SE Electronics Engineering
Semester IV
Credit and Evaluation scheme

Semester IV

Sub Code	Subject Name	Teaching Scheme(Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXS 401	*Applied Mathematics IV	04	--	01	04	--	01	05
EXC402	Discrete Electronic Circuits	04	--	--	04	--	--	04
EXC 403	Microprocessor and Peripherals	04	--	--	04	--	--	04
EXC404	Principles of Control Systems	04	--	--	04	--	--	04
EXC405	Fundamentals of Communication Engineering	04	--	--	04	--	--	04
EXC406	Electrical Machines	03	--	--	03	--	--	03
EXL401	Discrete Electronics Laboratory	--	02	--	--	01	--	01
EXL402	Microprocessor and Peripherals Laboratory	--	02	--	--	01	--	01
EXL403	Control System and Electrical Machines Laboratory	--	02	--	--	01	--	01
EXL 404	Communication Engineering Laboratory	--	02	--	--	01		01
Total		23	08	01	23	04	01	28

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. of Test 1 and Test 2					
EXS 401	*Applied Mathematics IV	20	20	20	80	**25	--	--	125
EXC402	Discrete Electronic Circuits	20	20	20	80	--	--	--	100
EXC 403	Microprocessor and Peripherals	20	20	20	80	--	--	--	100
EXC404	Principles of Control Systems	20	20	20	80	--	--	--	100
EXC405	Fundamentals of Communication Engineering	20	20	20	80	--	--	--	100
EXC406	Electrical Machines	15	15	15	60	--	--	--	75
EXL 401	Discrete Electronics Laboratory	--	--	--	--	25	50	--	75
EXL 402	Microprocessor and Peripherals Laboratory	--	--	--	--	25	--	25	50
EXL 403	Control Systems and Electrical Machines Laboratory	--	--	--	--	25	--	25	50
EXL 404	Communication Engineering Laboratory	--	--	--	--	25	50	--	75
Total		--	--	115	460	125	100	50	850

*Subject Common with EXTC
** Tutorial work will be assessed as Term Work

SE Electronics Engineering
Semester IV
Syllabus of Theory Subjects

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXS 401	Applied Mathematics IV	04	--	01	04	--	01	05

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Tutorial as Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXS401	Applied Mathematics IV	20	20	20	80	25	--	--	125

Course Prerequisite: Applied Mathematics III

Course Objective:
This course will present the method of calculus of variations (CoV), basic concepts of vector spaces, matrix theory, concept of ROC and residue theory with applications.

Expected Outcome:
Students in this course will apply the method of CoV to specific systems, demonstrate ability to manipulate matrices and compute eigenvalues and eigenvectors, Identify and classify zeros, singular points, residues and their applications. After completion of this course students will be:

Module No.	Unit No.	Topics	Hrs.
1. 0	**1. 0**	**Calculus of variation**	**10**
	1.1	a. Euler's Langrange equation, solution of Euler's Langrange equation (only results for different cases for function) independent of a variable, independent of another variable, independent of differentiation of a variable and independent of both variables	
	1.2	b. Isoperimetric problems, several dependent variables	
	1.3	**Functions involving higher order derivatives:** Rayleigh-Ritz method	
2.0	**2.0**	**Linear Algebra: Vector spaces**	**12**
	2.1	**Vectors in n-dimensional vector space**: properties, dot product, norm and distance properties in n-dimensional vector space.	
	2.2	Metric spaces, vector spaces over real field, properties of vector spaces over real field, subspaces.	
	2.3	Norms and normed vector spaces	
	2.4	Inner products and inner product spaces	
	2.5	The Cauchy-Schwarz inequality, Orthogonal Subspaces, Gram-Schmidt process	
3.0	**3.0**	**Linear Algebra: Matrix Theory**	**15**
	3.1	Characteristic equation, Eigen values and Eigen vectors, properties of Eigen values and Eigen vectors	
	3.2	Cayley-Hamilton theorem, examples based on verification of Cayley-Hamilton theorem	
	3.3	Similarity of matrices, Diagonalisation of matrix	
	3.4	Functions of square matrix, derogatory and non-derogatory matrices	
	3.5	Quadratic forms over real field, reduction of Quadratic form to a diagonal canonical form, rank, index, signature of quadratic form, Sylvester's law of inertia, value-class of a quadratic form of definite, semi- definite and indefinite	
	3.6	Singular Value Decomposition	
4.0	**4.0**	**Complex Variables: Integration**	**15**
	4.1	**Complex Integration:** Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula	
	4.2	Taylor's and Laurent's series	
	4.3	Zeros, singularities, poles of f(z), residues, Cauchy's Residue theorem	
	4.4	Applications of Residue theorem to evaluate real Integrals of $\int_0^{2\Pi} f(\sin\theta,\cos\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$	
		Total	**52**

