Self bias, Voltage-divider bias and source bias, current source bias. CS, CD and CG amplifier.
MOSFET: Depletion type, Enhancement type MOSFET and their biasing.
OP-AMP, Differential amplifier and its DC, AC analysis, OP-AMP characteristics, Non-Inverting/Inverting Voltage and Current feedback.
Linear and Non-Linear OP-AMP circuits, Regulated power supplies.
Barkhausen criteria of oscillations, Wein-bridge, RC oscillator
555 timer: its monostable and astable operation.

SUGGESTED BOOKS-

1. Millman and Halkias, “Integrated Electronics”, Mc Graw Hill.
2. R. Boylested and L. Nashelsky, “Electronics Devices and Circuits”, Prentice Hall India.
3. Millman and Halkias, “Electronics Devices and Circuits”, TMH Edition.
4. Malcolm Goodge, “Analog Electronics Analysis and Synthesis”, TMH Edition.
5. Malvino, “Electronics Principles”, TMH Edition.

ET-205 Measurement and Instrumentation-I

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

SI System of units, dimensional analysis.

Standards for mass, length, and time. Standards and sub-standards for R,C,M and L. Standards for temperature and luminous intensity. Laboratory standards of EMF. IEEE standards.

Errors in measurements, various types of error, error estimation, significant figures, uncertainty in results.

Analog measuring instrument, classification, principle of operation, torque to weight ratio, deflecting torque, control torque and damping torque. Scales.

Ammeters and voltmeters; Moving iron, moving coil, electrodynamic and rectifier type.

Ohmmeter, multimeter ratio meter and power factor meter.

DC potentiometer – Vernier type.

AC potentiometer; Polar and Co-ordinate type.

Wattmeter; Induction and electrodynamic type.

Energy meter; Induction type – single and three phase.

Measurement of low, medium and high resistances. Substitution and null methods.

Measurement of self-inductance and mutual inductance for low Q and high Q coils using Maxwell's. Hay's, Anderson's, Campbell's, and capacitance using DeSauty's, and Schering's bridges, shielding and grounding of bridges.

Magnetic measurements; Samples for Lloyd-Fisher square, separation of hysteresis loss and eddy current loss.

Instrument transformers; Current transformer and potential transformer, their performance characteristics.

SUGGESTED BOOKS-

1. AK Sawhney, "Electrical and Electronic Measurements & Instrumentation",Dhanpat Rai, Delhi.
2. C.T. Baldwin , "Fundamentals of Electrical Measurement", Lyall Book Depot.
3. E.W. Golding, "Electrical Measurement".

ET-207 Electrical Machines-I

L	T	
4	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

1. Electromechanical Energy Conversion-
   Basic principle Energy, Force and Torque in singly and multiply excited systems.
2. Transformers-
   a) Principle, construction and operation of single phase transformers, phasor diagram, equivalent circuit, voltage regulation, losses and efficiency.
   b) Testing- Open & short circuit tests, Polarity test, Sumpner's test, Separation of hysteresis and eddy current losses.
   c) Three phase Transformer: Construction, various types of connection and their comparative features.
   d) Parallel operation of single phase and three phase transformers.
   e) Autotransformers- Construction, Principle, Applications and Comparison with two winding transformer.
   f) Excitation phenomenon in transformers, Harmonics in single phase and three phase transformers, Suppression of harmonics.
   g) Phase conversion- Scott connections, Three phase to six phase conversion.
   h) Tap changing Transformers- No load and on load tap changing of transformers.
   i) Three winding Transformers.
   j) Cooling methods of transformers.
3. D.C. Machines-
   a) Working principle, construction and methods of excitation.
   b) Armature Winding- Detailed study of simple lap and wave windings.
   c) D.C. Generators- emf equation. Circuit models, Armature reaction, Effect of brush shift. Compensating winding, Characteristics of various types of generators, applications.
   d) D.C. Motors- Torque equation, Circuit models Characteristics of d.c. shunt, series and compound motors, applications.
   e) Starting & Speed Control- Starting methods and speed control of d.c. shunt and series motors.
   f) Commutation- Causes of bad commutation, Methods of improvement.
   g) Testing- Direct and regenerative methods to test d.c. machines.

SUGGESTED BOOKS-

1. Clayton. A.E.,"Performance and Design of Direct Current Machines "
2. Irving L." Kosow, Electric Machinery and Transformers, Prentice-Hall of India"
3. George Mcphersion ,"An Introduction to Electrical Machines and Transformers", John Wiley & Sons., NY
4. Nagrath & Kothari, "Electric Machines", Tata McGraw Hill.
5. PS Bimbhra, "Electrical Machinery", Khanna Publishers.
6. MG Say, Theory," Performance & Design of A.C. Machines", CBS Publisher.

ET-209 TRANSMISSION AND DISTRIBUTION

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

GENERAL- Importance of electric power, Power system components, Growth of power systems in India, power supply network, effect of voltage on conductor size, comparison of conductor vol. in typical supply systems elementary high voltage DC transmission and its advantages & disadvantages.

LINE PARAMETERS- Evaluation of inductance, capacitance, resistance for single phase, three- phase symmetrical, unsymmetrical, transposed, untransposed single circuit, double circuit lines; skin and proximity effect.

PERFORMANCE OF LINES- Classification of lines as short, medium and long, representation and detailed performance analysis of these lines including A B C D parameters. Detailed measurements and universal power circle diagram.

MECHANICAL CONSIDERATIONS- Various types of line conductors, line supports, poles and towers, sag calculations, effect of wind, ice and temperature, stringing chart, sag template, line vibrations.

INSULATORS- Various types of insulators, voltage distribution, string efficiency, methods of increasing string efficiency.

CORONA- Phenomenon of corona, disruptive critical voltage, visual critical voltage, corona loss, radio interference.

UNDERGROUND CABLES – Classification and construction, insulation resistance, capacitance, capacitance determination, power factor in cables, capacitance grading, use of intersheaths, losses, heat dissipation and temperature rise in cables, current rating, comparison with overhead lines.

SUGGESTED BOOKS-

1. IJ Nagrath and DP Kothari," Power System Engineering," (Tata McGraw-Hill).
2. A Chakrabarti, ML Soni, PV Gupta and US Bhatnagar," Power System Engineering," (Dhanpat Rai & Sons).
3. CL Wadhwa," Electric Power Systems", (Wiley Eastern Ltd.).
4. WD Sterenson," Elements of Power System Analysis," Jr (McGraw-Hill).
5. "Electrical Transmission and Distribution", Westinghouse Electric and Manufacturing Co.(East Pittsburgh).

B.TECH ELECTRICAL ENGINEERING
4th SEMESTER
ET-202 SIGNALS AND SYSTEMS

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

SIGNALS-

Types of Signals- Deterministic and stochastic, periodic and aperiodic, impulse function and sequences, analog and discrete, singular functions.

Signal Representation in terms of singular functions, orthogonal functions and their use in signal representation. Fourier series, Fourier and Laplace transforms. Convolution theorem, geometrical interpretation and applications.

Probability concepts, random variable, pdf. cdf. moments, distributions, correlation functions. Characterization of stochastic signals.

Discretization of analog signals – Sampling, sampling theorem and its proof. Effect of under sampling, recovery of analog signals from sampled signal. Characterization of Discrete Signals – in terms of impulse sequences, Z-transforms. Properties, Inversion and applications of Laplace, Fourier and Z-transforms.

SYSTEMS-

Classification-linear and Non-linear, Time invariant and time varying, Lumped and Distributed. Deterministic and Stochastic. Causal and Non Causal, Analog and Discrete/Digital, memory and memory less, 1-port and N-port, SISO, SIMO, MISO, MIMO.

System Modeling in terms of differential, equations, state variables, difference equations and transfer functions.

Linear time invariant system properties, elementary idea of response determination to deterministic and stochastic signals. Concept of Impulse response.

SUGGESTED BOOKS-

1. Fred J Taylor – "Principles of Signals and System," MGII.
2. Simon Haykins – "Signals and Systems," Wiley Eastern.
3. A Papoulis – "Circuits and System," Modern Approach HRW.
4. AV Oppenheim and AS Winsky – ,"Signals and System",PHI.
5. RP Singh and Sapre – Communication Systems TMH.
6. Sehwatz – Modulation, noise and spectral analysis MGH.
7. John Prokias – Digital signal processing PH.
8. RF Ziemen, WH Traiter and DR Frannin – Signals & System- Continuous and Discrete Macmillian.

ET-204 Electrical Machines - II

L	T	
4	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

1. Basic concepts of Electrical Machines-

Winding factors, generated e.m.f. and m.m.f. of distributed a.c. winding, rotating magnetic field.

2. Induction Machines-

a) Constructional features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque-slip characteristics.
b) Testing-Running light and blocked rotor test, load test.
c) Effect of rotor resistance, deep bar and double cage induction motor.
d) Generator Operation
e) Starting- Starting methods of squirrel cage and wound rotor induction motor.
f) Speed Control- Various methods of speed control of squirrel cage and wound rotor induction motor.
g) Effects of space harmonics.

3. Single phase induction motors-

1. Constructional features, double revolving field theory, equivalent circuit, determination of parameters.
2. Split phase starting methods & applications.

4. Synchronous Machines-

a) Constructional features.
b) Cylindrical rotor machine-
   I) Synchronous Generator- Generated e.m.f., circuit model and phasor diagram, armature reaction, synchronous impedance, voltage regulation and different methods for its estimation.
   II) Synchronous Motor- Operating principle, circuit model, phasor diagram, effect of load.
   III) Operating characteristics of synchronous machines, V-curves, starting methods of synchronous motors.
c) Salient pole Machine-
   Two reaction theory, analysis of phasor diagram, power angle characteristics, determination of x_d and x_q.
d) Parallel operation of Alternators-
   Synchronization and load division.

SUGGESTED BOOKS-

1. Fitzgerald & Kingsley, “Electric Machinery” McGraw Hill
2. Alexander S. Langsdorf, “AC Machines”, Tata McGraw Hill.
3. MG Say, “Theory Performance and Design of AC Machines” CBS Publisher
4. Nagrath & Kothari,” Electric Machines” TMH
5. PS Bhimbra, “Electrical Machinery”, Khanna Publishers.

ET-206 Power Electronics-I

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

Characteristics and switching behavior of different solid-state devices namely Power Diode, SCR, UJT, TRIAC, DIAC, GTO, MOSFET, IGBT, MCT and power transistor.

Two-transistor analogy of SCR, Firing circuits of SCR and TRIAC, SCR gate characteristics, SCR ratings.

Protection of SCR against over current, over voltage, high dV/dt, high dI/dt. Thermal protection Methods of commutation.

Series and Parallel operation of SCR.

Classification of Rectifiers, Phase controlled rectifiers: Single phase half wave controlled. Fully controlled and half controlled rectifiers and their performance parameters.

Three phase half wave, full wave and half controlled rectifiers and their performance parameters.

Effect of source impedance on the performance of single phase and three phase controlled rectifiers. Single-phase and three phase Dual Converter.

SUGGESTED BOOKS-

1. M. Ramamoorthy.Thyristor and their applications, East West Publication.
2. PS Bhimbra.Power Electronics, Khanna Publishers.
3. MD Singh and KB Khanchandani, Power Electronics ,TMH Edition.
4. AK Gupta and LP Singh, Power Electronics,Dhanpat Rai Publishing Co.
5. Rama Reddy, Fundamental of Power Electronics, Narosa Publishing.

ET-208 DIGITAL ELECTRONICS

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

1. Number System and Codes

Review of number systems, different codes and specifications, Integer and floating point systems.

2. Boolean Algebra: Basic theorems, commutative, associative, distributive laws, duality concept, SOP and POS form of Boolean expressions, minimization techniques up to six variables using K maps, QM method.

3. Logic gates and Logic Families

Logic gates, Universal gates, transistor as a switching element, Tri-state switch, Bipolar logic Families: RTL, DTL, TTL, ECL, 1^2L, MOS Logic families: NMOS, CMOS families and characteristics, TTL to CMOS interface, CMOS to TTL interface, various logic functions and their implementation.

4. Combinational Logic gates

Introduction to combinational circuits, arithmatic and logical operation, design of Half adder & full adder, subtractor circuits, parity generator & and checker, code converter, decoders, multiplexers, demultiplexers, comparators, ROM, concept of PLD, PAL, PLA devices.

5. Sequential Circuits

Flip-flops, bistable circuits: RS, JK, D, T, Master/Slave Flip-flop, race around condition, latches, synchronous and asynchronous counters up & down counters, shift registers, state transition diagram, introduction to finite state machine concept.

6. Semiconductor Memory

Basics of memory, memory addressing, ROM, PROM, EPROM, static and dynamic RAM.

7. A/D & D/A Converters

D/A converter, accuracy, resolution and precision, variable resistor network, binary ladder, A/D converter, accuracy and resolution, simultaneous conversion, counter method, continuous A/D converter, dual slope, successive approximation method.

SUGGESTED BOOKS-

1. RP Jain, 'Modern Electronics'.
2. AP Malvino and DP Leach, ' Digital Principles and applications'.
3. Floyd, 'Digital Circuits'.
4. Charles Roth, 'Fundamentals of Logic Design'.
5. H. Taub and D. Schilling, 'Digital Integrated Electronics'.
6. Gothman, Digital Electronics.

ET-210 FIELDS AND WAVES

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

1. Review of Vector Analysis :

Coordinate Systems, Vectors, gradient, divergence, curl, Laplacian, divergence theorem, Stoke's theorem.

2. Electric and Magnetic fields:

Electric fields due to distributed charges configurations line(s) of charges, uniform plane surface and spherical volume charge distributions; behavior of conductors and dielectrics in electrostatic fields, boundary conditions, applications of ampere's law and Biot-Savart's law; capacitance and inductance calculations for simple configurations; time varying fields – displacement current, Maxwell's equations; Laplace's and Poisson's equations.

3. Electromagnetic Waves:

Wave equation, uniform plane waves, plane wave propagation in dielectric and conducting media. Reflection and refraction of plane wave (normal incidence). Wave propagation in bounded media, ground waves, sky waves, and space waves. Transmission line: Distributed parameter circuits, traveling and standing waves impedance matching, and smith chart.

Wave Guides: parallel plane guide, TE, TM and TEM waves, rectangular and cylindrical wave guides, resonators, planes transmission line; strip lines, microstrip line.

4. Antenna and Microwaves:

Electromagnetic radiation, elements of antenna theory (gain, BW, Bandnwidth and polarization, effect of ground) antenna coupling, high frequency antennas, microwave antennas (introduction to microwave services, integrated circuits and measurements).

SUGGESTED BOOKS:

1. N.N. Rao Basic Electromagnetics with applications, PHI
2. E.C. Jordan and K.G. Balmain.Electromagnetic waves and radiating systems, PHI
3. J.D. Kraus Electromagnetism
4. D.J. Griffith Introduction to Electrodynamics, PHI .
5. Guru & Hiziroglu Electromagnetic field theory fundamentals Vikas Publishing House Hayt's book.

