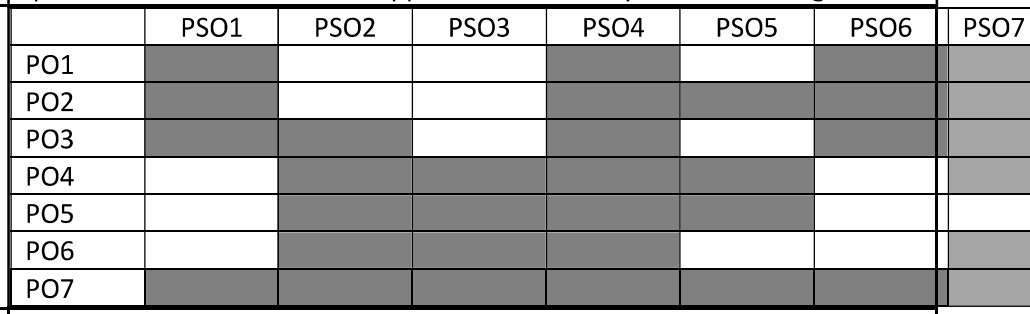
Master of Science - PHYSICS

Name of Program	Master of Science - ELECTRONICS
Abbreviation	**M.Sc.-** ELECTRONICS
Duration	**2 Years**
Eligibility Criteria	Passed B.Sc.- ELECTRONICS
Objective of Program	The core objective of the MSc.- ELECTRONICS programme is to prepare the students for teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** The Students will obtain basic theoretical and Practical knowledge in ELECTRONICS Sciences. They will be trained to complete tests like UGC-CSIR, NET, GSET, GATE etc.. Successfully. It also makes students capable of using core concepts of ELECTRONICS. **PO2 : Critical Thinking Development** The examination pattern for M.Sc. program ELECTRONICS having the 30% weight age for problem and applications and 70% weightage given to theory. This concept develops the skills of critical thinking, program solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Advanced Emerging Technology Awareness** The Syllabus of this program consist of Advanced QM, Advance, Microelectronics and Microprocessor. So, the students avail the advance knowledge in their resign. Which enrich them through this knowledge of latest technologies that is being used in Industry as well as Research Institute. The continuous syllabi review adds value to the program for the outgoing students and make them ready to face challenging demands of the Industry. **PO4 : Advanced Tools Usage** Computer laboratory are compulsory for all specification, so their soft skill are developed by programming. LCD project smart class room, PPT and Videos are used for regular teaching. This teaching helps them to apply the advanced tools to solve real world problems. **PO5 : Nurturing Project Planning and Management Capabilities** The program trains students for designing and conceptualizing the software architecture, planning and managing the product development process of complex and live software projects. It also makes students understand the decision making for selection of appropriate project management capabilities. **PO6 : Real World Problem / Project Development** Real world project provides the candidates exposure to work in the challenging and demanding environment of the industry. The project development training makes students employable and industry ready. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership of the project management team.
Program Specific Outcomes	**Learning Outcomes:** **PSO1 :** Develop and strengthen the fundamental core concepts that are required to solve complex problems. **PSO2 :** Develop the professional and entrepreneurship skills that needs independent logical and analytical thinking, teamwork and leadership.

	PSO3 : Nurture the students to investigate for the design and development of a workable solution for a real world problem through computer program. **PSO4 :** The Students would be able to realize various applications with proper understanding of linear vector space and matrices, differential equations, special functions, series expansion and integral transforms. The students are enabled to understand the motion of a mechanical system using Lagrange and Hamilton formalisms. The Students would be able to understand the concepts of Quantum Mechanics and capable to solve their problems. The students would be able to explain basic physics and application of different types of electronic devices, familiazation with microelectronics and microprocessor of circuits and to seek career in electronics Industry. The Students would be able to apply ensemble theory to complex problems, analyze the peculiar Gas behavior and explore the in applications using different approximations. Their soft skills may develop by programming laboratory works. **PSO5 :** Develop students for self-learning and practicing challenging problem solution through Design built and Test experiments. **PSO6 :** Train students to use advanced knowledge in their resign of specifications for science and application domain specific knowledge.
Mapping between POs and PSOs	
Medium of Instruction	English

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
PO1							
PO2							
PO3							
PO4							
PO5							
PO6							
PO7							