Recommended books:

1. *A Text Book of Applied Mathematics* Vol. I & II by P.N.Wartilar & J.N.Wartikar, Pune, Vidyarthi Griha Prakashan., Pune
2. *Mathematical Methods in science and Engineering* , A Datta (2012)
3. *Higher Engg. Mathematics* by Dr. B.S. Grewal, Khanna Publication
4. Todd K.Moon and Wynn C. Stirling, *Mathematical Methods and algorithms for Signal Processing*, Pearson Education..
5. Kreyszig E., *Advanced Engineering Mathematics*, 9th edition, John Wiley, 2006.
6. *Linear Algebra* Hoffman & Kunze (Indian editions) 2002
7. Linear Algebra Anton & Torres(2012) 9th Indian Edition.
8. *Complex Analysis* – Schaum Series.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining questions (Q.2 to Q.6) will be set on all the modules.
5: Weightage of marks will be as per Blueprint.

Term Work:
At least **08** assignments covering entire syllabus must be given during the **Class Wise Tutorial.** The assignments should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every assignment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract.	Tut.	Total
EXC 402	Discrete Electronic Circuits	04	--	-	04	--	-	04

Sub. Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
EXC 402	Discrete Electronic Circuits	Test 1	Test 2	Average of Test1 & Test2					
		20	20	20	80	--	--	--	100

Prerequisite: FEC105 Basic Electrical & Electronics Engineering and EXC 302 Electronic Devices

Course Objectives:

1. To understand DC biasing needed for various applications.
2. To understand DC and AC models of semiconductor devices and usefulness of the devices for various applications like amplifiers, oscillators etc..
3. To apply concepts of DC and AC modeling of semiconductor devices for the design and analysis.
4. To understand theoretical concepts and verify through laboratory and simulation experiments.
5. To deliver the core concepts and reinforce the analytical skills learned in Electronic Devices
6. To motivate students to use MOS devices for designing and analyzing electronic circuits which will help them to understand the fundamentals required for further part of Engineering

Course Outcome:

1. Students will be able to understand and the usefulness of semiconductor devices in circuit making.
2. Students will be Able to perform dc and ac analysis of the basic electronic circuits useful to conclude an application based on these.
3. They will be able to analyze and design multistage electronic circuits.
4. Mainly understanding of discrete and integrated biasing will be understood and very useful for mixed mode designs..
5. They will understand the difference between small signal and large signal amplifiers.
6. They will be able to use these basic circuits to develop various useful applications.