ET-212 POWER GENERATION AND CONTROL

L T
3 1

Internal Marks: 50
External Marks: 50
Ext. Exam.Time: 3 Hrs.

Loads and Load Forecasting

Load Curves, Maximum Demand, Load Factor, Diversity Factor, Capacity Factor, Utilization Factor, Types of Load, Load Forecasting

Power Plant Economics

Choice of type of generation, Size of generator and number of units, Cost of Electrical Energy, Depreciation of plant, effect of load factor on cost of Electrical Energy.

Thermal Power Plants

Choice of site, Main and auxiliary equipment, Flue Gas-flow diagram, Water-steam-flow diagram, Working of power plants and their layout, Characteristics of turbo-generators.

Hydro-Electric Plants

Choice of site, Classification of Hydro-Electric plants, Main parts and working of plants and their Layouts, Characteristics of Hydro-Electric generators

Nuclear Power Plants

Choice of site, Classification of plants, main parts, Layout and their working, Associated problems.

Diesel Power Plants

Diesel plant Equipment, Diesel plant Layout and its working, Application of diesel plants.

Combined working of Plants

Advantages of combined operation, plant requirements for Base load and Peak load Operation. Combined working of Run-off River Plant and steam plant.

Power Station Equipment and Control

(i) Excitation Systems- Purpose and requirements of excitation systems, static excitation systems, brushless excitation system.

(ii) Voltage Regulators- Functions and characteristics of automatic voltage regulators, Solid state regulator.

(iii) Speed Governing Systems- Purpose of speed governing system, Hydraulic type speed governing system for steam turbines and hydro-turbines.

(iv) Automatic Generation Control- Types of interconnection, Advantages of interconnection, Real and Reactive power control, Single area automatic generation control, Automatic Generation control for two area system, Types of automatic generation control for interconnected power systems.

Tariffs and Power Factor Improvement

Different types of tariffs and methods of power factor improvement

SUGGESTED BOOKS-

1. P.S.R.Murty, 'Power System Operation and Control', Tata Mc Graw Hill, New Delhi.
2. M.V. Deshpande, 'Elements of Electrical Power System Design', Wheeler Publishing Co, Allahabad.
3. B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (Pvt)Ltd, New Delhi.
4. P.V. Gupta et al, 'A Course in Electrical Power, 'Dhanpat Rai and Sons, Delhi-6.
5. S. Mukhopadhyay, 'Modern Power System Control and Operation,' Roorkee Publishing House, Roorkee.
6. S.S. Vadhera, 'Power System Analysis and Stability', Khanna Publishers, Delhi.

B.TECH ELECTRICAL ENGINEERING
5th SEMESTER
ET-301 Network Analysis and Synthesis

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

Concept of generalized frequency, circuit representation and their response in terms of generalized frequency.

Concept of one port, two-port networks, characteristics and parameters, interrelationships of parameters, image & iterative impedance concept of characteristic impedance, scattering parameters, insertion loss, interconnection of 2-port networks, analysis of terminated 2-port networks, extensions to multiport networks.

Generalized network functions (Driving point and Transfer), concepts of poles and zeros, determination of free and forced response from poles and zeros, concept of minimum phase networks, analysis of ladder, lattice, T and bridged-T networks.

Introduction to state-space representation of networks and their analysis.

Concept of filtering, filter types and characteristics, classical design of T and PI passive filters, frequency transformations. Introduction to active filters, active filter specifications, design of first and second order RC –active filters, maximally flat and equi-ripple filter characteristics, implementation using passive elements and op-amps. Introduction to switched capacitor networks.

Network synthesis- Synthesis problem formulation, properties of positive real functions, hurwitz polynomials, properties of RC, LC and RL driving point functions, foster and cauer synthesis of LC and RC circuits.

SUGGESTED BOOKS-

1. Temes & LaPatra – Introduction to circuit Synthesis & Design, McGra Hill.
2. Valkenberg – Modern Network Synthesis, PHI.
3. Weinberg – Network Analysis & Synthesis, McGraw Hill.
4. FF Kuo – Network Analysis.
5. SK Mitra – Analysis & Synthesis of Active Network.
6. Peikari – Fundamentals of Network Analysis & Synthesis, Wiley.

ET-303 Power Electronics-II

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

D.C. to D.C. Converter:

Classification of choppers. Principle of operation, steady state analysis of class A chopper, step up chopper, switching mode regulators: Buck, Boost, Buck-Boost, Cuk regulators. Current commutated and voltage commutated chopper.

A.C. to A.C. Converter:

Classification, principle of operation of step up and step down cycloconverter. Single phase to single phase cycloconverter with resistive and inductive load. Three phase to single phase cycloconverter: Half wave and full wave. Cosine wave crossing technique. Three phase to three phase cycloconverter. Output voltage equation of cycloconverter.

D.C. to A.C. Converter:

Classification, basic series and improved series inverter, parallel inverter, single phase voltage source inverter, steady state analysis, Half bridge and full bridge inverter: Modified Mc Murray and Modified Mc Murray Bedford inverter, voltage control in single phase inverters, PWM inverter, reduction of harmonics, current source inverter, three phase bridge inverter.

Power Supplies:

Switched mode D.C. and A.C. power supplies. Resonant D.C. and A.C. power supplies.

Applications: Dielectric and induction heating. Block diagram of D.C. and A.C. motor speed control.

SUGGESTED BOOKS:

1. Jacob, Michael Power Electronics: Principles & Application, Vikas Publishing House Pvt. Ltd.
2. M.H. Rashid, Power Electronics : Circuits, devices and applications , PHI.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics : Converters, Applications and Design , John Wiley & Sons.
4. P.S. Bimbhra, Power Electronics .
5. M. Ramamoorthy An Introduction to Thyristors and their applications East-West Press.
6. M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw-Hill.
7. A.K. Gupta & L.P. Singh, Power Electronics and Introduction to Drives Dhanpat Rai Publishing Co.

ET-305 POWER SYSTEM ANALYSIS

L	T	Internal Marks: 50
3	1	External Marks: 50
		Ext. Exam.Time: 3 Hrs.

General Aspects:

Per-unit quantities, single-line diagrams, impedance diagram, reactance diagram.

Line performance improvement devices – Series and shunt compensation of lines, methods of voltage control, tap-changing and regulating transformers, introduction to voltage stability, reactive power injection, static var compensators (SVC), elementary ideas of various FACTS controllers STATCOM, TCR, TSC, TCSC, TCVL.

Travelling Waves:

Travelling waves on lines, reflection and refraction of waves at function points and for various line terminations.

Neutral Grounding:

Need of neutral grounding, various types of neutral grounding, earthing transformer, equipment earthing for safety.

Symmetrical Faults:

Three-phase short-circuit on a synchronous machine, transient analysis, various reactances, current-limiting reactors, various types and the methods of locating the reactors, calculation of fault MVA.

Unsymmetrical Faults:

Symmetrical components transformation, Sequence impedance and Sequence networks of power system components and power system, various unsymmetrical shunt faults on alternator and power system, inter connection of sequence networks for various types of faults.

Stability Analysis:

The stability problem, steady-state, transient, and dynamic stability, rotor dynamics and the swing equation, equal-area criterion and its applications, step-by-step solution of the swing curve, factors affecting transient stability.

Economic Operation of Power Systems:

Operating cost of a thermal unit, incremental cost, coordination equations without and with transmission losses, economic distribution of load between units and between plants, iterative method for load distribution.

SCADA: Introduction, functions of SCADA.

SUGGESTED BOOKS:

1. IJ Nagrath and DP Kothari Modern Power Systems Analysis, (Tata Mc-Graw Hill).
2. A Chakrabarty, ML Soni, PV Gupta and US Bhatnagar Power System Engineering, (Dhanpat Rai & Sons).
3. John J Grainger and William D Stevenson Jr. Power System Analysis, (McGraw-Hill, Inc.).
4. CL Wadhwa Electric Power Systems, (Wiley Eastern Limited).

ET-307 MATERIALS, COMPONENTS AND PROCESSES

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

MATERIALS: Conductors- free electron theory and electron scattering
Dielectrics- Polarization, solid, liquid and gas dielectrics
Insulators- Classification, Application in electric devices.
Magnetic materials- classification based on orientation of magnetic dipoles
Optoelectronic materials
Semiconductors- simple and compound
Refractory Materials. Solders and contacts
Superconductivity and super conducting materials.

COMPONENTS: Resistors and Capacitors. Display units:- LED, LCD and Monitors. Effect of environment on components.

PROCESSES: Basic processes used in the manufacture of integrated circuits such as
Epitaxy, masking, photolithography, diffusion, oxidation,
Etching, metallization, Scribing, wire bonding and
Encapsulation. Induction and Dielectric heating. Electron beam welding and cutting.

SUGGESTED BOOKS-

1. S.O. Kasap, 'Principles of Electrical Engineering Materials,' (NGH).
2. Mahajan, 'Principles of growth and processing of semiconductors,' (NGH).
3. Dhir, 'Electronic components and Materials Principles manufacturing and Maintenance,' (YMH).
4. Allison, 'Electronic Engineering Materials and Devices,' (TMH).
5. Ruska N Scot, 'Microelectronic processing – an introduction to the manufacture of integrated circuits,' (MGH).
6. Deeker, 'Electrical Engineering Materials,'(PHI).
7. Seth and Gupta, 'A course in Electrical Engineering Materials,' Dhanpat Rai and Sons.

ET-309 CONTROL SYSTEM

L T
3 1

Internal Marks: 50
External Marks: 50
Ext. Exam.Time: 3 Hrs.

Introduction to Control Systems:

Concept of control, control system terminology, classification of Control Systems.

Mathematical Models of Systems:

Differential equations of physical systems, transfer function of linear systems, block diagram models, and signal flow graph.

D.C. & A.C. Servomotors, Synchros.

State Variable Models:

State variables of a dynamic system, state equation, transfer function from the state equation and vice-versa.

Feed back Control System Characteristics:-

Time domain and frequency domain responses and characteristics, steady state error, performance indices, concept of stability.

Analysis of Linear Feedback Systems:-

R-H stability criterion, Nyquist criterion, Bode plot, Root locus and Liapunov's criterion.

Design of Feedback Control System:-

Approaches to system design, phase lead, phase lag design using Bode-diagram and root locus techniques Design using State variable Feedback:-

Controllability, observability, pole placement using state feedback, Ackerman's formula, limitations of state variable feedback.

Introduction to P/I/D and ON-OFF control actions.

SUGGESTED BOOKS:

1. Nagrath and Gopal, Control System Engg, TMH
2. Ogata.Control System Engg., PHI
3. BC Kuo, Automatic Control System, Prentice Hall
4. RC Dorf and RH Bishop,.Modern Control Systems, Addison-Wesley Publisher

BTech Electrical Engineering
6th Semester
ET-302 Electric Drives

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam.Time: 3 Hrs.

Introduction:-

Classifications of Electric Drives, components of electric drives, advantages of electric drives, Review of characteristics and speed control of d.c. and a.c. motors.

Dynamics of Electric Drives:-

Fundamental torque equation, speed-torque conventions and multiquadrant operation, equivalent values of drive parameters, components of load torques, nature and classification of load torques, calculation of time and energy-loss in transient operations, criteria for steady state stability, load equalization.

Rating and Heating of Motors:-

Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating, frequency of operation of motors subjected to intermittent loads.

Rectifier Control of D.C. Drives:-

Controlled rectifier circuits, 1-phase fully controlled rectifier-fed separately excited d.c. motor, 1-phase half-controlled rectifier-fed separately excited d.c. motor, 3-phase fully controlled rectifier-fed separately excited d.c. motor, multiquadrant operation of fully-controlled rectifier-fed d.c. motor.

Chopper Control of D.C. Drives:

Principle of operation and control techniques, motoring operation of separately excited and series excited motors, multiquadrant control of chopper-fed motors.

Induction Motor (IM) Drives:-

3-phase a.c. voltage controller-fed IM drive, voltage source inverter (VSI) and current source inverter (CSI) variable frequency drives, comparison of VSI and CSI drives, cycloconverter-fed IM drive, static rotor resistance control of 3-phase slipring IM.

Synchronous Motor Drives:-

VSI drive, CSI drive, CSI drive with load commutation, cycloconverter drive,

Braking methods:-

Various methods of braking d.c. and a.c. motors, regenerative braking of d.c. motors during chopper control, static scherbius drive, commutatorless Kramer drive.

Microprocessor Control of Electric Drives:-

Dedicated hardware systems versus microprocessor control, application areas and functions of microprocessor in drive technology, control of d.c. drives using microprocessors, vector control of IM drive using microprocessor, some aspects of control system design of microprocessor based variable speed drives.

SUGGESTED BOOKS:

1. G.K. Dubey, “Fundamentals of Electrical Drives” Narosa Publishing House, 1995.
2. SK Pillai, “A First course on Electrical Drives” Wiley Eastern Ltd.
3. V. Subrahmanyam, “ Electric Drives: Concepts and Applications”, Tata Mc Graw Hill Publishing Co. Ltd., 1994.
4. GK Dubey, “ Power semiconductor Controlled Drives, “Prentice Hall, Englewood cliffs, New Jersey, 1989.
5. EL- Sharkawi & A Mohamad “ Fundamental of Electric Drive”, Vikas Publishing House

ET-304 Microprocessors and Microcontrollers

L T	Internal Marks: 50
3 1	External Marks: 50
	Ext. Exam. Time: 3 Hrs.

Microprocessor Architecture:

8085 microprocessor architecture, timing and control unit, machine cycles, interrupt diagram.

Programming:

Addressing modes, instruction set, assembly language programming, program for multibyte addition/subtraction, multiplication, division, block transfer.

Interfacing:

Basic principles of interfacing memory and I /O devices. Data transfer techniques – programmed interrupt and DMA. Details of interfacing devices 8255 and 8253. Interfacing of D/A and A/D converter.

Semi Conductor Memory:

Read only memories, random access memories. Interfacing of memories with 8085.

Microcontroller:

Architecture of 8051 microcontroller. Interrupt, serial and timer control. Instruction set and programming. Interfacing with D/A and A/D converter.

Architecture of 8086 microprocessor.

SUGGESTED BOOKS:

1. R.S. Gaonkar, "Microprocessor Architecture, Programming and Applications", Penram International.
2. A.P. Mathur, "Introduction to Microprocessor".
3. K.J. Ayala, "8051 Microcontroller", Penram International.
4. D.V. Hall, "Advanced Microprocessor".

ET-306 Analog and Digital Communication

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to Communication Systems:

Block diagram, modulation and demodulation, need for modulation, transmission considerations and decibel ratios.

Amplitutde modulation, generation of AM waves, concept of SSB and DSB modulation, vestigial sideband transmission, power-relationships, AM receivers, S/N ratio.

Phase and frequency modulation, pre-and de-emphasis, generation of FM waves, CW modulation systems, narrowband FM, FM detectors and superheterodyne receivers, S/N ratio.

Concepts of information, Shannon-Hartley theorem, bandwidth-S/N ratio tradeoff, coding, codes for error detection and correction, convolution codes, block and trellis codes.