Master of Science – (Electronics), SEM-I

Course:	**EL-411: Mathematical Methods**
Course Outcomes	CO1 : At the end of the course, the students will be able to use different mathematical methods to study problems in non-linear sciences. CO2 : Understand the methods to ordinary differential equations. understand the methods to solve Nonlinear Schrodinger type equations CO3 : Uunderstand the concepts and application of solutions.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Course:	**EL- 412: Microcontroller and Applications**
Course Outcomes	CO1 : Being Advance subject, Microcontroller and its application is introduced in the curriculum. CO2: In the field of electronics & Instrumentation the micro controller base circuits play important roll. CO3: Therefore the employability of the student's in the Industry increases.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Course:	**EL-413: Measurement, Instrumentation and Experimental Planning**
Course Outcomes	CO1 : At the end of the course, the students will be able to acquire the knowledge about the different errors occurring during measurement. CO2 : Understand the principle behind the instrumentation for measurement. CO3 : Identify the various transducers involved in measurement .
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Course:	**EL- 414: C and CAD for Electronics**
Course Outcomes	CO1 : At the end of the course, the students will learn higher level language programming and their basic. CO2 : The skill to write the programming using IF, FOR, WHILE and DO statement and there are aware global automatic static variables. CO3 : Student's do best exercise for simulation for electronics circuit using simulation program per Integrated Circuit Enchases (Spice)

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	■			■		
	CO2					■	■
	CO3					■	■

Course:	**EL-415: Practical's**
Course Outcomes	CO1 : At the end of course work, students are update about skills of measurement of various electronic Components, soldering , Circuit layout etc. CO2 : The design approach is a simple step-by-step Procedure in which the student knows exactly why each Component Value is Selected.

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1			■			
	CO2	■					■
	CO3						■

Master of Science – PHYSICS, SEM-II

Course:	**EL - 421: Digital Signal Processing**
Course Outcomes	CO1 : The students will learn basic Principles of Digital Signal processing and roll of Signal functions in signal processing. CO2 : Student's may aware with system properties and basic of Fourier, Laplace and other transformations and basic terms associated with properties and transformation. CO3 : The basic introduction of Discrete, Fourier, Transformations (DFT), DDFT, IDFT and their utility in digital filter designing. CO4: The Applications of Digital signal processing are briefly cover in this syllabus. So, students learn and thing about their present and future applications.

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	■					
	CO2		■	■		■	
	CO3			■			
	CO4			■			

Course:	**EL- 422 : Op Amp & Circuit Designing**
Course Outcomes	CO1: The Student Will relays Practical Application or Operational They Learn the basic term Associated with op Amp to. CO2 : the Student may Premier general linear applications of Op Amp this concept may help them to think about special Application about Op Amp CO3 : The student may understand the basic design concept of the use of Op Amp single and dual power supply they may also learn about the use of feedback circuit Op Amp CO4: A student may aware with basic idea of interfacing of and Op Amp

	for ADC & DAC Circuit.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1		■				
CO2	■					
CO3			■	■		
CO4						

Course:	**EL-423:- Electromagnetic Fields and Waves**
Course Outcomes	CO1 : At the end of the course, the students will be able to understand the basic concepts nucleus and its properties. CO2 : To gain the knowledge on elementary particles.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■	■				
CO2				■		

Course:	**EL- 424: Electronic Communication-I**
Course Outcomes	CO1 : The course provides excitement of the electronic communication field as well as background essential for advanced study in communication systems. CO2 : The practicing students will find it of service to update their knowledge in the field.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■					■
CO2			■			■
CO3						

Course:	**EL-425: Practical's**
Course Outcomes	CO1 : At the end of the Course work, the students are familiar about the design and analysis of all the Basic semiconductor Circuit Apart from discrete Component. CO2 : Circuits, the design procedure for using IC operational amplifiers in various circuits is discussed. CO3 : Students are aware of operation of transducers.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■					
CO2			■	■		
CO3						■

Master of Science – PHYSICS, SEM-III

Course:	**EL - 531: Microwave**
Course Outcomes	CO1 : The students will learn about basic devices used for production and applications of Microwave frequencies.