Module No.	Topics	Hrs.
1.0	**Bipolar device based circuit analysis**	**08**
1.1	**Review of Diode Based circuits:** Analytical analysis of Single level clippers, Double level Clippers and clampers (both only explanation, no analytical analysis)	
1.2	**DC Circuit Analysis of BJT:** DC load line and region of Operation, Common Bipolar Transistor Configurations, Single base resistor biasing, voltage divider biasing and bias stability, Analysis and Design of biasing circuits	
1.3	**AC Analysis of BJT Amplifiers: Bipolar Junction Transistor (BJT):** Graphical Analysis and AC Equivalents Circuits, Small Signal hybrid-pi model (no other models), early effect, Common-Emitter Amplifiers, Common-Collector Amplifiers, Common-Base Amplifiers.	
2	**Field Effect devices based circuit analysis**	**10**
2.1	**DC Circuit Analysis:** **Junction Field Effect Transistor (JFET):** Self bias, Voltage divider bias, Design and Analysis of Biasing Circuits **Metal-Oxide Field Effect Transistor (MOSFET):** Common-Source circuits, DC load line and region of operation, Common-MOSFETs configurations, Analysis and Design of Biasing Circuits	
2.2	**AC Analysis:** **JFET Amplifiers:** Small-Signal Equivalent Circuit, Small-Signal Analysis **MOSFET Amplifiers:** Graphical Analysis, load line and Small-Signal parameters, AC Equivalent Circuit, Small-Signal Model. Common-Source, Source Follower, Common-Gate	
3.0	**Multistage analysis and Frequency Analysis of Amplifiers**	**10**
3.1	Multistage (CS-CS), (CS-CE) cascode (CS-CG) Amplifiers & Darlington pair.	
3.2	Effect of capacitors (coupling, bypass, load) on frequency response of JFET and MOSFET Amplifiers, High frequency hybrid-pi equivalent circuits of MOSFET, Miller Effect and Miller capacitance, unity gain bandwidth, Low and high frequency response of single stage (CS,CG, CD) and multistage (CS-CS).	
4.0	**Feedback Amplifiers and Oscillators**	**08**
4.1	Types of Negative Feedback, block diagram representation, Effect of negative feedback on Input impedance, Output impedance, Gain and Bandwidth with derivation, feedback topologies (analysis of different feedback circuits is not expected).	
4.2	Positive feedback and principle of oscillations, RC oscillators: Phase shift (no derivations), Wien bridge, LC Oscillators: Hartley, Colpitts and clapp, Tunned Oscillator (no derivations), Twin T Oscillator (no derivations), Crystal Oscillator (BJT circuits analysis).	
5.0	**Differential Amplifiers**	**10**
5.1	**BJT Differential Amplifier:** Terminology and qualitative description, DC transfer characteristics, Small signal Analysis, differential and common mode gain, CMRR,	

	differential and common mode input impedance.	
5.2	**MOSFET Differential Amplifiers:** DC Transfer characteristics, Small signal Analysis, differential and common mode gain, CMRR, differential and common mode input impedance.	
5.3	**Constant Current Sources:** Two transistor (BJT, MOSFET) current source, current relationship, output resistance. Improved three transistor (BJT, MOSFET) current source, Cascode (BJT, MOSFET) current source, Wilson and Widlar current source	
6.0	**Power Amplifiers**	**06**
6.1	Power BJTs, Power MOSFETs, Heat Sinks, Class A, Class B, Class C and Class AB operation, Power efficiency, Class AB output stage with diode biasing, VBE multiplier biasing, input buffer transistors, Darlington configuration.	
	Total	**52**

Recommended Books:

1. Donald A. Neamen, "*Electronic Circuit Analysis and Design*", TATA McGraw Hill, 2nd Edition
2. Adel S. Sedra, Kenneth C. Smith and Arun N Chandorkar," *Microelectronic Circuits Theory and Applications*", International Version, OXFORD International Students Edition, Fifth Edition.
3. David A. Bell, "*Electronic Devices and Circuits*", Oxford, Fifth Edition.
4. S. Salivahanan, N. Suresh Kumar,*"Electronic Devices and Circuits",* Tata McGraw Hill, 3rd Edition
5. Jacob Millman, Christos C Halkias, and Satyabratata TIT, *"Millman's Electronic Devices and Circuits",* McGrawHill, 3rd Edition
6. Muhammad H. Rashid, *"Microelectronics Circuits Analysis and Design",* Cengage Learning, 2nd Edition
7. Jacob Millman and Arvin Grabel, "Mircroelectronics", Tata McGraw-Hill Second Edition

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
EXC 403	Microprocessor and Peripherals	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 403	Microprocessor and Peripherals	20	20	20	80	--	--	-	100

Course Objective:
To create a strong foundation by studying the basics of Microprocessors and interfacing to various peripherals which will lead to a well designed Microprocessor based System. The course is a pre-requisite for all further courses in Microcontrollers and Embedded systems.