Pulse modulation, PAM, PPM, PWM systems. Concept of PCM, basic coding and quantization, sample and hold, quantization noise, signal to noise ratio, companding, TDM, Delta modulation, adaptive delta modulation, S/N ratio, comparison of PCM, delta and adaptive delta modulation ASK, PSK, FSK, differential PSK and quadriphase shift keying, synchronization concepts and phase locked loops.

Block diagram of Fibre optic communication systems, light propogation in optical fibres, numerical aperature and acceptance cones of OF_s, losses in optical fibres. Multiplexing in optic fibre links.

An introduction to telephone exchange systems. Telecommunication traffic, circuit switching, message switching and packet switching. Resource sharing and multiple access techniques.

An introduction to microwave, radar and satellite communication.

SUGGESTED BOOKS:

1. G. Kennedy, “Electronic Communication Systems”, McGraw-Hill, NY .
2. H.Taub and D.L. Schilling, “Principles of Communication Systems”, TMH.
3. W.D. Stanley, “Electronic Communication Systems”, Reston Pub. Co. PH Virginia.
4. W. Tomari & V.F. Alisauskas, “Telecommunications”, PH Inc., NJ.
5. Dungan, Frank R “ Electronic Communication Systems’ Vikas Publishing B House Pvt. Ltd

ET-308 Switchgear and Protection

L	T	Internal Marks: 50
3	1	External Marks: 50
		Ext. Exam. Time: 3 Hrs.

Switchgear:

Introduction, functions of a circuit breaker, contacts separation and arc phenomenon, theory of arc formation and its extinction, recovery voltage, restriking voltage, interruption of capacitive and inductive currents, resistance switching, double frequency transients, circuit breaker ratings, clearing time, reclosing time, classification of circuit breakers, oil, air-blast, vacuum and SF_6 circuit breakers.

Protection Against Lightning:

Lightning mechanism and its characteristics, over-voltages due to lightning, protection of lines and sub-stations against lightning using shield wires, tower footing resistance, counterpoises, ground wires, rod gaps, lightning arrestors, their construction, working and ratings, surge absorbers and surge divertors.

Insulation Co-ordination:

Impulse volt-time characteristics of electrical apparatus, basic impulse insulation level, insulation levels of sub-station equipments.

Protective Relays:

Introduction, basic requirements, operating principles and characteristics of electromagnetic type over-current, differential, impedance and admittance relays. Detail of protection against abnormal conditions for alternators, transformers, feeders transmission lines, and bus-bars. Carrier current protection for long lines.

Static Relays:

Introduction, comparison with electromagnetic relays, working of instantaneous, definite time, inverse time and directional over current relays, introduction to digital relays.

Sub-Stations:

Types of sub-stations, sub-station equipments and outdoor yard layout, types of bus-bars, key diagrams and bus-bar arrangements.

SUGGESTED BOOKS:

1. A Chakrabarti, ML Soni, PV Gupta and US Bhatnagar, “Power System Engineering” Dhanpat Rai & Sons.
2. IJ Nagrath and DP Kothari,”Power System Engineering” Tata McGraw-Hill.
3. CL Wadhwa, “Electric Power Systems”, Wiley Eastern Limited.
4. Sunil S. Rao, “Switchgear, Protection and Power Systems”, Khanna Publishers.
5. Badriram and DN Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw-Hill.

ET-310 Advanced Programming and Software Engineering

L	T	
4	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Loaders:

Loader Schemes-absolute, binder, linking overlays and dynamic binder.

Operating Systems:

Functions of operating systems, Input/Output memory, Processor,Device, and file management, some typical examples from UNIX/LINUX/WINDOWS/MS-DOS operating systems.

Compilers:

Functions, Lexical and system analysis, parsing techniques, storage assignment, code generation.

C++ Programming Language:

Concept of Object Oriented Programming Abstract data types & classes, data encapsulation, inheritance and polymorphism, run time polymorphism, virtual functions, templates, standard template library and container classes. Implementation using C++.

SUGGESTED BOOKS:

1. John J. Donovan, "System Programming" .
2. A.V. Aho and J.D. Ullman, "Principles of Compiler Design", Addision Wesley Pub.Co.
3. D.M. Dhamdhere, "System Software", TMH.
4. Peterson, "Operating Systems",.
5. Herbert Schildt, "C++ - Complete reference", TMH.
6. Stroustrup "C++", Addision Wesley Pub. Comp.
7. Litvin, Maria, "Programming in C++", Vikas Publishing House.

ET-312 Measurements and Instrumentation-II

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Thermocouple and rectifier type instruments, Electronic analog instruments for measurement of direct and alternating currents, voltages and power.

Digital instruments – advantages over analog instruments. Measurement of voltage, resistance, time and frequency by digital techniques. Digital wattmeters and energy meters.

Construction and synchronization of C.R.O. measurement of voltages, currents, phase and frequency by C.R.O. Distortion meter, harmonic analyzer, Q meters.

Recorders – X-Y recorder, strip chart recorder and magnetic recorder. Frequency modulation and pulse duration recording. Digital tape recording. Noise in reproduction. `

Digital display methods. Display systems – LED, LCD. Medical display devices – Cardioscope.

Principles of telemetry, wire link channels, radio channels, microwave channels, multiplexers. Digital and Analog Data Acquisition Systems.

Measurements of high direct and alternating voltages and currents.

Measurement of phase and frequency:

Single phase and three- phase electrodynamometer type power factor meters, electrical resonance frequency meter, Weston frequency meter, ratio meter type frequency meter.

Transducers:

Classification, transducers for measurement of position, force, pressure, temperature, torque, flow, velocity (linear and angular) strains, humidity, vibrations and p.H. value.

SUGGESTED BOOKS:

1. A.K. Sawhney “Electrical Measurements and Measuring Instruments”, Dhanpat Rai & Sons.
2. W.D. Cooper- “Electronics Instrumentation and Measurement Techniques”, Prentice Hall India.
3. B.C. Nakra and K.K. Chaudhry- “Instrumentation Measurement and Analysis”, Tata Mc-Graw-Hill Publishing Company Limited, New Delhi.

B.Tech. Electrical Engineering
7th Semester
ET-401Computer Methods in Power Systems

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

General:

Impact of computers, orientation of Engineering problems to computers, review of matrices and matrix operations.

Incidence and Network Matrices:

Network graph, various incidence matrices, generalized element representation, primitive network and primitive network matrices, formation of various network matrices by singular transformations, inter-relations between various incidence matrices and network matrices.

Bus impedance and admittance matrices:

Building algorithm for bus impedance matrix, modification of bus impedance matrix for change of reference bus and for network changes, formation of bus admittance matrix and modification, calculation of Z Bus elements from Y Bus.

Three-phase Elements:

Representation of three-phase network elements, treatment under balanced and unbalanced excitation, transformation matrices, unbalanced elements.

Short-Circuit Studies:

Introduction, network short-circuit studies using Z bus, short-circuit calculations using symmetrical components for various types of faults.

Load-Flow Studies:

Introduction, importance of load-flow studies, classification of buses, load-flow equations, iterative methods, computer algorithm and load flow solutions using Gauss-Seidel and Newton-raphson methods, decoupled and fast decoupled load-flow solutions, representation of regulating and off-nominal ratio transformers, comparison of load-flow solution methods.

Sparsity :

Introduction, optimally ordered triangular factorization, schemes of optimal ordering.

Stability Studies:

Algorithmic flow chart and transient stability solution using modified euler method.

Power System Security:

Introduction, contingency analysis using Z Bus and various distribution factors.

SUGGESTED BOOKS:

1. Glenn W. Stagg and Ahmed El-Abiad, " Computer Methods in Power System Analysis", McGraw-Hill.
2. George L Kusic, " Computer-Aided Power Systems Analysis", PHI.

3. John J Grainger and William D Stevenson, “Power System Analysis”, Jr. .McGraw-Hill.
4. IJ Nagrath and DP Kothari , “Power System Engineering”, Tata McGraw-Hill.

ET-403 Digital Signal Processing

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

The Z-Transform analysis of LTI Systems:

Analysis of LTI systems in z-domain, transient and steady -state response, causality and stability, Shur-Cohn stability test, Jury test, Shur-Cohn-Fuzzivera stability criterion.

DFT and FFT:

DFT and its properties, linear filtering using DFT, Direct computation of DFT, circular convolution, FFT algorithms; Geortzel algorithm, Radix-2 and Radix-4 algorithms, Chirp-Z algorithm.

Circular convolution and fast linear convolution.

Implementation of Discrete time Systems:

Direct form, cascade form, frequency selective and lattice structure for FIR filters, direct form, signal flow graph and transposed structure for IIR filters, cascade, parallel and lattice structure for IIR filters, state space structure.

Design of Digital Filters:

Design of FIR filters, window method, frequency sampling method, design of IIR filters by approximation of derivatives, quantization effects in digital filters. Bilinear transformation, characteristics of some commonly used analog filters for design of IIR filters, least square methods.

Time- Frequency Analysis:

Introduction to wavelets and wavelet transforms.

Brief introduction to DSP architecture:

Pipeline, lattice and systolic architecture.

SUGGESTED BOOKS:

1. S.K. Mitra, " Digital Signal Processing", TMH.
2. Rabinar, Gold, " Digital Signal Processing" ,PHI.
3. J.G. Proakis and DG Manolakis, " Digital Signal Processing",PHI.
4. Oppenheim and Schafer, " Discrete Time Signal Processing" ,PHI.
5. S. Salivahanan, " Digital Signal Processing", TMH.
6. Ingle, Vinay K, " Digital Signal Processing using Matlab", Vikas Publishing House Pvt. Ltd.

ET-413 CONTROL THEORY
(Power Apparatus and System)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Non-linear Systems:

classification and comparison. Special features of non-linear systems, limit cycle, jump resonance, subharmonics, bifurcations, chaos, multiple eq. points.

Analysis of Non-linear systems:

Describing function and phase plane techniques.Concept of local, global, asymptotic and total stability of NL system, Liapunov's direct method, Popov's method.

PID controller:

Function of PID, Tunning features, Ziegler-Nichols Tunning method, ultimate cycle tuning method, Process reaction curve, Tunning for Minimum error integrals.

Optimal Control System:

Introduction to OCT, Advantages, Problem Formulation (minimization problem, tracking problem). Optimization through transfer function , limitations of transfer function approach, optimization through state variable approach, regulator problem, HJ equation, solution of finite time regulator problem.

SUGGESTED BOOKS:

1. Ogatta. K. , "Modern Control System", PHI.
2. M.Gopal, "Optimal Control Theory" ,TMH.
3. M.Gopal ,"Digital Control and State variable Methods", TMH.

ET-415 Computer Organization and Architecture (Computer Application)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to basic computer architecture, register transfer, bus and memory transfers, arithmetic, logic and shift microperations.

Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, I/O interrupt, complete computer description, design of basic computer, design of accumulator logic.

Microprogrammed control, control memory, address sequencing, microprogram example, design of control unit.

Central Processing Unit:

Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, RISC.

Pipeline and Vector Processing:

Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing, array processors.

Input-output Organisation:

Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, IOP serial communication.

Memory Organisation:

Memory hierarchy, main memory, auxillary memory, associative memory, cache memory, virtual memory, memory management, hardware multiprocessor architectures and their characteristics, interconnection structures, interprocessor arbitration, interprocessor communication and synchronization, cache coherence.

SUGGESTED BOOKS:

1. Morris Mano, " Computer System Architecture", PHI.
2. J.F. Heys, " Computer Organization and Architecture",TMH.
3. Hwang K. and F.A. Briggs, " Computer Architecture and Parallel Processing", TMH.

ET-417 Information Technology
(Information and Control)

L T
3 1

Internal Marks: 50
External Marks: 50
Ext. Exam. Time: 3 Hrs.

An overview of the revolution in computers and communications.

Applications software, common features of software speciality software, Ethics & intellectual property rights.

Systems software, common operating systems, software for online computing.

System Unit:

System board, microprocessor.

Input and output:

Keyboard, pointing, scanning, voice input devices, voice recognition system, monitors, printers, plotters, voice output devices.

Secondary storage:

Floppy, hard, optical disks, CD-R Drives.

Communication and Connectivity:

E-mail, fax, voice messaging system, user connection, communication channels, data transmission, network types.

Internet and Web:

Applications, Access, E-mail, discussion groups, E-commerce, services, browsers, web pages, multimedia, graphics program, virtual reality privacy, security and other such issues.

SUGGESTED BOOKS:

1. Leon and Leon, " Fundamental of Information Technology", Vikas Publishing House.
2. T.J. O'Leary and L.I. O'Leary, " Computing Essentials 2000-2001-Irwin", McGraw Hill-2000.
3. Williams, Sawyer and Hutchinson, " Using Information Technology",TMH, 2000.
4. Curtin, Foley, Sen and Morin, " Information Technology",TMH.
5. "Internet for every one", Vikas Publishing House.

ET-419 Digital System Design
(Electronics and Instrumentation)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Review of combinational logic, minimization in combinational logic, sequential machine fundamentals.

Multi-input system controller design, timing and frequency considerations, system controller state specification, state assignment, next state and output decoder.

A synchronous finite state machines and their design.

VHDL, basic terminology, configuration, package declaration, basic language elements, behavioral modeling. Data flow and structural modeling.

SUGGESTED BOOKS:

1. J. Bhaskar, " A VHDL primer", Pearson Education Asia.
2. J. Bhaskar, "An Engineering approach to Digital Logic Design".

ET-421 Electrical Machines Design
(Power Apparatus and Systems)

L	T
3	1

Internal Marks: 50
External Marks: 50
Ext. Exam. Time: 3 Hrs.

Review of Magnetic and insulating materials.

Principles of design of Machines:

Factors and limitations in design, specific magnetic and electric loadings, output, real and apparent flux densities, separation of main dimensions for D.C., induction and synchronous machines.

Heating, Cooling and Ventilation:

Temperature rise calculation, continuous, short-time and intermittent ratings, types of ventilation, hydrogen cooling and its advantages.

Design of Transformers:

General considerations, output equation, main dimensions, leakage reactance, winding design, tank and cooling tubes, calculation of magnetizing current, losses, efficiency and regulation.

Design Three- phase induction motors:

General considerations, output equation, choice of specific electric and magnetic loadings, No. of slots in stator and rotor, elimination of harmonic torques, design of stator and rotor windings, leakage reactance, equivalent resistance of squirrel cage rotor, magnetizing current, temperature rise and efficiency.

Design of Alternators:

Classification and their comparison, specific loadings, output coefficient, main dimensions, short circuit ratio, elimination of harmonics in generated EMF, stator winding design.

Introduction to computer aided electrical machine design.

SUGGESTED BOOKS:

1. Clayton A.E., "The performance and design of D.C. Machines", Pitman(ELBS).
2. Say MG, "The performance and design of A.C. Machines", Pitman(ELBS).
3. Sawhney AK, "Electrical Machine Design",(Dhanpat Rai & Sons.

ET-423 Problem Solving, Data Structures and Algorithms (Computer Application)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Problem Solving Strategies:

Statements, goals and rules, abstraction, problem spaces, inference, subproblems and subgoals, hill climbing, working backwards, heuristics, back tracking, iteration and recursion.