	CO2 : The Devices like Tunnel Diode, MIS diode, IMPATT diode, TRAPATT diode, BARITT diode. CO3: Students will learn about Microwave transmission lines, Smith chart, Impedance matching, Couplers and Isolators. CO4: The students may aware with basics of Reflex klystrons, and Helix travelling wave cubes and Agile coaxial magnetrons.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						

Course:	**EL- 532 : Optoelectronics**
Course Outcomes	CO1: At the end of the Course work, it Provides the Students with a general understanding of the Characteristics of Optical Fibers and how they are used in a telecommunication system courses in Communication theory would be helpful for gaining a full understanding of the material. CO2: The course Progresses Systematically from descriptions & the individual elements of System designs and ends with discussion of measurement techniques for evaluating components & systems
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						

Course:	**EL-533:- Solid State Devices**
Course Outcomes	CO1 : The syllabus provide an introduction to theory of Semiconductor Device. CO2 : The emphasis on vital understanding of both the operation of present day devices will be benefited of present day device will be benefited to further development of new Semiconductor device in the field.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						

Course:	**EL- 534: Instrumentation**
Course Outcomes	CO1 : At the end & the course , Students are upload in the area of measurement and indirectly allied to that of laboratory teaching. CO2 :The primary empress is on the measurement of Physical & mechanical variables encountered in experimental investigations & indusial processes. CO3: The Students also need to Put into action concepts of accuracy and Precision when diagnosing Problems and maintaining medical and laboratory equipment
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6

	CO1	■					
	CO2		■	■			
	CO3					■	■

Course:	**EL-535: Practicals**
Course Outcomes	CO1 : At the end of the Course work ,an attempt has been made to introduce the concepts of modern digital techniques and IC, for realization of various functions. CO2 : The Students are aware of experiments related with Microware & C-programming strong emphasis is placed on basic experiments of Electronics communication.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■	■	■	■	■	■
CO2						

Master of Science – PHYSICS, SEM-IV

Course:	**EL - 541: Laser and its Applications**
Course Outcomes	CO1 : At the end of the course work, the student has to knowledge of the basic theory behind Laser Operation and Its properties throughout. CO2 : the treatment has been kept as simple as positive with some familiarity of electromagnetic theory and non-linear optics.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■		■			■
CO2		■		■		
CO3						

Course:	**EL- 542 : Integrated Circuits Technology**
Course Outcomes	CO1 : The students learn about classification of Integrating circuits and how the IC's are fabricated. CO2 : The students may also aware with basic steps of IC's fabrication processes like Crystal Growth, Epitaxial growth, Oxidation Photo litho grapy diffusion and metallization. CO3: The students are familiarize with IC fabrication methods for fabrication of BJT, FET, MOSFET and SMOS. CO4: The students may aware with topical concept for IC's, thay may also aware with different types of Bonding and packages for ICs
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1		■				
CO2	■			■	■	
CO3			■			

Course:	**EL-543:- Analog & Digital Electronics**
Course Outcomes	CO1 : The course contains the advance topics of Microelectronics like, NMOS, CMOS, BIFET-BIMOS-BICMOS, ECL and CCD

	technology. CO2 : Syllabus also giving emphasis on architecture of memory devices likes PROM, EPROM, EEPROM. CO3 : Current sources multi loop feedback Amplifier, and Theory of High Frequency response of Amplifiers are briefly discuss.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Course:	**EL- 544: Electronic Communication – II**
Course Outcomes	CO1 :At the end of the course work, it is to extend & Update of the Knowledge of the students to more modern Digital Communication Systems, terrestrial and microwave radio communication systems and satellite communication systems. CO2 :An attempt is mode to know the fundamental of telephone Switching traffic load & service grade.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Course:	**EL- 545: Practicals**
Course Outcomes	CO1 : As part of this lab course, a full semester project is carried out on some Electronics related problem which is am electronic circuit. CO2:The project in this lab. Includes system designing, PCB designing, using, construction and testing of the circuit. CO3: Good training in planning and executing an Electronic project and technical skill development is the outcome.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

Syllabus

OF

Course Work

for

MASTER OF SCIENCE (M.Sc.)