Course Outcome:

1. Students will be able to understand and design Microprocessor based systems.
2. Students will be able to understand assembly language programming
3. Students will be able to learn and understand concept of interfacing of peripheral devices and their applications

Module No.	Topics	Hrs.
1	**Introduction to Intel 8085 Microprocessor:** Basic functions of the microprocessor, System bus, Architecture, Pin Configuration and Programmer's model of Intel 8085 Microprocessor.	06
2	**Intel 8086 Architecture:** Major features of 8086 processor, 8086/88 CPU Architecture and the pipelined operation, Programmer's Model and Memory Segmentation	06
3	**Instruction Set of 8086 and Programming:** Instruction Set of 8086 microprocessor in details, Addressing modes of 8086/88, Programming the 8086 in assembly language, Mixed mode Programming with C-language and assembly language. Assembler Directives Procedures and Macros.	10
4	**8086 Interrupts:** Interrupt types in 8086, Dedicated interrupts, Software interrupts,	04
5	**Designing the 8086 CPU module:** 8086 pin description in details, Generating the 8086 System Clock and Reset Signals, 8086 Minimum and Maximum Mode CPU Modules, Memory interfacing with timing consideration, Minimum and Maximum Mode Timing Diagrams	10
6	**Peripheral Controllers for 8086 family and System Design:** Functional Block Diagram and description, Control Word Formats, Operating Modes and Applications of the Peripheral Controller namely 8255-PPI, , 8259- PIC and 8237-DMAC. Interfacing of the above Peripheral Controllers. Keyword and Display Interface using 8255.	08
7	**Multiprocessor Systems:** Study of Multiprocessor Configurations namely Closely Coupled System (CCS) and Loosely Coupled System (LCS), CCS with the case study of the Maths Coprocessor, Various System Bus Arbitration Schemes in LCS, and Role of the Bus Arbiter (Intel 8289) in the LCS.	08
	Total	52

Recommended Books:

1) Microprocessor architecture and applications with 8085: By Ramesh Gaonkar (Penram International Publication).
2) 8086/8088 family: Design Programming and Interfacing: By John Uffenbeck (Pearson Education).
3) 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala
4) Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: ByLiu & Gibson (PHI Publication).
5) Microprocessor and Interfacing: By Douglas Hall (TMH Publication).

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
EXC 404	Principles of Control Systems	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 404	Principles of Control Systems	20	20	20	80	--	-	--	100

Prerequisite Topics*:*
Differential equations; Laplace transforms and Matrices.

Course Objectives:
Objectives of this course are:

1. To study the fundamental concepts of Control systems and mathematical modeling of the system.
2. To study the concept of time response and frequency response of the system.
3. To study the basics of stability analysis of the system and design of simple controllers

Course Outcome:

1. Students will be able to derive the mathematical model of different type of the systems.
2. Students will understand the basic concepts of control system.
3. Students will understand the analysis of systems in time and frequency domain.
4. Students will be able to apply the control theory to design the conventional PID controller widely used in the industries.