Basic Data Structures:

Arrays, strings, stacks, queues – linear and circular, single- linked lists, double linked lists – linear and circular, trees, binary trees, implementation using linked lists.

Algorithms:

Introduction to analysis of algorithms, asymptotic notation, features of a structured program. Recursion, top down and bottom up programming techniques. Divide and conquer strategy.

Sorting methods –

internal and external sort, double, exchange, insertion, selection, merge, heap, radix and quick sort. Comparison with respect to their efficiency.

Searching methods, Sequential, Binary search, indexed search, hashing techniques and collision handling mechanism.

Graphs and their applications – computer representation of graphs traversal techniques like depth – first/breadth-first.Greedy algorithms – study with respect to shortest path, minimum spanning trees, knapsack problems, traveeling salesman problem.

Mathematical methods:

Sparse matrices their representation manipulations, strassen's matrix multiplication, permutations & combinations, random number generation techniques.

SUGGESTED BOOKS:

1. Trembley and Sorenson, “An Introduction of Data Structures with Applications”, McGraw Hill.
2. Goodman, S.E., and Hetedniemi, S.T., “Introduction to the Design and Analysis of Algorithms”, McGraw Hill.
3. Sahni, “Data Structures, Algorithms and Applications in C++”, TMH.
4. Horowitz, Ellis and Sahni, Sartaj, “Fundamentals of Computer Algorithms”, Galgotia Publications.
5. Gorgono, “Problem Solving & Computer Programming”, Narosa Nelwn.
6. Horowitz, E. and Sahani, S. “Fundamentals of Data Structures”, Galgotia Publications.

ET-425 Digital and Non-linear Control System (Information and Control)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Pulse transfer function, block diagrams and signal flow graphs for sampled data systems.

State variable representation and solution of discrete data systems, stability in state space representation correlation between S-plane and Z-plane, Jury's modified Rouths criteria and time response characteristics & bode plots.

Non-linear systems classification and comparison. Special features of non-linear systems: Limit cycle, jump renonances. Subharmonies biferation, chaos, multiple equilibrium points.

Analysis of Non-linear systems:

Describing function and phase plane techniques.

Concept of local, global, asymptotic and total stability of non-linear systems. Liapunov's direct method, Popov's method.

SUGGESTED BOOKS:

1. Ogatta, "Modern Control System", PHI.
2. Nagrath and Gopal, "Control System Engg", TMH.
3. M.Gopal, "Digital Control System", TMH.
4. B.C. Kuo, "Digital Control System", PHI.

ET-427 Biomedical and Analytical Instrumentation
(Electronics & Instrumentation)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Biomedical Instrumentation:

Model of generation of bioelectric voltage. Electrophysiology and pump theory of cell membrane.

Electrocardiography, cardiovascular circulatory system electrical conduction and mechanical functions of heart. Einthoven and Wilson models. ECG specifications. 6 lead an 12 lead ECG measurements and interpretation of some typical abnormalities of ECG. Fetal ECG and its interpretation.

Ultrasonography, ultrasonic scanning and Doppler ultrasound.

Electroencephalography (EEG) – Recording instruments, EEG display modes and applications. X-ray machine .

Blood pressure – direct and indirect measurement of blood pressure. Blood flow measurement, cardiac output and blood volume.

Analytical Instrumentation:

A brief review of on-line instrumentation and laboratory techniques: sampling techniques for liquids and gases for analysis purpose, automatic sampling.

Gas chromatography – Thermal conductivity gas analyzer. Gas analysis by chemical absorption.

Humidity and moisture measurements. Chemical Composition analysis. Measurement of viscosity and consistency. Specrochemical analysis. Mass spectrometry and emission spectrometry.

Statistical treatment of experimental data as applied to various analysis techniques.

SUGGESTED BOOKS:

1. Bolton W, "Measurement and Instrumentation Systems", Newnes.UK.
2. Cromwell L, Weibell F.J, Pfeiffer E.A, "Biomedical Instrumentation and Measurements", Prentice Hall of India Pvt.Ltd., New Delhi.
3. Rangan C S, Sarma G R, Mani V.S.V., "Instrumentation Devices and Systems", TMH New Delhi, India.
4. Beckwith T.G. et al, "Mechanical Measurements", Addison-Wesley.
5. Gupta J.B., "A Course in Electronic and Electrical Measurements and Instrumentation", SK Kataria & Sons, Delhi, India.
6. Nakra. B.C., Chaudhary KK, "Instrumentation Measurement and Analysis",TMH, New Delhi,India.

ET- 461 Non-Conventional Energy Sources

L	T
3	1

Internal Marks: 50
External Marks: 50
Ext. Exam. Time: 3 Hrs.

Introduction:

Limitations of conventional energy sources, need and growth of alternate energy sources, basic schemes and applications of direct energy conversion.

MHD Generators:

Basic principles and hall effect, generator and motor effect, different types of MHD generators, conversion effectiveness. Practical MHD generators, applications and economic aspects.

Solar Energy:

Photovoltaic effect, characteristics of photovoltaic cells, conversion efficiency, solar batteries and applications. Solar energy in India, solar collectors, solar furnaces & applications.

Wind Energy:

History of wind power, wind generators, theory of wind power, characteristics of suitable wind power sites, scope in India, advantages and limitations.

Thermo-electric Generators:

Seeback effect, peltier effect, Thomson effect, thermoelectric convertors, brief description of the construction of thermoelectric generators, applications and economic aspects.

Fuel Cells:

Principle of action, gibbs free energy, general description of fuel cells, types, construction, operational characteristics and applications.

Miscellaneous Sources:

Geothermal system, characteristics of geothermal resources, choice of generators, electric equipment and precautions.

Low head hydroplants, definition of lowhead hydro power, choice of site and turbines.

Tidal energy, idea of tidal energy, tidal electric generator, limitations.

SUGGESTED BOOKS:

1. R.A. Coormbe,. “An introduction to direct energy conversion”.
2. M. Kettani, . “Direct energy conversion”.
3. Robest L Loftness, “Energy hand book”. .
4. Considine, “Energy Technology Hand book”.

ET-463 System Modelling and Control

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. exam. Time: 3 Hrs.

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Basic elements for system modelling, modeling of devices and systems. Mathematical and state variable models of the system.

Mechanical systems, electrical systems, electromechanical, liquid level (with interaction) pressure, thermal.

Fluidic devices and their applications.

Classification of control systems, nature of control problems, concept of feed back, comparison of open loop and closed loop structures, characteristics of control system, error criteria.

Basic control actions (ON-OFF, P/I/D), realization of control actions:

Pneumatic, liquid level, hydraulic and electronics.

Concept of controllability and observability. Controllability and observability of composite system.

SUGGESTED BOOKS:

1. W.R. Perkins and J.B. Guz Jr., "Engineering of Dynamic Systems".
2. K. Ogatta, "Modern Control Engineering".
3. M. Gopal, "Principles and design of control system", TMH.
4. M. Gopal, "Modern Control Theory", TMH.

ET-465 Fault Tolerance and Reliability Engineering

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Fault tolerant concepts, fault detection techniques: test generation, design of testable circuits, fault tolerant system modeling, redundancy techniques: voting schemes, qudded logic, radial logic, use of error-correcting codes, N-version and modular redundancy, SIFT, replicas, alternatives, dynamics of replicas and alternatives.

Reliability data analysis: reliability function, mean-time to failure, bathtub curve, hazard models: Linear, polynomical, exponential, normal, lognormal, weibull, analysis of failure data, Estimation of failure data : Least-square, maximum likelihood, Reliability Data Management: Data collection, storage and recovery of data, data banks, reliability data sources, system reliability modeling, reliability evaluation techniques, system analysis through fault trees, reliability improvement.

Design for Safety and Reliability: Design and Engineering practices. A typical case study.

SUGGESTED BOOKS:

1. Friedman & Menon, "Fault Detection in Digital Circuits," Prentice-Hall, 1971.
2. Shem.Tov-Levi, Ashok K. Agrawala, "Fault Tolerant System Design," McGraw-Hill, 1994.
3. V.N. Yarmolik, "Fault Diagnosis of Digital Circuits", John Wiley & Sons, 1990.
4. Shooman M.L, "Probabilistic Reliability; An Engineering Approach", McGraw Hill.
5. K.B. Misra, "Reliability Analysis & Prediction", Elsevier, 1992.
6. EE Lewis, "Introduction to Reliability Engineering", John Wiley & Sons.
7. Lawrence M. Leemis, "Reliability Probabilistic Models and Statistical Methods", Prentice Hall.

ET-467 Illumination Engineering

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction:

Terms used in illumination:

Light, luminous flux, luminous intensity, lumen, candle power, illumination, lux, candela, mean horizontal candle power (M.H.C.P), mean spherical candle power (M.S.C.P), mean hemi spherical candle power (M.H.S.C.P), reduction factor, lamp efficiency, specific consumption, brightness, glare, space-height ratio, utilization factor, maintenance factor, depreciation factor, absorption factor, beam factor, reflection factor.

Laws of Illumination and Sources of Light:

Law of inverse squares, lambert's cosine law, Arc lamps, incandescent filament type lamps, gaseous discharge lamps, fluoresceint type lamps, comparison between tungsten filament lamps and fluorescent tubes.

Lighting Schemes and Light Fittings:

Direct lighting, semi-direct lighting, semi-indirect lighting, indirect lighting, general lighting, light fittings.

Lighting Schemes:

Factory lighting, street lighting, flood lighting methods of lighting calculations.

SUGGESTED BOOKS:

1. PV Gupta, "A text book on Power System Engineering", et.all., Dhanpat Rai & Sons, Delhi-6.

ET-469 Microprocessor and its applications

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Gates, flip flops, counters, tri-state switch, bus organized computer, 8085 microprocessor architecture, stack, interrupt and its operation. Timing and control unit, machine cycles.
Assembly language programming, mode of addressing, programming examples, interfacing schemes, interfacing with 8255, 8253, A/D and D/A converter.
Semiconductor memories.
Applications of 8085 microprocessor.

SUGGESTED BOOKS:

1. R.S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International.
2. A.P. Malvino, "Digital Computer Electronics, An Introduction to Microcomputers", TMH Edition.

ET-471 Transducers and Applications

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction:

Definition of transducer. Advantages of an electrical signal as out-put. basic requirements of transducers, Primary and Secondary Transducer.

Analog or digital types of transducers.

Resistive, inductive, capacitive, piezoelectric, photoelectric and, hall effect.Tranducers:

Measurement of displacement – Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers.

Measurement of pressure – Manometers, elastic transducers, Mclead gage, ionization gage, knudsen gage.

Measurement of temperature – Metallic resistance thermometers, semi conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.

Measurement of flow – Venturi meter, orifice meter, nozzle meter, pitot – static tube, rotameter, turbine flow meter, ultrasonic flow meters, electromagnetic flow meter, hot wire anemometer.

Measurement of velocity – variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator, stroboscope.

Measurement of Force – Strain-gage load cells, pneumatic load cell, LVDT type force transducer.

Measurement of Torque – Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods.

Measurement of Humidity – Resistive, capacitive, aluminium oxide and crystal hygrometers.

SUGGESTED BOOKS:

1. B.C. Nakra, K.K. Chaudhry, “Instrumentation Measurement and Analysis,” Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, “Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, “ A Course in Electrical and Electronic Measurements and Instrumentation,” Dhanpat Rai & Sons, Delhi-6.

B.Tech. Electrical Engineering
8th Semester
System Engineering and Reliability
ET-402

L	T	
3	1	Internal Marks: 50
		External Marks: 50
		Ext. Exam. Time: 3 Hrs.

Generalised principles of system modeling, some examples.

Linear programming, concept of convexity, simplex method, duality in linear programming, cost flow and routing problems, critical path scheduling.

Elementary ideas of genetic algorithms.

Reliability and its importance, mortality curve, hazard rate, courses of failure, modes of failure, general reliability function and other reliability functions. Mean time to failure (MTTF), repair rate, mean-time-between failures (MTBF), availability, uptime, downtime. Failure frequency and failure distributions. Reliability testing.

Reliability models – statistical, structural, Markov, and fault tree. Reliability evaluation using various models. Redundancy techniques. Reliability allocation and optimization.

Basic principles of maintainability, availability and security.

Basic concepts of fuzzy reliability, failure frequency and loss of load probability.

SUGGESTED BOOKS:

1. S.S. Rao, ".Optimization Techniques".
2. R.J. Richards, "Introduction to Dynamic and Control".
3. E. Balaguruswamy, " Reliability Engineering".
4. A.K. Govil, "Reliability Engineering" .
5. KK Aggarwal, "Reliability Engineering".
6. Martin L. Shooman, "Probabilistic Reliability-An Engineering approach" .

ET-404 HIGH VOLTAGE ENGINEERING

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Conduction & Breakdown in Gases, Liquid & Solid Dielectrics:

Gases - Ionization process, town send's current growth equation. Ist & 2nd ionisation coefficients. Town send's criterion for breakdown. Streamer theory of breakdown. Paschen's law of gases. Gases used in practice.

Liquid Dielectrics- Conduction & breakdown in pure & commercial liquids, suspended particle theory, stressed oil volume theory, liquid dielectrics used in practice.

Solid Dielectrics- Intrinsic, electromechanical, & thermal breakdown, composit dielectric, solid dielectrics used in practice.

Applications of Insulating Materials:

Application of insulating materials in power transformers, rotating machines, circuit breakers, cables & power capacitors.

Generation of High Voltages & Currents:

Generation of high D.C., A.C., impulse voltage & impulse currents. Tripping & control of impulse generators.

Measurement of High Voltages & Currents:

Measurement of high D.C., A.C. (Power frequency & high frequency) voltages, various types of potential dividers, generating voltmeter, peak reading A.C. voltmeter, Digital peak voltmeter, electrostatic voltmeter. Sphere gap method, factors influencing the spark voltage of sphere gaps.

High Voltage Testing of Electrical Apparatus:

Testing of insulators, bushings, circuit breakers power capaitors & power transformers.

Over voltage Phenomenon & Insulation Co-ordination:

Theory of physics of lightning flashes & strokes. Insulation co-ordination, volt-time and circuit time characteristics.

Boys camera, standard voltage & current shapes produced in Lab., Horn gap, single diverters, ground wires, surge absorbers.

E.H.V. Transmission & Corona Labs:

Need for E.H.V. transmission, use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, corona loss, factors affecting the corona. Shunt & series compensation of E.H.V. lines. Tuned power lines.

8. H.V.D.C. Transmission:

Advantages, disadvantages & economics of HVDC transmission system. Types of d.c. links, converter station equipment, their characteristics.

SUGGESTED BOOKS:

1. Kamaraju & Naidu, “H.V. Engg.” .
2. RS Jha, “H.V. Engg.” .
3. Rakesh Das Bagamudre, “E.H.V. AC Transmission Engg.”.
4. Kuffel & Abdullah, “H.V. Engg.”
5. Kimbark, “HVDC Transmission”.