ELECTRONICS

Choice Based Credit System (CBCS)

DEPARTMENT OF PHYSICS,
VEER NARMAD SOUTH GUJARAT UNIVERSITY,
UDHANA MAGDALLA ROAD,
SURAT -395007. (GUJARAT)

Proposed Structure for M.Sc. Syllabus

SEMESTER- I

M.Sc. (ELECTRONICS)

Sr. No.	Course Code	Course Title	L	T	Cr.
1	EL-411	Mathematical Methods	4	1	4
2	EL-412	Microcontrollers and its Applications	4	1	4
3	EL-413	Measurement, Instrumentation and Experimental Planning	4	1	4
4	EL-414	C and CAD for Electronics	4	1	4
5	EL-415	Practicals	9	1	8
			25	05	24

Faculty Code: **Science** Subject Code: EL Level Code: **04**

Name of Program**: M.Sc.** Subject: **ELECTRONICS**

External Examination Time Duration: **03 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
M.Sc.	**1**	**EL-411**	**Core**	**04**	**30**	**70**	**100**
		EL-412	**Core**	**04**	**30**	**70**	**100**
		EL-413	**Core**	**04**	**30**	**70**	**100**
		EL-414	**Core**	**04**	**30**	**70**	**100**
		EL-415	**Practical**	**08**	**60**	**140**	**200**
			TOTAL	**24**	**180**	**420**	**600**

Faculty of Science **M.Sc. ELECTRONICS**

DEPARTMENT OF PHYSICS, VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT -395007

M.Sc. Syllabus 2017

M.Sc. (Electronics): SEMESTER-I

EL-411: Mathematical Methods

Unit 1 **Linear spaces**

Vector spaces and subspaces, Linear dependence and independence, Basis and Dimensions, linear operators, linear transformations

Unit 2 **Matrices and eigen values:**

Review of algebraic operations on Matrices, matrix representation, Similarity transformations, Inner product, Orthogonality, Unitary transformations, Eigen values and eigenvectors, Diagonalization using Jacobi method

Unit 3 **Ordinary Differential Equations**

Solution in closed form: First order differential equations, Linear equations, Bernoulli's equation, Exact equation, Clairaut's equation

Second order differential equation: Homogeneous and inhomogeneous forms, variation of parameters method, changes of variable.

Power series solution: General consideration, Legendre' equations, Bessel's equation, miscellaneous approximate methods, the W K B method.

Unit 4 **Special functions**

Legendre functions,: Rodrigue's formula, Integral representation, Generating function, recursion relations, orthogonality of Legendre's polynomial, Associated Legendre's polynomial ,it's recursion relations and orthogonality.

Bessel functions: Generating function, recursion relations and orthogonality of Bessel's function, Hermite functions, spherical harmonics, Lagaurre's functions.

Unit 5 **Integral transforms**

Fourier transform, Parseval's theorem, Laplace transforms, Properties of Fourier and Laplaces transforms ,Convolution theorem, other transform pairs, applications of integral transforms.

Complex integration:

Residue and residue theorem, contour integration

Unit 6 **Probability distributions**

Binomial, poison and Gaussian distribution, properties of distributions
Group theory: an introduction, Subgroup and classes, Group representation, Applications

Recommended Books

1. J. Mathews and R. L. Walker Mathematical Methods of Physics Benjamin (IBH) (1979).
2. H. Margenau and G. M. Murphy, Mathematics of Physics and Chemistry, East-West Press (1975).
3. P. M. Morse and H. Feshbach, Methods of Theoretical Physics, Vols. 1-2, Mc Graw Hill-Kogekusha (1953).
4. R.V. Churchill, Complex Variables and Applications, McGraw Hill, (1960).
5. Mathematical Methods by B S Rajput Pragati Prakashan, (1997)
6. Mathematical Methods in Physics by George Arfken, Hans Weber, Frank Harris, Academic Press, 7th Edition (2012).

Theory Tutorials (EL-411)

1. Applications of series solution method
2. Problems on matrix inversion
3. Problems on Eigen value equation
4 Application of W.K.B. method
5. Problems of method of separation of variables for PDE.
6. Addition theorem of spherical harmonics
7. Problems on Fourier transform
8. Problems on Laplace transform
9. Problems on Gaussian distributions
10. Problems on binomial distributions

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

M.Sc. (Electronics) : Semester – I

EL- 412: Microcontroller and Applications

Unit 1 **Microcontroller Architecture PIC18F Family:**
PIC18F Microcontroller Families, Processes of Data Transfer between a Microcontroller and Outside Peripherals, Support Devices, Microchip PIC Family of Devices, PIC18F Instructions and Assembly Language, Illustration: Displaying a Byte at an I/O Port of PIC18F452 Microcontroller, Embedded System: Temperature and Time Display

Unit 2 **PIC18F Programming Model, Instruction Set and Programming:**
PIC18F Programming Model, Introduction to PIC18 Instruction Set, Instruction Format, Illustration: Addition, Approach to Problem Solving with Programming, Illustrative Program: Addition with Carry Check, Integrated Development Environment (IDE), Illustrative Program: Addition with Carry Check, Assembling, Debugging, and Executing a Program Using MPLAB IDE