Module No.	Topics	Hrs.
1.	**Introduction to control system analysis**	06
	1.1 Introduction: Open loop and closed loop systems; feedback and feedforward control structure; examples of control systems.	
	1.2 Modeling: Types of models; Impulse response model; State variable model; Transfer function model.	
	1.3 Dynamic Response: Standard test signals; Transient and steady state behavior of first and second order systems; Steady state errors in feedback control systems and their types.	
2	**Mathematical modeling of systems**	08
	2.1 Transfer function models of various systems: Models of mechanical systems; Models of electrical systems; Models of thermal systems.	
	2.2 Manipulations: Block diagram reduction; Signal flow graph and the Mason's gain rule.	
3	**State Variable Models**	12
	3.1 State variable models of various systems: State variable models of mechanical systems; State variable models of electrical systems; State variable models of thermal systems.	
	3.2 State transition equation: Concept of state transition matrix; Properties of state transition matrix; Solution of homogeneous systems; solution of non-homogeneous systems.	
	3.3 Controllability and observability: Concept of controllability; Controllability analysis of LTI systems; Concept of observability; Observability analysis of LTI systems using Kalman approach.	
4	**Stability analysis in time domain**	06
	4.1 Concepts of Stability: Concept of absolute, relative and robust stability; Routh stability criterion.	
	4.2 Root locus analysis: Root-locus concepts; General rules for constructing root-locus; Root-locus analysis of control systems.	
5	**Stability analysis in frequency domain**	10
	5.1 Introduction: Frequency domain specifications, Response peak and peak resonating frequency; Relationship between time and frequency domain specification of system; Stability margins.	
	5.2 Bode plot: Magnitude and phase plot; Method of plotting Bode plot; Stability margins on the Bode plots; Stability analysis using Bode plot.	
	5.3 Nyquist Criterion: Polar plots, Nyquist stability criterions; Nyquist plot; Gain and phase margins.	
6	**Compensators and controllers**	10
	6.1 Compensators: Types of compensation; Need of compensation; Lag compensator; Lead compensator.	
	6.2 Controllers: Concept of ON/OFF controllers; Concept of P, PI, PD and PID Controllers.	
	6.3 Advances in Control Systems: Introduction to Robust Control, Adaptive control and Model predictive control.	
	Total	**52**

Recommended Books

1. I. J. Nagrath, M. Gopal, Control Systems Engineering, New Age International, Fifth Edition, 2012.
2 Dhanesh N. Manik, Control Systems, Cengage Learning, First Edition, 2012.
3. M. Gopal, Control Systems: Principle and design, Tata McGraw Hill, First Edition, 1998
4. Richard C. Dorf and Robert H. Bishop, Modern Control System, Pearson, Eleventh Edition, 2013.
5. Norman S. Nice, Control Systems Engineering, John Wiley and Sons, Fifth Edition, 2010
6. Rajeev Gupta, Control Systems Engineering, Wiley India, First Edition, 2011.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 405	Fundamentals of Communication Engineering	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical And Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 405	Fundamentals of Communication Engineering	20	20	20	80	--	--	--	100

Prerequisite Topics*:* Basic Electronic Devices and Circuits and measurements

Course Objective:

1. **To understand basics of wireless communication systems.**
2. **To understand modulation and demodulation techniques.**
3. **To understand working of transmitters and receivers**
4. **To understand the basic concept of Digital communication**

Course Outcome:

1. **Students will be able to understand the components of wireless communication systems**
2. **Students will be able to understand various modulation techniques and their applications**
3. **Students will be able to understand difference between analog and digital communication**