ET-412 Utilisation of Electrical Energy & Electric Traction
(Power Apparatus & Systems)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Illumination:

Nature of light, important definitions, laws of illumination, principle of production of light-discharge through gases under pressure – incandescence/sources of light-filament lamp,halogen lamp-discharge lamp-sodium discharge lamp,high pressure mercury discharge lamp,dual lamps,fluorescent lamps, lamp efficiency,requirements of good lighting,illumination level,absence of contrasts, shadows, glare, colour rendering-lamp fittings. Lighting schemes,design of indoor & outdoor lighting system-street lighting,flood lighting,photometers.

Electric Heating:

Advantages of electric heating, classification of heating methods, detailed study of resistance heating, arc heating, electron bombardment heating, induction heating & dielectric heating and their control.

Electrolytic Processes:

Fundamentals of electro deposition-laws of electrolysis applications of electrolysis, electro deposition, manufacture of chemicals, anodizing, electropolishing, electrocleaning, electroparting, electrometallurgy, electric supply.

Train Mechanics:

Types of services, characteristics of each type of service, speed time curve, simplified speed time curve, average speed, schedule speed, factors affecting schedule speed, tractive effort for propelling a train, power of the traction motor, specific energy output, specific energy consumption, factors affecting specific energy consumption, mechanics of train movement, co-efficient of adhesion, factors affecting slip.

Electric Traction:

D.C. & A.C. traction motors, their characteristics

Traction Motor Control:

Starting and speed control of D.C. series motors, shunt transition, bridge transition, drum controller employing shunt transition, energy saving with series parallel strarting, metadyne control, multiple unit control, braking of traction motors.

Current Collection Systems:

Conductor rail equipment, current collection gear for OHE: Cable collector, pole collector, bow collector, pantograph collector.

SUGGESTED BOOKS:

1. E. Openshan Taylor, "Utilisation of Electric Energy", Orient Longmans.
2. P.V. Gupta et. al, "A Course in Electrical Power", Dhanpat Rai & Sons Delhi-6.
3. H. Partap, "Art & Science of Utilisation of Elect. Energy".
4. N.V. Suryanarayana,"Utilisation of Elect. Power" .
5. BR Sharma, "Utilisation of Elect. Energy".
6. AT Dover, "Electric Traction",Pitman.

ET-414 System Analysis & Data Base Management
(Computer Applications)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Identification of need for computerization; Pole, Tasks, Attributes and Tools of System Analyst; Information Collection: Sources, searching Methods, Interviewing Techniques; Feasibility, Economic and Technical Analysis, Allocation and Trade –off. Requirements Specifications.

Need for a DBMS, Uses of a DBMS, Advantages. Introduction to Data models, Schemes, Architecture, Languages and Environment.

Entity-Relationship concepts, Attributes, Domains, keys, Foreign Keys, ER Diagram, Naming Secondary storage devices, file operations. File organization- Sequential, direct, indexed, Btrees, Inverted lists.

Relational models- Order, tuple Keys, relational algebraic operations- Set operations, select, project, join, division operation.

Hierarchial data models- Parent child relationships, Occurrence trees, data definition and manipulation.

Network Models

Structures, Sets, Constraints on insertion and retention, special sets, user work area, currency indicators, DML commands. Relational languages: SQL-Data definition, queries in SQL, update statements, views, indexing.

Relational Calculus- Tuple calculus, well formed formula, specifications, quantifiers.

QBE- data retrieval, update, conditions, aggregate operators, directory.

Relational data base design

Functional dependencies- Anomalies, rules, axioms, equivalence of sets, minimal representation, Normal forms- first, second. Third and Boyce Codd; algorithms for conversion, dependency preservation multivalued dependencies and fourth normal form.

An Elementary Introduction to Oracle.

Concept of object oriented database management systems, Distributed Data Base Management Systems.

SUGGESTED BOOKS:

1. Pralf,"Concept of Data base Management System", Vikas Publishing House.
2. Pressman, "Software Engg." McGraw Hill.
3. Korth & Silberschatz, "Database Concepts", McGraw Hill.
4. Rajaraman, "Analysis & Design of Information Systems", PHI.
5. Hanrysskiewycz, "Introduction to System Analysis and Design", PHI.

ET-416 Data Communication Networks
(Information & Control)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

A communications model, concepts and terminology of data transmission, analog and digital data transmission, transmission impairments, guided transmission media, wireless transmission.

Data Encoding:

Digital data-digital signals, digital data-analog signals, analog data digital signals, analog data-analog signals, spread spectrum.

The data Communication Interface:

Asynchronous and synchronous transmission, line configuration, interfacing.

Circuit Switching:

Switched networks, circuit switching networks, switching concepts, routing in circuits switched networks, control signaling.

Packet Switching:

Principles, routing, congestion control, X.25.

Frame Relays:

Frame relay protocol architecture, frame relay operation.

ATM Protocol Architecture:

ATM logical connection, ATM cells, transmission of ATM cells, ARM adaptation layers, traffic and congestion control.

Need of computer networks, network classification – LAN, MAN, WAN.

LAN Archditecture:

Communications Architecture and Protocols:

Protocols, the OSI model, TCP/IP protocol suite, principles of internetworking, connectionless internetworking, the internet protocol, routing protocol, transport services, protocol mechanisms, TCP, UDP.

Introduction to Network Security:

Data encryption and digital signatures.

Overview of ISDN, ISDN channels, user access, ISDN protocols, Broad band ISDN.

SUGGESTED BOOKS:

1. Miller, Michael A,. “Data and Network Communication”, Vikas Publishing House.
2. Shay Villium, “Understading Data Communication and Networks”, Vikas Publishing House.
3. Behrouz Forouzan, “Introduction to data communication and networking”, TMH.
4. Fred Halsall, “Data Communications, computer networks and open systems”, Addison Wesley.
5. William Stallings, “Data and Computer Communications”, PHI.
6. Andrew S. Tannenbaum, “Computer networks”, PHI.

ET-418 Advanced Instrumentation
(Electronics & Instrumentation)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to advances in measurement instruments and computers, interface for instrumentation system.

Microprocessor based data acquisition system, microprocessor based instruments and their advantages and disadvantages.

Introduction to SCADA system and its application, introduction to virtual instrumentation. Concept and some basic applications.

Programmable logic controller and programming introduction to on-line instrumentation, iteractive graphics and interactive computing.

SUGGESTED BOOKS:

1. Liptak, "Instrument Engineers hand book in Process Control," Chilton book company.
2. Radnai, Kingham, " Jone's Instrument Technology", Butter worth International Edition.
3. Curtis Johnson, "Process Control".

ET-420 Electrical Machines – III
(Power Apparatus & Systems)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Induction Machines:

b) Performance analysis of three phase induction machine using current locus diagram.
c) Three- phase induction regulators.
d) Construction, working and applications of linear induction motor.
e) Induction motor dynamics.

Commutator Machines:

a) Effects of voltage injection in the rotor circuit of a slip ring induction motor, action of commutator.
b) Speed and p.f. control of induction motor by auxillary commutator machines.
c) Construction, working and applications of schrage and doubly fed commutator motor.

Single- Phase Motors:

a) Shaded pole, hystersis and reluctance motors.
b) Single phase series and repulsion motors.

Special Machines:

Construction, working and applications of servomotors, stepper motors and brushless D.C. Motors (BLDC).

Induction Generators:

Operation, equivalent circuit and performance characteristics of grid connected and self-excited induction generators, voltage control in self-excited induction generators.

SUGGESTED BOOKS:

1. Fitzgerald and Kingsley, "Electric Machinery", McGraw Hill .
2. Langsdarf, "Theory of Alternating Current Machinery", Tata McGraw-Hill.
3. M.G. Say, "Theory, Performance and Design of A.C. Machines", CBS Publishers.
4. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Willey & Sons.
5. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers.
6. E.O. Taylor, "Theory, Performance and Design of A.C. Commutator Machines", A.H.Wheeler & Co., Allahabad.

ET-422 **Advances in Computers**
(Computer Applications)

L	T
3	1

Internal Marks: 50
External Marks: 50
Ext. Exam. Time: 3 Hrs.

Concepts of Parallel and distributed processing. Computer Networks, LAN/WAN, Network components. ISO-OSI Architecture, Introduction to Broadband-ISDN and ATM.

Basic Features of Multimedia systems, Main features of Internet and Intranet. FTP, Telnet, HTTP, Gopher, Browsing of WWW, Introduction to HTML and Java Script.

Principles of Artificial intelligence, Problem representation, Solution, Knowledge representation, searching techniques, game playing, Rule based expert system.

Classification of Programming: Procedure, object oriented, Functional and logic programming comparison.Introduction to logic programming PROLOG.

SUGGESTED BOOKS:

1. Miller, "Data and Communication Network", , Vikas Publishing House.
2. Behrouz & Forouzan, "Data Communications and Networking", TMH.
3. Tennenbaum, "Computer Communication Networks", PHI.
4. Rich, "Artificial Intelligence", McGraw Hill.
5. Winston, "Artificial Intelligence", Addison-Wwesley.
6. Waterman, "A Guide to Expert Systems", Addison-Wesley.
7. Clocksin & Mellish, "Programming in PROLOG", Narosa.
8. Bratko, "PROLOG Programming for Artificial Intelligence",Addison-Wesley.
9. Brain J Thomas, "The Internet for Scientists & Engineers", SPIE Press.

ET-424 **Optimal and Industrial Control**
(Information & Control)

L T
3 1

Internal Marks: 50
External Marks: 50
Ext. Exam. Time: 3 Hrs.

Optimal Control:

Introduction, problem formulation, performance indicies, calculus of variation approach. Euler's equations, hamiltonion system, two point boundary value problem and solution introduction to LQR.

Computer Control of Processes – Digital Control principles, optimal control application to process control, optimum controller settings.

Introduction to process control, process model identifications. Mathematical modeling of processes such as: Mixing process, heat transfer process.

Type of controllers and their characteristics: proportional, integral, derivative, interaction between derivative and integral controls, ON-OFF ratio, feedforward, feedback, cascade, controls.

SUGGESTED BOOKS:

1. D. Patianabis, " Principles of Process Control".
2. M. Gopal, "Modern Control theory", TMH .
3. M. Gopal, " Control Systems: Principles and Design", TMH, 1997.
4. F.L. Lewis, "Optimal Control", Wiley interscience.

ET-426 Microprocessor and Microcontroller-II
(Electronics & Instrumentation)

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Review of 8085 and introduction to architecture of 8086.

Development of 80x86 processor, interrupt structure, addressing modes. Instruction set and application programs (8086). Main assembler directives, interfacing of D/A and A/D converters using 8255.

Introduction to digital signal processors, architecture and programming.

Application of microprocessor, micro controller and digital signal processor in power & controls.

Serial and parallel interfacing of 8051, interfacing with D/A and A/D converter.

SUGGESTED BOOKS:

1. Gibson, "Microprocessors", PHI.
2. K.J. Ayala, "Micro Controller", Penram International.
3. D.V. Hall, "Advanced Microprocessor".

ET-462 Energy Management and Conservation

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Energy sceneraio, planning of generation expansion, demand side characteristics, supply side characteristics, meeting the load, demand side management, DSM planning and implementation, peak load management techniques, energy management in small, medium and large industries.

Energy conservation, energy conservation principles, energy conservation planning, energy conservation in illumination, energy conservation in domestic sector, energy conservation in industry, energy conservation through reactive power management, energy conservation through optimal design and operation of induction motor.

Energy audit, energy flow diagram, strategy of energy audit, instruments for energy audit, energy audit of illumination, generation, distribution and utilization systems.

Cogeneration, benefits, cogeneration potential, cogeneration techniques, related economics.

Captive power generation, advantages, constraints, captive generation options, financing, energy banking, energy wheeling.

Energy storage, general considerations, model of storage, electrochemical energy storage, storage batteries, power extraction system, a typical battery energy storage system.

SUGGESTED BOOKS:

1. Generation of Electrical Energy, B.R. Gupta (Eurasia Publishing House, New Delhi).
2. Energy Storage for Power Systems, A Ter-Gazarian (Peter Peragrinus Ltd.).
3. Proceedings of National Seminar on Energy Management, March, 1995, MR Engg. College, Allahabad.
4. Proceedings of National Seminar on Energy Conservation and Management, Oct. 1991, REC, Kurukshetra.
5. Quarterly journals on Energy Managements, Energy Management Centre (Govt. of India, Ministry of Power), New Delhi.

ET-464 Robotics Dynamics and Control

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction, components and structure of robotics system.
Kinematics of manipulators, rotation translation and transformotion, David – Hastemberg Representation, Inverse Kinematics.

Dyamics – modeling using Newton Euler equation.
Linerarization of Robot Dynamics – State variable continuous and diserete models.
Robotic Motion: Different types of trajectories and introduction to their generation.
Position Control: Independent joint control.
Introduction to advanced control for robot application.

SUGGESTED BOOKS:

1. John J. Craig, "Introduction to Robotics, Mechanics and Control", Addison Wesley publishing company.
2. A.J. Koivo, " Fundamentals for Control of Robotic manipulators", John Wiley & Sons, New York.
3. Lorenzo Sciaviceo, Brsurw Siciliarw, "Modelling & Control of Robot manipulation", Mcgraw Hill Inter national edition.
4. M.W. Spong and M. Vidyasagar, "Robot Dyamics and Control," John Wiley & Sons, New York.

ET-466 Reliability Centered Maintenance

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Basic reliability concepts, reliability measures, concept of failures, failure consequences.

Maintenance:

Factors affecting maintenance, types of maintenance, optimum maintenance policies.

Maintainability and AvailabilityAnalysis:

Measures of maintainability and availability, maintainability measurement and prediction, preventive maintenance scheduling, prediction of spare parts requirement. Condition based monitoring and monitoring techniques.

Design for reliability and maintainability.

RCM Concepts:

RCM methodology-system selection and information collection, system boundary definition, system description and functional/logic block diagram, system functions and functional failures, failure mode and effects analysis, logic tree analysis, task section, quantitative reliability data, information traceability and coding. Benefits realized from RCM process.

RCM – A case study.

SUGGESTED BOOKS:

1. Aggarwal K.K, "Reliability Engineering", Dordrecht, Kluwer Academic Publisher.
2. Anthony M. Smith, "Reliability Centered Maintenance", McGraw-Hill, 1997
3. William H. Van Alven, "Reliability Engineering" , Prentice Hall, 1964.
4. Lawrence M. Leemis, "Reliability Probabilistic Models and Statistical Methods", Prentice Hall.
5. Marvin A. Moss, Marcel Dekkar, "Designing for Minimal Maintenance Expense".
6. E.E. Lewis, "Introduction to Reliability Engineering" , John Wiley & Sons.
7. Doris Llayd & Grosh, "A Primer of Reliability Theor" , John Wiley & Sons.