Module No.	Unit No.	Topics	Hrs.
1.0		**Elements of Communication System :**	**08**
	1.1	**Electromagnetic Waves Propagation:** Maxwell's equations for static and time varying fields, wave equation for free space and dielectric mediums, propagation terms and definition, electromagnetic frequency spectrum,	
	1.2	**Basic communication system:** Block diagram representation	
	1.3	**Concept of Modulation and Demodulation:** Signal representation**, n**oise in communication signals and channels, signal-to-noise ratio, noise factor and noise figure, equivalent noise temperature	
2.0		**Amplitude Modulation**	**10**
	2.1	Principles of DSB Full Carrier AM	
	2.2	**Different types of AM :** DSB-SC ,SSB-SC , VSB, ISB	
	2.3	Practical diode detector	
3.0		**Angle modulation**	**10**
	3.1	Principles of Frequency Modulation and Phase Modulation	
	3.2	**FM Modulators:** Narrow band FM and wide band FM, FM transmitter, noise triangle, Pre-emphasis and De-emphasis circuits	
	3.3	**FM Detection**: frequency discriminator and phase discriminator	
4.0		**Radio Receivers**	**06**
	4.1	Receiver Characteristics , TRF Receivers, and Super heterodyne, Receivers, Choice of IF, AGC, AFC in AM and FM receivers	
5.0		**Analog Pulse Modulation**	**08**
	5.1	**Sampling:** Theorem, aliasing error and sampling techniques	
	5.2	Demodulation and spectrum of PAM, PWM, PPM	
6.0		**Digital Pulse Modulation(only concepts and no numerical problems)**	**10**
	6.1	Comparison of digital signal transmission and analog signal transmission	
	6.2	Pulse- code modulation (PCM) : sampling ,quantizing ,encoding technique, PCM bandwidth	
	6.3	Concept of Delta modulation (DM) and Adaptive Delta Modulation(ADM)	
	6.4	Multiplexing: TDM, FDM- Principles & applications	
		Total	**52**

Recommended Books:

1. Wayne Tomasi "*Electronics communication systems*" Pearson education, Third edition, 2001.
2. Kennedy and Davis "*Electronics communication system* ",Tata McGraw Hill
3. R.P. Sing and S.D. Sapre, "*Communication systems Analog and Digital*", Tata McGraw Hill
4. Taub and Schilling "*Principles of communication systems*", Tata McGraw Hill
5. Roy Blake, "*Electronics communication system*", Thomson learning, second edition.
6. B.P. Lathi "*Modern Digital and analog Communication system*" Third edition, OXFORD
7. Robert J. Schoenbeck "*Electronics communications modulation and transmission*".
8. Lean W couch "*Digital and Analog communication system*", Pearson education, Sixth edition.
9. Roddy Coolen, "*Electronic Communications*" PHI

Term Work:

At least 10 experiments based on the entire syllabus should be set to have well predefined inference and conclusion. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be selected from all the modules.
5: Weightage of marks will be as per Blueprint.

Subject Code	Subject Name	Teaching Scheme (Hrs)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 406	Electrical Machines	3	--	--	3	--	--	03

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 406	Electrical Machines	15	15	15	60	--	-	-	75

Course Objective: To understand performance, working of Electrical Machines and their characteristics etc.

Expected Outcome:

5. **Students will be able to understand electrical motors and their working principles**
6. **Students will be able to understand brushless drives**
7. **Students will be able to understand special types of motors such as stepper motor and applications**

Module No.	Unit No.	Contents	Hrs.
1.0		**DC Machines**	08
	1.1	**Construction:** principle of working, MMF and flux density waveforms, significance of commutator and brushes in DC machine,	
	1.2	**EMF equation**: and Torque equation, characteristics of DC Motors,	
	1.3	**Starters** for shunt and series motors	
	1.4	**Speed Control** (Armature voltage control and field control using block diagrams)	
2.0		**Three phase Induction Motor**	08
	2.1	**Construction**: Working principle of squirrel cage induction motor,	
	2.2	**Equivalent circuit**: Equivalent circuit development, torque speed characteristics, power stages, no load and blocked rotor test	
	2.3	**Speed control:** Classify different methods, stator voltage control using Triac, V/f control using converter inverter scheme (only block diagram)	
	2.4	**Starting methods:** Classification and working of different methods, high torque motors	
3.0		**Single phase Induction Motor**	04
	3.1	**Working Principle:** Double field revolving theory	
	3.2	**Staring methods:** Split phase, capacitor start, capacitor start and run, shaded pole,	
	3.3	**Equivalent circuit:** Determination of equivalent circuit parameters by no load and block rotor test.	
4.0		**Permanent Magnet Synchronous Motors**	04
	4.1	Working principle, EMF and torque equations	
5.0		**Brushless DC Motors**	04
	5.1	Unipolar brushless DC motor, Bipolar brushless DC motor, speed control, important features and applications	
6.0		**Stepper Motors:**	06
	6.1	Constructional features, working principle	
	6.2	**Variable reluctance motor:** Single and multi-stack configurations, characteristics, drive circuits	
7.0		**Switched Reluctance Motors:**	04
	7.1	Constructional features, working principle, operation and control requirements	
		Total	38