ET-468 Process Instrumentation and Control

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to process control, different types of process controllers (P/I/D, ON-OFF).
Study of the performance of different transducers commonly used in process control: temperature, pressure, liquid density, flow monitoring and control.
Signal conditioning: Amplification, operational amplifier, typical operation amplifier application, differential amplifiers, modulation, demodulation filters.
Datal transmission and telemetry

Requirements of a data transmission system, coding, timing-error detection and correction, industrial telemetry system.
Introduction to digital control principles, block diagram and basic components of digital control.

SUGGESTED BOOKS:

1. Patrick Dale R, "Industrial Process Control System", Vikas Publishing House.
2. Patranibis, "Principles of Process Control".
3. E.J. Wightman, "Instrumentation in Process Control".
4. John.D.Curtis, "Process Control Instrumentation Technology".

ET-470 ANN and Fuzzy Logic

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to fuzzy sets, fuzzy mathematics, membership functions, design of a fuzzy model & its working, steps of working – fuzzification, composition, implication, aggregation, defuzzification.
Introduction to ANN, feedforward and feed back network, neural network learning rules, perceptron classifier, LMS algorithm, multilayer feedforward neural network, back propagation learning algorithm, Hopfield neural network, associative memories. Self organizing feature map.

Application of ANN & Fuzzy System.

SUGGESTED BOOKS:

1. S. Haykins, "ANN a Comprehensive Foundation".
2. Zurada, "ANN".
3. T.J. Ross, "Fuzzy logic: with Application to Engineering", McGraw Hill.

ET-472 CONTROL AND GUIDANCE

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction and brief history of control systems, Transfer functions, Mathematical modeling of Electrical and Mechanical (translational and rotational) systems, electrical analog of mechanical systems, Synchos transmitter and receivers, LVDT, Thermal and hydraulic system modeling, Hydraulic actuator and liquid level systems, Rotating power amplifier: Amplidyn, DC and AC servomotors, Electromechanical systems, Lagrange equations, Elementary ideas of robot, aircraft and missile modeling. Realisation of real systems using Op-Amp circuits. State-space representation of systems.

Step response of second order systems, Performance measures, Steady state errors, Solution of state equations. Concept of observability, controllability and stability of systems, Introduction to frequency response of systems, Nyquist plots, Concept of Gain and phase margins.

Fundamentals of guidance: Tracking and regulating systems, basic ideas of gyroscope, resolvers, altimeters, accelerometers, proportional navigarion and homing guidance loops.

Introduction to Passive (lag/lead) Compansator design and Kalman Filterning.

SUGGESTED BOOKS-

1. P.Garnell and D.J. East, “Guided Weapon Control Systems”, Pergamon Press.
2. J.J. A’zzo and C.H. Houpis, “Linear Control System: Analysis and Design” , McGraw Hill.
3. M.Gopal, “Control Systems: Principles and Design”, Tata McGrawHill.

ET-474 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L	T	
3	1	Internal Marks: 50 External Marks: 50 Ext. Exam. Time: 3 Hrs.

Introduction to the concept of A.I.
Problem Solving: General problem solver, Contributions of GPS to recursive programming, problem representation and extrapolation, Cybernetics and adaptive control. Accomplishments and limitations of GPS.
Production systems: design, implementation and limitations.
Game Playing: History of A.I. in game playing, game trees and graph theory. Mini-max procedure, pruning the game tree.
Knowledge representation: Features of knowledge representation schemes, design considerations for a knowledge representation system. Semantic networks, Minsky theory of frames, Script theory of Schank and Abelson.
Searching techniques: Basic search techniques, Airline booking problem, Tower of Hanoi problem, Traveling salesman problem, graphs and goal trees.
Depth-first search, breadth-first search, hill climbing, heuristics, best-first heuristics.
LISP/Prolog programming language.
Expert Systems: Structure of an expert system. Organisation and representation of knowledge in an expert system. Basic activities of an expert system. Expert system shells. Few examples of expert systems.

SUGGESTED BOOKS-

1. Morris W. Firebaugh, "Artificial Intelligence: A knowledge based approach", PWS-Kent publishing co., Boston.
2. Rich, "Artificial Intelligence", McGraw-Hill.
3. Patrick H Winston, "Artificial Intelligence", Addison Wesley.
4. Peter Jackson, "Introduction to expert systems", Addison Wesley.
5. D.A. Waterman, "A guide to expert system" .
6. Clocksin & Mellish, "Programming in PROLOG" , Springer Pub.
7. John Stobo, "Problem solving with PROLOG", Pitman Publishing.

ANNEXURE – PRACTICALS

SUGGESTED LIST OF EXPERIMENTS IN EACH LAB COURSE
(May be revised by lab coordinators from time to time)

B.Tech, 1st Semester and 2nd Semester
(Common to all branches)
Basic Electrical Engineering ELT-107

PART- A

1. To Draw phasor diagram to scale for series RL and RC circuits for different value of current and keeping applied voltage constant.
   R L-at 50 V and R C at 200 V
   Measure the resistance of choke

2. To Draw a graph between Current Vs Capacitance in Series RLC circuit and calculate inductance using results of resonance.

3. To Measure three phase power with Two wattmeter method for balanced and unbalanced load connected in star.

4. To calibrate single phase Energy meter at unity power factor at i)Full load ii) Half load iii) Quarter Load.

5. To draw phasor diagram to scale for parallel RL and RC circuits for different values of current and keeping the applied voltage constant.

PART-B

1. To measure iron losses and copper losses in a single phase transformer and to find equivalent circuit parameters by performing open circuit and short circuit tests.

1. To perform load test on a single phase transformer and to plot (a) terminal voltage (b)efficiency Vs load current.

2. a) To study the various parts of a D.C. Mchine.
   b)To start and run a D.C. shunt motor and reverse its direction of rotation.
   c) To control the speed of D.C. shunt motor by I
   i)field control ii) efficiency.

4. To perform load test on a D.C. shunt generator and to plot
   a) Terminal voltage b) efficiency V/s load current.

5. To run three phase induction motor at no load and reverse its direction.
   (b) To vary the supply voltage and plot input current power, speed and poer factors V/s supply voltage.

B.Tech. I/II Semester
Computer Lab
COT-103

L	T	P
-	-	2/2

1. Understand the concept of operating system and learn related commands

Write C programs for following:

2. Addition, subtraction, multiplication, division of 2 numbers
3. Find max and min of 3 numbers
4. Using while loop, find

$S = 1 + 3+5 + \ldots$upto N

$S = x + x^2/2 + x^3/3 \ldots$.N terms

Repeat these exercises using do-while loop.

5. Using for loop, calculate
   $S = x - x^3/3! + x^5/5! \ldots..$N terms
6. Using loops, print following design

(a)
```
1
12
123
…N lines
```

(b)
```
*
***
  ****
  ….N lines
```

7. Read 2 numbers. Read the choice of operation. Add them if + is pressed. Subtract if – is pressed. Similarly for multiplication (*) and division (/).
8. Repeat exercise 7 such that program gets repeated again and again until user wants to exit.
9. Using function, compute "Cm.
10. Using 1-d array, read n numbers and find average. Also find the largest of these numbers. Use functions to implement these operations.

Write modular programs for the following:

11. Implement following operations on matrices

    (a) Addition of two matrices (b) Transpose of a matrix
    (c) Multiplication of two matrices

B.Tech, 3rd Semester

ET-211 Electrical Machines Lab-I

ROTOR-I

1. To separate hysteresis and eddy current losses of a single phase transformer at rated voltage and frequency by conducting no load tests at different frequencies keeping V/f constant.
2. To operate two single phase transformers of different KVA rating in parallel and plot the variation of currents shared by each transformer Vs load current.
3. To conduct sumpners test on two identical single phase transformers and determine their efficiency at various loads.
4. To perform direct load test on a D.C. shunt motor and plot variation of (a) Input current (b) Speed(c) Torque(d)Efficiency Vs out put power.
5. To obtain magnetization characteristics of a D.C. machine. Estimate field circuit resistance of a D.C. shunt Generator at rated speed. Measure field winding and armature winding resistance. Plot the external characteristics of D.C. shunt generator.

ROTOR- II

6. To make scott connection of two single phase transformer and to verify the current .relation by drawing phaser diagrams for
   i) Balanced and
   ii) Unbalanced resistive load.
7. To conduct open circuit and short circuit test on a three phase three winding transformer and determine the equivalent circuit parameters in pu
8. To conduct sumpners test on two identical single phase transformers and determine their efficiency at various loads.
9. To conduct direct load test on a D.C. compound generator with
   (a) Shunt field alone
   (b) Cummulative and differential compounding for short and long shunt connections.
10. To conduct load test on a cross field machine for different degrees of compensation and plot the variation of terminal voltage Vs load current.

ET-213 ELECTRICAL MEASUREMENT AND INSTRUMENTATION

1. To calibrate D.C. Energy Meter at different loads.

2 To study the error in wattmeter at various p.f,s (power factors)

3. To measure resistance of the order of 5/10 ohm using
   (a) Ammeter, Voltmeter method.
   (b) Method of substitution
   © Carrey foster bridge.

4. To measure the inductance and resistance of given inductor at different audio frequencies 200 Hz to 10Kz, using Mexwell's inductance, capactance bridge, Hays Bridge.

5. To measure low resistance using Kelvin's Double Bridge.

6. To determine the current ratio and phase angle of the given current transformer at different nominal current ratio using direct deflection method.

7. To study Lloyd fisher square and separate hysterises and eddy current losses of the specimen in the square.

8. Study of transducer.

9. Calibration of D.C. Voltmeter 0-300 V and Ammeter 0-10 mA using cromption potentiometer.

ET-215 Analog Electronics Lab

1. To Study the diode clipping circuits.

2. To study the diode clamping circuits.

3. To study zenor diode as voltage regulator.

4. To study the common emitter configuration of a transistor.

5. To study the common base configuration of a transistor.

6. To study the common collector configuration of a transistor.

7. To study FET as
   (a) A source follower
   (b) A voltage variable resistor.

8. To study FET as
   (a) A chopper
   (b) A constant current source.

9. To study the following mathematical operations using Op-amps:-
   (a) Addition
   (b) Subtraction
   (c) Multiplication
   (d) Division
   (e) Integration
   (f) Differentiation

10. To study the Op-amp as following wave form Generators.
    (a) Astable Multivibrator
    (b) Triangle Wave Generator
        Schmitt Trigger

ET-217 Computer Lab. (C programming)

1. Solution of resistive network using KCL / KVL equations by two numerical methods.
2. Solution of first order equation of electrical network using Euler's method and Simpson's rule.
3. Inversion of a matrix.
4. Solution of transcendental equation by Newton-Raphson method.

5. Sorting of list by bubble sort method.
6. Use of multiple-function programming to carry out star-delta conversions.
7. Curve fitting of given data set.
8. To solve for eigen values and corresponding eigen vectors of a matrix.
9. Simulation of CE amplifier.
10. Minimization of a function.

IVth SEMESTER
ET-214 MACHINE LAB.
ROTOR – I

1. Conduct running light test on a three phase squirrel cage induction motor and measure & plot input current, power, power factor at different values of applied voltage.Compute shunt parameters of the equivalent circuit at rated voltage conditions.
   a. To conduct blocked rotor test on above motor at rated current conditions,measure stator winding resistance and compute series parameters of the equivalent circuit.
   b. Draw complete equivalent circuit of the motor and compute the performance at krated voltage and at a slip of 5 %.
2. To conduct direct load test on a three phase squirrel cage induction motor and measure & plot input current ,torque, power factor, speed efficiency against output power.
3. To separate hysteresis and eddy current losses of a single phase transformer at rated voltage and frequency by conducting no load tests at different frequencies keeping V/f constant.
4. To conduct open circuit and short circuit test on a three phase three winding transformer and determine the equivalent circuit parameters in pu
5. To run a slip ring induction motor with variable rotor resistance and plot.
   i) Speed V/S external resistance.
   ii) Braking time V/S external resistance.
6. To determine the resistance of cage I/M by performing variable frequency test.
7. To conduct running light and blocked rotor test on a 3-phase slipring I/M and to measure stater resistance .to draw the circuit diagram and determine therefrom its performance characteristics.
8. To start run and reverse a single phase capacitor start induction motor. Perform running light test and blocked rotor test to determine the equivalent circuit of the same.
9. To run a three phase scarge motor plot the variation of
   a) Injected voltage Vs brush seperation.
   b) No load speed Vs brush seperation.
   c) No load speed Vs injected voltage.

10. To run the I/M as a SEIG (seperately excited induction generator) and plot the variation of terminal voltage with speed,frequency with speed at different excitation capacitance.

Power Electronics Lab.- I E T – 216

1. To study the performance of single-phase half-wave and full-wave uncontrolled rectifiers.

2. To study different firing circuits of SCR.

3. To study forced commutation circuits of SCR.

4. To study following protection circuits of SCR
   (i) dv/dt
   (ii) di/dt
   (iii) Over voltage
   (iv) Over current

5. To study the characteristics of a Thyristor and a Triac.

6. To study firing circuit of SCR using ramp-comparator scheme.

7. To study firing circuit of SCR using cosine-wave scheme.

8. To study firing circuit of SCR using Op-amps and Gates.

9. To study digital firing circuit of SCR.

10. To study operation of Triac in all four modes and study AC phase control using Triac.

E T – 311 Power Electronics Lab.- II

1. To study the operation of full-wave phase control of an A.C. load using parallel – connected SCR's.

2. To study the operation of single-phase full- wave phase control of a D.C. load using
   (i) a fully-controlled full-wave rectifier.
   (ii) a half-controlled full-wave rectifier.

3. To study the D.C. circuit breaker.

4. To study the zero voltage switching.

5. To study the UJT Chracteristics and relaxation Oscillator.

6. To study (i) the U J T trigger circuit of S C R
   ii) the P U T trigger circuit of S C R

7. To study speed control of a D.C. motor using single-phase half and fully controlled bridge converters.

8. To study speed control of a D.C. motor using three-phase half and fully controlled bridge converters.

9. To study speed control of a D.C. motor by thyristor chopper.

10. To study cycloconverter based speed control of a 3-phase induction motor.

B.Tech V Semester (Electrical)
Control Lab ET - 313

1. Study of Step Response and Feed Back Properties for Ist and 2nd order system.

2. Error Detector Characteristics and Control Applications of the following.

   i) LVDT (ii) Potentiometer

3. Performance Analysis of Thermal System and Design using PID/Relay Control.

4. To study the characteristics (using DIGIAC 1750) of

   (i) Voltage to Current Converter.
   (ii) Current to Voltage Converter.
   (iii) Voltage to Frequency Converter.
   (iv) Frequency to Voltage Converter.

5. To obtain the Frequency Response Characteristics and Design of Compensator for a given system.

6. To obtain the Tr. Function and Control Characteristics of Servo Motor of DC/AC.

7. To obtain the Operational Characteristics for the Control Application of the following devices.

   (i) Stepper Motor
   (ii) Temperature Detectors (Thermister, Thermo couple etc.)