Recommended Books:

1. Bimbhra P.S., *Electric Machinery* , Khanna Publisher,
2. G.K. Dubey, *Fundamentals of electrical drives*, Narosa Publications
3. Nagrath I.J., Kothari D.P., *Electric Machines*, TMH Publishcations
4. A.E. Fitzgerald, Kingsly, Stephen., *Electric Machinery*, McGraw Hill
5. M.G. Say and E. O. Taylor, *Direct current machines*, Pitman publication
6. Ashfaq Husain, *Electric Machines*, Dhanpat Rai and co. publications
7. M.V. Deshpande, *Electric Machines*, PHI
8. Smarajit Ghosh, *Electric Machines*, PEARSON

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be selected from all the modules.
5: Weightage of marks will be as per Blueprint.

SE Electronics Engineering
Semester IV
Syllabus of Laboratory

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
EXL 401	Discrete Electronics Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXL 401	Discrete Electronics Laboratory	--	--	--	--	25	50	-	75

Syllabus: Same as **EXC402 (Discrete Electronics)**

Term Work:
At least 10 experiments based on the entire syllabus of Subject **EXC402 (Discrete Electronics)** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are encouraged. Therefore, minimum of 05 simulation experiments be carried out (out of total 10 Expts.) The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

Suggested Experiments on Simulation:

1. One SPICE simulations and implementation for BJT and FET DC biasing (Design and Testing)
2. One SPICE simulation and implementation for an Amplifier Design and Testing with measurement of input and output impedance.
3. One SPICE simulation and implementation for Frequency response of cascaded and single stage amplifiers.
4. One SPICE simulation and implementation for Oscillators.
5. One SPICE simulation and implementation for Negative feedback amplifiers.
6. One SPICE simulation for Differential amplifier with active load.
7. One SPICE simulation for power amplifier.
8. One SPICE simulation for Darlington/cascode amplifier.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
EXL 402	Microprocessor and Peripherals Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXL 402	Microprocessor and Peripherals Laboratory	--	--	--	--	25	--	25	50

Syllabus: Same as **EXC 403 (Microprocessor and Peripherals)**

Term Work:

At least 10 experiments based on the entire syllabus of **EXC 403 (Microprocessor and Peripherals)** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

Suggested Experiments

1. Write a program to arrange block of data in i) Ascending and (ii) Descending order.
2. Write a program to find out any power of a number
3. Write a programmable delay
4. Write a program to find out largest number in an array.
5. Experiment on String instructions (e.g Reversing of string & palindrome)
6. Write a programme to multiply 32 bit numbers
7. Menu driven programming
8. Write a program for code conversion
9. Programming the 8255 to read or write to port (any one application)
10. Programming the 8259 to demonstrate rotating priority, Specific priority ,etc

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
EXL 403	Control Systems and Electrical Machines Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXL 403	Control Systems and Electrical Machines Laboratory	--	--	--	--	25	--	25	50

Syllabus: EXC 404 (Principles of Control Systems) 07 Experiments and
EXC 406 (Electrical Machines) 03 Experiments

Term Work:
At least **03 experiments on EXC 406 (Electrical Machines) and 07 experiments on EXC 404 (Principles of Control Systems)** based on the entire syllabus should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
EXL 404	Communication Engineering Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXL 404	Communication Engineering Laboratory	--	--	--	--	25	50	--	75

Syllabus: Same as **EXC 405 (Fundamentals of Communication Engineering)**

Term Work:
At least 10 experiments based on entire syllabus of **EXC 405 (Fundamentals of Communication Engineering)** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.