8. Simulation of control systems using MATLAB.

9. To obtain the Position Control performance of DC Servo Motor.

10. Comparision of different Control Action (P/I/D/Relay) on Industrial Process (Phneumatic/Simulated System.

ET-315 Signals and Systems Lab

1. Study of types of signals Deterministic & Stochastic (continuous)
2. Study of time properties of signals.
3. Study of frequency properties of signal.
4. Study of Stochastic properties of signal.
5. Study of Discrete signals.
6. Basic properties of linear system. (Superposition Theorem etc.)
7. Study of Impulse response to Linear System.
8. Analysis of MIMO System (2 – Port)
9. Study of Realization Theorem and filters.
10. Simulation of systems using Op-amps./ Software tools (Spice/ MATLAB)

B. Tech. (Elect. Engg.) VI th Semester

Power System Lab. ET-316

1. To plot the characteristics of an Over Current Relay (inverse type CDG) for plug setting of 2.5 A and 0.5 A and TMS of 0.6 and 1.0. Find out pick-up to reset value of 2.5 A plug setting and 1.0 TMS.

2. To plot the impedance characteristics of the given admittance relay YCG-14.

3. To measure A B C D parameters of a transmission line model

4. To plot the power transfer characteristics (P.V. delta) of the given transmission line model. Vs =Vr = 40V.

5. To measure (P P S and N P S) sequence components of supply voltage and current by segregating networks . Verify graphically.

6. (a)To measure zero sequence components of line current in a 3 ph. 4 wire system

(b) To measure zero sequence components of phase voltage in a 3 ph. 4 wire system.

7 To find the zero sequence impedance of a given 3 ph. transformer

8 To plot the characteristics of a Biased differential relay.

9. (a)To find the String efficiency .
   i) with guardring
   ii) without guardring.
   b) To determine the dielectric strength of the given transformer oil with the help of standard oil testing equipment.

10. To test the given A.C. Energy Meter by phantom loading at (i) Unity p.f . (ii) 0.8 p.f. lagging (iii) 0.8 p.f. leading.

E T – 311 Power Electronics Lab.- II

11. To study the operation of full-wave phase control of an A.C. load using parallel – connected SCR's.

12. To study the operation of single-phase full- wave phase control of a D.C. load using
    (i) a fully-controlled full-wave rectifier.
    (ii) a half-controlled full-wave rectifier.

13. To study the D.C. circuit breaker.

14. To study the zero voltage switching.

15. To study the UJT Chracteristics and relaxation Oscillator.

16. To study (i) the U J T trigger circuit of S C R
    ii) the P U T trigger circuit of S C R

17. To study speed control of a D.C. motor using single-phase half and fully controlled bridge converters.

18. To study speed control of a D.C. motor using three-phase half and fully controlled bridge converters.

19. To study speed control of a D.C. motor by thyristor chopper.

20. To study cycloconverter based speed control of a 3-phase induction motor.

ANNEXURE – A

List of final year projects for the last three years

Year 1999

1. Energy Management and Auditing.
2. Expert System, Fuzzy Logic, and Neural Networks in Powerelectronics and Drives.
3. An Application of A C Drive.
4. Analysis of Exciting Current under Unbalanced over Voltages.
5. Power Factor Correction in Power System.
6. Comparation Study of NR, DC, & FDC methods of LF study on a given sample P.
7. Development of Expert System for Computer Controlled Power System Application.
8. Torsional Characteristics of Series Compensaed Power System.
9. Unbalanced Operation of a Transformer.
10. Fault Analysis in Power Systems.
11. Redundancy Optimization of General Systems.
12. Microprocessor based moving message display

Year 2000

1. Optimal Design of Distribution System.
2. Optimal Design, Fabrication and Testing of Aluminium winding Transformer and its Comparison with Copper Winding Transformer.
3. Power loss estimation in a radial feeder using load-flow analysis.
4. Behaviour of wound-rotor Induction Generator.
5. An Application of FACTs (Flexible AC Transmission) Controller.
6. Microprocessor based power system protection.
7. Fuzzy-set Theory based reliability evaliation.
8. Techniques for variable frequency operation of three-phase induction motors.
9. Application of soft computing tools to some case study problems.
10. ECG Signal conditioning and data acquisition.
11. Study the performance of Induction Generator.
12. Simulation of Power System Components using computer.
13. Computer Simulation and analysis of TCSC (Thyristor Controlled Series Compensator) Compensated power system.
14. Text recognition softwre

Year 2001

1. Implementation of the Genetic Algorithm loss minimum re-configuration.
2. Software for the design of Hydro-generators.
3. Design aspects of induction motors.
4. Reliability evaluation of complex systems using Fuzzy-set theory.
5. Design of transformers using software.
6. Computer simulation of HVDC light.
7. Real-time operating system with Embedded Applications.
8. Some aspects of 765-kv line design.
9. Study of compensation techniques in transmission lines.
10. Comparison of PWM, multipulse, and multilevel invertors.
11. Field oriented control of a three-phase induction motor.
12. Neural network based adoptive control of induction motor drive.
13. Load flow study for stability analysis.
14. Simulation of 8-bit CPU using VHDL & ORCAD
15. Development of energymeter using 8051
16. RC applications in PS
17. Microprocessor based linear displacement measurement and control

ANNEXURE – BOOK

1st /2nd SEMESTER

ELT-105 BASIC ELECTRICAL ENGINEERING

1. V. Del Toro, "Principles of Electrical engineering," ,PHI.
2. E. Huges, " Electrical Technology," ,ELBS.
3. A.E. Fitzerald, D.E. Higginbotham and A.Grabel , " Basic Electrical Engineering",MGH.
4. S.A.Nasar and C.R. Paul, "Introduction to Electrical Engineering" ,MGH.

3rd SEMESTER

ET-201 CIRCUIT THEORY

1. Desoer & Kuh, " Basic Circuit theory", McGraw Hill.
2. Van Valkenberg , "Network Analysis", PHI.
3. Valkenberg & Kinariwala , "Linear Circuits", PHI.
4. Trick , "Introduction to circuit Analysis", Wiley.
5. Roy Choudhary , "Networks & systems", Wiley.
6. Iyer, "Circuit Analysis", TMH.
7. Aatre , "Network Theory & Filter Design", New Age.

ET-203 ANALOG ELECTRONICS

1. illman and Halkias, "Integrated Electronics", Mc Graw Hill.
2. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India.
3. Millman and Halkias, "Electronics Devices and Circuits", TMH Edition.
4. Malcolm Goodge, "Analog Electronics Analysis and Synthesis", TMH Edition.
5. Malvino, "Electronics Principles", TMH Edition.

ET-205 Measurement and Instrumentation-I

1. AK Sawhney, "Electrical and Electronic Measurements & Instrumentation",Dhanpat Rai, Delhi.
2. C.T. Baldwin , "Fundamentals of Electrical Measurement", Lyall Book Depot.
3. E.W. Golding, "Electrical Measurement".

ET-207 Electrical Machines-I

1. Clayton. A.E.,"Performance and Design of Direct Current Machines "
2. Irving L." Kosow, Electric Machinery and Transformers, Prentice-Hall of India"
3. George Mcphersion ,"An Introduction to Electrical Machines and Transformers", John Wiley & Sons., NY
4. Nagrath & Kothari, "Electric Machines", Tata McGraw Hill.
5. PS Bimbhra, "Electrical Machinery", Khanna Publishers.
6. MG Say, Theory," Performance & Design of A.C. Machines", CBS Publisher.

ET-209 TRANSMISSION AND DISTRIBUTION

1. IJ Nagrath and DP Kothari," Power System Engineering,"
   i. (Tata McGraw-Hill).
2. A Chakrabarti, ML Soni, PV Gupta and US Bhatnagar," Power System Engineering," (Dhanpat Rai & Sons).
3. CL Wadhwa," Electric Power Systems", (Wiley Eastern Ltd.).
4. WD Sterenson," Elements of Power System Analysis," Jr (McGraw-Hill).
5. "Electrical Transmission and Distribution",
   i. Westinghouse Electric and Manufacturing Co.(East Pittsburgh).

4th SEMESTER

ET-202 SIGNALS AND SYSTEMS

1. Fred J Taylor – "Principles of Signals and System," MGII.
2. Simon Haykins – "Signals and Systems," Wiley Eastern.
3. A Papoulis – "Circuits and System," Modern Approach HRW.
4. AV Oppenheim and AS Winsky – ,"Signals and System",PHI.
5. RP Singh and Sapre – Communication Systems TMH.
6. Sehwatz – Modulation, noise and spectral analysis MGH.
7. John Prokias – Digital signal processing PH.
8. RF Ziemen, WH Traiter and DR Frannin – Signals & System- Continuous and Discrete Macmillian.

ET-204 Electrical Machines - II

1. Fitzgerald & Kingsley, "Electric Machinery" McGraw Hill

2. Alexander S. Langsdorf, “AC Machines”, Tata McGraw Hill.
3. MG Say, “Theory Performance and Design of AC Machines” CBS Publisher
4. Nagrath & Kothari,” Electric Machines” TMH
5. PS Bhimbra, “Electrical Machinery”, Khanna Publishers.

ET-206 Power Electronics-I

1. M. Ramamoorthy.Thyristor and their applications, East West Publication.
2. PS Bhimbra.Power Electronics, Khanna Publishers.
3. MD Singh and KB Khanchandani, Power Electronics ,TMH Edition.
4. AK Gupta and LP Singh, Power Electronics,Dhanpat Rai Publishing Co.
5. Rama Reddy, Fundamental of Power Electronics, Narosa Publishing.

ET-208 DIGITAL ELECTRONICS

1. RP Jain, ‘Modern Electronics’.
2. AP Malvino and DP Leach, ‘ Digital Principles and applications’.
3. Floyd, ‘Digital Circuits’.
4. Charles Roth, ‘Fundamentals of Logic Design’.
5. H. Taub and D. Schilling, ‘Digital Integrated Electronics’.
6. Gothman, Digital Electronics.

ET-210 FIELDS AND WAVES

1. N.N. Rao Basic Electromagnetics with applications, PHI
2. E.C. Jordan and K.G. Balmain.Electromagnetic waves and radiating systems, PHI
3. J.D. Kraus Electromagnetism
4. D.J. Griffith Introduction to Electrodynamics, PHI .
5. Guru & Hiziroglu Electromagnetic field theory fundamentals Vikas Publishing House Hayt’s book.

ET-212 POWER GENERATION AND CONTROL

1. P.S.R.Murty, ‘Power System Operation and Control’, Tata Mc Graw Hill, New Delhi.
2. M.V. Deshpande, ‘Elements of Electrical Power System Design’, Wheeler Publishing Co, Allahabad.
3. B.R. Gupta, ‘Generation of Electrical Energy’, Eurasia Publishing House (Pvt)Ltd, New Delhi.
4. P.V. Gupta et al, ‘A Course in Electrical Power, ‘Dhanpat Rai and Sons, Delhi-6.

5. S. Mukhopadhyay, 'Modern Power System Control and Operation,' Roorkee Publishing House, Roorkee.
6. S.S. Vadhera, 'Power System Analysis and Stability', Khanna Publishers, Delhi.

5th SEMESTER

ET-301 Network Analysis and Synthesis

1. Temes & LaPatra – Introduction to circuit Synthesis & Design, McGra Hill.
2. Valkenberg – Modern Network Synthesis, PHI.
3. Weinberg – Network Analysis & Synthesis, McGraw Hill.
4. FF Kuo – Network Analysis.
5. SK Mitra – Analysis & Synthesis of Active Network.
6. Peikari – Fundamentals of Network Analysis & Synthesis, Wiley.

ET-303 Power Electronics-II

1. Jacob, Michael Power Electronics: Principles & Application, Vikas Publishing House Pvt. Ltd.
2. M.H. Rashid, Power Electronics : Circuits, devices and applications , PHI.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics : Converters, Applications and Design , John Wiley & Sons.
4. P.S. Bimbhra, Power Electronics .
5. M. Ramamoorthy An Introduction to Thyristors and their applications East-West Press.
6. M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw-Hill.
7. A.K. Gupta & L.P. Singh, Power Electronics and Introduction to Drives Dhanpat Rai Publishing Co.

ET-305 POWER SYSTEM ANALYSIS

1. IJ Nagrath and DP Kothari Modern Power Systems Analysis, (Tata Mc-Graw Hill).
2. A Chakrabarty, ML Soni, PV Gupta and US Bhatnagar Power System Engineering, (Dhanpat Rai & Sons).
3. John J Grainger and William D Stevenson Jr. Power System Analysis, (McGraw-Hill, Inc.).
4. CL Wadhwa Electric Power Systems, (Wiley Eastern Limited).

ET-307 MATERIALS, COMPONENTS AND PROCESSES

1. S.O. Kasap, 'Principles of Electrical Engineering Materials,' (NGH).
2. Mahajan, 'Principles of growth and processing of semiconductors,' (NGH).
3. Dhir, 'Electronic components and Materials Principles manufacturing and Maintenance,' (YMH).
4. Allison, 'Electronic Engineering Materials and Devices,' (TMH).
5. Ruska N Scot, 'Microelectronic processing – an introduction to the manufacture of integrated circuits,' (MGH).
6. Deeker, 'Electrical Engineering Materials,'(PHI).
7. Seth and Gupta, 'A course in Electrical Engineering Materials,' Dhanpat Rai and Sons.

ET-309 CONTROL SYSTEM

1. Nagrath and Gopal, Control System Engg, TMH
2. Ogata.Control System Engg., PHI
3. BC Kuo, Automatic Control System, Prentice Hall
4. RC Dorf and RH Bishop,.Modern Control Systems, Addison-Wesley Publisher

6th Semester

ET-302 Electric Drives

1. G.K. Dubey, "Fundamentals of Electrical Drives" Narosa Publishing House, 1995.
2. SK Pillai, "A First course on Electrical Drives" Wiley Eastern Ltd.
3. V. Subrahmanyam, " Electric Drives: Concepts and Applications", Tata Mc Graw Hill Publishing Co. Ltd., 1994.
4. GK Dubey, " Power semiconductor Controlled Drives, "Prentice Hall, Englewood cliffs, New Jersey, 1989.
5. EL- Sharkawi & A Mohamad " Fundamental of Electric Drive", Vikas Publishing House

ET-304 Microprocessors and Microcontrollers

1. R.S. Gaonkar, "Microprocessor Architecture, Programming and Applications", Penram International.
2. A.P. Mathur, "Introduction to Microprocessor".
3. K.J. Ayala, "8051 Microcontroller", Penram International.
4. D.V. Hall, "Advanced Microprocessor".

ET-306 Analog and Digital Communication

1. G. Kennedy, "Electronic Communication Systems", McGraw-Hill, NY .
2. H.Taub and D.L. Schilling, "Principles of Communication Systems", TMH.

3. W.D. Stanley, "Electronic Communication Systems", Reston Pub. Co. PH Virginia.
4. W. Tomari & V.F. Alisauskas, "Telecommunications", PH Inc., NJ.
5. Dungan, Frank R " Electronic Communication Systems' Vikas Publishing B House Pvt. Ltd

ET-308 Switchgear and Protection:

1. A Chakrabarti, ML Soni, PV Gupta and US Bhatnagar, "Power System Engineering" Dhanpat Rai & Sons.
2. IJ Nagrath and DP Kothari,"Power System Engineering" Tata McGraw-Hill.
3. CL Wadhwa, "Electric Power Systems", Wiley Eastern Limited.
4. Sunil S. Rao, "Switchgear, Protection and Power Systems", Khanna Publishers.
5. Badriram and DN Vishwakarma, "Power System Protection and Switchgear", Tata McGraw-Hill.

ET-310 Advanced Programming and Software Enginee

1. John J. Donovan, "System Programming" .
2. A.V. Aho and J.D. Ullman, "Principles of Compiler Design", Addision Wesley Pub.Co.
3. D.M. Dhamdhere, "System Software", TMH.
4. Peterson, "Operating Systems",.
5. Herbert Schildt, "C++ - Complete reference", TMH.
6. Stroustrup "C++", Addision Wesley Pub. Comp.
7. Litvin, Maria, "Programming in C++", Vikas Publishing House.

ET-312 Measurements and Instrumentation-II

1. A.K. Sawhney "Electrical Measurements and Measuring Instruments", Dhanpat Rai & Sons.
2. W.D. Cooper- "Electronics Instrumentation and Measurement Techniques", Prentice Hall India.
3. B.C. Nakra and K.K. Chaudhry- "Instrumentation Measurement and Analysis", Tata Mc-Graw-Hill Publishing Company Limited, New Delhi.

7th Semester

ET-401Computer Methods in Power Systems

1. Glenn W. Stagg and Ahmed El-Abiad, " Computer Methods in Power System Analysis", McGraw-Hill.

2. George L Kusic, " Computer-Aided Power Systems Analysis", PHI.
3. John J Grainger and William D Stevenson, "Power System Analysis", Jr. .McGraw-Hill.
4. IJ Nagrath and DP Kothari , "Power System Engineering", Tata McGraw-Hill.

ET-403 Digital Signal Processing

1. S.K. Mitra, " Digital Signal Processing", TMH.
2. Rabinar, Gold, " Digital Signal Processing" ,PHI.
3. J.G. Proakis and DG Manolakis, " Digital Signal Processing",PHI.
4. Oppenheim and Schafer, " Discrete Time Signal Processing" ,PHI.
5. S. Salivahanan, " Digital Signal Processing", TMH.
6. Ingle, Vinay K, " Digital Signal Processing using Matlab", Vikas Publishing House Pvt. Ltd.

ET-413 CONTROL THEORY
(Power Apparatus and System)

1. Ogatta. K. , "Modern Control System", PHI.
2. M.Gopal, "Optimal Control Theory" ,TMH.
3. M.Gopal ,"Digital Control and State variable Methods", TMH.

ET-415 Computer Organisation and Architecture
(Computer Application)

1. Morris Mano, " Computer System Architecture", PHI.
2. J.F. Heys, " Computer Organization and Architecture",TMH.
3. Hwang K. and F.A. Briggs, " Computer Architecture and Parallel Processing", TMH.

ET-417 Information Technology
(Information and Control)

1. Leon and Leon, " Fundamental of Information Technology", Vikas Publishing House.
2. T.J. O'Leary and L.I. O'Leary, " Computing Essentials 2000-2001-Irwin", McGraw Hill-2000.
3. Williams, Sawyer and Hutchinson, " Using Information Technology",TMH, 2000.
4. Curtin, Foley, Sen and Morin, " Information Technology",TMH.
5. "Internet for every one", Vikas Publishing House.

ET-419 Digital System Design
(Electronics and Instrumentation)

1. J. Bhaskar, " A VHDL primer", Pearson Education Asia.
2. J. Bhaskar, "An Engineering approach to Digital Logic Design".

ET-421 Electrical Machines Design
(Power Apparatus and Systems)

1. Clayton A.E., "The performance and design of D.C. Machines", Pitman(ELBS).
2. Say MG, "The performance and design of A.C. Machines", Pitman(ELBS).
3. Sawhney AK, "Electrical Machine Design",(Dhanpat Rai & Sons.

ET-423 Problem Solving, Data Structures and Algorithms
(Computer Application)

1. Trembley and Sorenson, "An Introduction of Data Structures with Applications", McGraw Hill.
2. Goodman, S.E., and Hetedniemi, S.T., "Introduction to the Design and Analysis of Algorithms", McGraw Hill.
3. Sahni, "Data Structures, Algorithms and Applications in C++", TMH.
4. Horowitz, Ellis and Sahni, Sartaj, "Fundamentals of Computer Algorithms", Galgotia Publications.
5. Gorgono, "Problem Solving & Computer Programming", Narosa Nelwn.
6. Horowitz, E. and Sahani, S. "Fundamentals of Data Structures", Galgotia Publications.

ET-425 Digital and Non-linear Control System
(Information and Control)

1. Ogatta, "Modern Control System", PHI.
2. Nagrath and Gopal, "Control System Engg", TMH.
3. M.Gopal, "Digital Control System", TMH.
4. B.C. Kuo, "Digital Control System", PHI.

ET-427 Biomedical and Analytical Instrumentation
(Electronics & Instrumentation)

1. Bolton W, "Measurement and Instrumentation Systems", Newnes.UK.
2. Cromwell L, Weibell F.J, Pfeiffer E.A, "Biomedical Instrumentation and Measurements", Prentice Hall of India Pvt.Ltd., New Delhi.
3. Rangan C S, Sarma G R, Mani V.S.V., "Instrumentation Devices and Systems", TMH New Delhi, India.

4. Beckwith T.G. et al, "Mechanical Measurements", Addison-Wesley.
5. Gupta J.B., "A Course in Electronic and Electrical Measurements and Instrumentation", SK Kataria & Sons, Delhi, India.
6. Nakra. B.C., Chaudhary KK, "Instrumentation Measurement and Analysis",TMH, New Delhi,India.

ET- 461 Non-Conventional Energy Sources

1. R.A. Coormbe,. "An introduction to direct energy conversion".
2. M. Kettani, . "Direct energy conversion".
3. Robest L Loftness, "Energy hand book". .
4. Considine, "Energy Technology Hand book".

ET-463 System Modelling and Control

1. W.R. Perkins and J.B. Guz Jr., "Engineering of Dynamic Systems".
2. K. Ogatta, "Modern Control Engineering".
3. M. Gopal, "Principles and design of control system", TMH.
4. M. Gopal, "Modern Control Theory", TMH.

ET-465 Fault Tolerance and Reliability Engineering

1. Friedman & Menon, "Fault Detection in Digital Circuits," Prentice-Hall, 1971.
2. Shem.Tov-Levi, Ashok K. Agrawala, "Fault Tolerant System Design," McGraw-Hill, 1994.
3. V.N. Yarmolik, "Fault Diagnosis of Digital Circuits", John Wiley & Sons, 1990.
4. Shooman M.L, "Probabilistic Reliability; An Engineering Approach", McGraw Hill.
5. K.B. Misra, "Reliability Analysis & Prediction", Elsevier, 1992.
6. EE Lewis, "Introduction to Reliability Engineering", John Wiley & Sons.
7. Lawrence M. Leemis, "Reliability Probabilistic Models and Statistical Methods", Prentice Hall.

ET-467 Illumination Engineering

PV Gupta, "A text book on Power System Engineering", et.all., Dhanpat Rai

ET-469 Microprocessor and its applications

1. R.S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International.

2. A.P. Malvino, "Digital Computer Electronics, An Introduction to Microcomputers", TMH Edition.

ET-471 Transducers and Applications

1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, " A Course in Electrical and Electronic Measurements and Instrumentation," Dhanpat Rai & Sons, Delhi-6.

8th Semester

ET-402 System Engineering and Reliability

1. S.S. Rao, ".Optimization Techniques".
2. R.J. Richards, "Introduction to Dynamic and Control".
3. E. Balaguruswamy, " Reliability Engineering".
4. A.K. Govil, "Reliability Engineering" .
5. KK Aggarwal, "Reliability Engineering".
6. Martin L. Shooman, "Probabilistic Reliability-An Engineering approach" .

ET-404 HIGH VOLTAGE ENGINEERING

1. Kamaraju & Naidu, "H.V. Engg." .
2. RS Jha, "H.V. Engg." .
3. Rakesh Das Bagamudre, "E.H.V. AC Transmission Engg.".
4. Kuffel & Abdullah, "H.V. Engg."
5. Kimbark, "HVDC Transmission".

ET-412 Utilisation of Electrical Energy & Electric Traction
(Power Apparatus & Systems)

1. E. Openshan Taylor, "Utilisation of Electric Energy", Orient Longmans.
2. P.V. Gupta et. al, "A Course in Electrical Power", Dhanpat Rai & Sons Delhi-6.
3. H. Partap, "Art & Science of Utilisation of Elect. Energy".
4. N.V. Suryanarayana,"Utilisation of Elect. Power" .
5. BR Sharma, "Utilisation of Elect. Energy".
6. AT Dover, "Electric Traction",Pitman.

ET-414 System Analysis & Data Base Management
(Computer Applications)

1. Pralf,"Concept of Data base Management System", Vikas Publishing House.
2. Pressman, "Software Engg." McGraw Hill.
3. Korth & Silberschatz, "Database Concepts", McGraw Hill.
4. Rajaraman, "Analysis & Design of Information Systems", PHI.
5. Hanrysskiewycz, "Introduction to System Analysis and Design", PHI.

ET-416 Data Communication Networks
(Information & Control)

1. Miller, Michael A,. "Data and Network Communication", Vikas Publishing House.
2. Shay Villium, "Understading Data Communication and Networks", Vikas Publishing House.
3. Behrouz Forouzan, "Introduction to data communication and networking", TMH.
4. Fred Halsall, "Data Communications, computer networks and open systems", Addison Wesley.
5. William Stallings, "Data and Computer Communications", PHI.
6. Andrew S. Tannenbaum, "Computer networks", PHI.

ET-418 Advanced Instrumentation
(Electronics & Instrumentation)

1. Liptak, "Instrument Engineers hand book in Process Control," Chilton book company.
2. Radnai, Kingham, " Jone's Instrument Technology", Butter worth International Edition.
3. Curtis Johnson, "Process Control".

ET-420 Electrical Machines – III
(Power Apparatus & Systems)

1. Fitzgerald and Kingsley, "Electric Machinery", McGraw Hill .
2. Langsdarf, "Theory of Alternating Current Machinery", Tata McGraw-Hill.
3. M.G. Say, "Theory, Performance and Design of A.C. Machines", CBS Publishers.
4. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Willey & Sons.

5. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers.
6. E.O. Taylor, "Theory, Performance and Design of A.C. Commutator Machines", A.H.Wheeler & Co., Allahabad.

ET-422 Advances in Computers
(Computer Applications)

1. Miller, "Data and Communication Network", , Vikas Publishing House.
2. Behrouz & Forouzan, "Data Communications and Networking", TMH.
3. Tennenbaum, "Computer Communication Networks", PHI.
4. Rich, "Artificial Intelligence", McGraw Hill.
5. Winston, "Artificial Intelligence", Addison-Wwesley.
6. Waterman, "A Guide to Expert Systems", Addison-Wesley.
7. Clocksin & Mellish, "Programming in PROLOG", Narosa.
8. Bratko, "PROLOG Programming for Artificial Intelligence",Addison-Wesley.
9. Brain J Thomas, "The Internet for Scientists & Engineers", SPIE Press.

ET-424 Optimal and Industrial Control
(Information & Control)

1. D. Patianabis, " Principles of Process Control".
2. M. Gopal, "Modern Control theory", TMH .
3. M. Gopal, " Control Systems: Principles and Design", TMH, 1997.
4. F.L. Lewis, "Optimal Control", Wiley interscience.

ET-426 Microprocessor and Microcontroller
(Electronics & Instrumentation)

1. Gibson, "Microprocessors", PHI.
2. K.J. Ayala, "Micro Controller", Penram International.
3. D.V. Hall, "Advanced Microprocessor".

ET-462 Energy Management and Conservation

1. Generation of Electrical Energy, B.R. Gupta (Eurasia Publishing House, New Delhi).
2. Energy Storage for Power Systems, A Ter-Gazarian (Peter Peragrinus Ltd.).
3. Proceedings of National Seminar on Energy Management, March, 1995, MR Engg. College, Allahabad.
4. Proceedings of National Seminar on Energy Conservation and Management, Oct. 1991, REC, Kurukshetra.

5. Quarterly journals on Energy Managements, Energy Management Centre (Govt. of India, Ministry of Power), New Delhi.

ET-464 Robotics Dynamics and Control

1. John J. Craig, "Introduction to Robotics, Mechanics and Control", Addison Wesley publishing company.
2. A.J. Koivo, " Fundamentals for Control of Robotic manipulators", John Wiley & Sons, New York.
3. Lorenzo Sciaviceo, Brsurw Siciliarw, "Modelling & Control of Robot manipulation", Mcgraw Hill Inter national edition.
4. M.W. Spong and M. Vidyasagar, "Robot Dyamics and Control," John Wiley & Sons, New York.

ET-466 Reliability Centered Maintenance

1. Aggarwal K.K, "Reliability Engineering", Dordrecht, Kluwer Academic Publisher.
2. Anthony M. Smith, "Reliability Centered Maintenance", McGraw-Hill, 1997
3. William H. Van Alven, "Reliability Engineering" , Prentice Hall, 1964.
4. Lawrence M. Leemis, "Reliability Probabilistic Models and Statistical Methods", Prentice Hall.
5. Marvin A. Moss, Marcel Dekkar, "Designing for Minimal Maintenance Expense".
6. E.E. Lewis, "Introduction to Reliability Engineering" , John Wiley & Sons.
7. Doris Llayd & Grosh, "A Primer of Reliability Theor" , John Wiley & Sons.

ET-468 Process Instrumentation and Control

1. Patrick Dale R, "Industrial Process Control System", Vikas Publishing House.
2. Patranibis, "Principles of Process Control".
3. E.J. Wightman, "Instrumentation in Process Control".
4. John.D.Curtis, "Process Control Instrumentation Technology".

ET-470 ANN and Fuzzy Logic

1. S. Haykins, "ANN a Comprehensive Foundation".
2. Zurada, "ANN".
3. T.J. Ross, "Fuzzy logic: with Application to Engineering", McGraw Hill.

ET-472 CONTROL AND GUIDANCE

1. P.Garnell and D.J. East, "Guided Weapon Control Systems", Pergamon Press.
2. J.J. A'zzo and C.H. Houpis, "Linear Control System: Analysis and Design" , McGraw Hill.
3. M.Gopal, "Control Systems: Principles and Design", Tata McGrawHill.

ET-474 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

1. Morris W. Firebaugh, "Artificial Intelligence: A knowledge based approach", PWS-Kent publishing co., Boston.
2. Rich, "Artificial Intelligence", McGraw-Hill.
3. Patrick H Winston, "Artificial Intelligence", Addison Wesley.
4. Peter Jackson, "Introduction to expert systems", Addison Wesley.
5. D.A. Waterman, "A guide to expert system" .
6. Clocksin & Mellish, "Programming in PROLOG" , Springer Pub.
7. John Stobo, "Problem solving with PROLOG", Pitman Publishing.