Unit 3 **Introduction to Data Copy (Move), Arithmetic, and Branch Instructions:**
Data Copy (Move) and Set/Clear Operations, Arithmetic Operations, Redirection of Program Execution (Branch and Skip Operations), Generating Time Delays, Illustrative Program: Generating Waveforms, Illustrative Program: Copying a Block of Data from Program Memory to Data Registers, Illustrative Program: Addition of Data Bytes, Illustrative Program: Searching for Specific Characters in a Data Set.

Unit 4 **Introduction to Logic, Bit Manipulation, and Multiply-Divide Operations:**
Logic Operations, Bit Operations, Multiply and Divide Operations, Illustrative Program: Finding the Highest Temperature in a Data String, Illustrative Program: Finding an Average Temperature of Data Readings.

Unit 5 **Application Programs and Software Design:**
BCD to Binary Conversion, Binary to BCD Conversion, ASCII Code to Binary Conversion, Binary to ASCII Code Conversion, Illustrative Program: Multiplication of 16-Bit Numbers, Illustrative Program: Division of Two 8-Bit Unsigned Numbers, Software Design.

Unit 6 **Input/Output (I/O) Ports and Interfacing:**
Basic Concepts is I/O Interfacing and PIC18 I/O Ports, Interfacing Output Peripherals, Illustration: Displaying BCD Counter at Seven-Segment LEDs, Interfacing Input Peripherals, Illustration: Interfacing Push-Button Keys, Illustration: Interfacing an LCD (Liquid Crystal Display), Illustration: Interfacing a Matrix Keyboard, Illustration: Interfacing Seven Segment.

Recommended Books

1. Ramesh Gaonkar, Fundamentals of Microcontrollers and Applications In Embedded Systems Penram International Publishing (2010).
2. John B. Peatman, Design with PIC Microcontroller, Pearson Education, (2005).

Theory Tutorials (EL- 412)

1. Study of different code system
2. Environment (IDE) for embedded system development.
3. System development tools.
4. Assembly language program for embedded systems.
5. C-language program for embedded systems.
6. Interfacing different Keyboards.

M.Sc. Physics Semester-I

PH-413: Measurement, Instrumentation and Experimental Planning

Unit-1 Measurement System

Measurement, Definition of basic Terms, Calibration, The Generalized Measurement Systems, Static Characteristics - Some basic statistics, Static Sensitivity, Linearity, Threshold, Noise Floor, Resolution, Hystersis Scale Readability, spam, Dynamic Characteristics. Generalized Mathematical Model of Measurement System.

Unit-2 Transducers

Transducers, The Variable-Resistance Transducer, The Differential Transformer (LVDT), Capacitive Transducer, Piezoelectric Transducer, Photoconductive Transducer, Photovoltaic Transducer, Ionization Transducers, Hall-Effect Transducer, Digital Displacement Transducers, Problems.

Unit-3 Measurements of Different Physical quentity

Mechanical Pressure Measurement Devices, Low Pressure measurement, Ionization Gages, Dimensional Measurement, Force Measurement. Measurement of Viscosity, Humidity Measurement, pH Measurement, Detection of Nuclear radiation, Neutron Detection, Air Pollution standards.

Unit-4 Instrumentation and Experimental Planning

Instrument - Zero order Instrument, Second order, Third order instrument, Their step, Ramp, Frequency, Impulse Responses.

Unit-5 Electrodes, Sensors & Transducers

Sensor error source Tactics & signal processing for improved sensing, Electrodes for biophysical sensing, Medical surface electrodes, Micro electrodes, Temperature transducers. ECG Machine, Overview of Clinical instrumentation, Blood Cell Counters.

Unit-6 Report Writing

Report Writing, Function of Research Report, Types of Report, Contents of a Report, Mechanics of writing a Report, Challenges of a Good writing, Graphical Presentations, Processing of Reports, Oral and Poster Presentations.

Reference Books:

1. Measurement Systems - Application and Design. Earnest O. Doebein, Tata McGraw Hill Publication (5th Edition) (2004)
2. Experimental Methods for Engineers J.P. Holman. Tata McGraw Hill Publication (7th Edition) (2004).
3. B.E. Jones, Instrumentation measurement & feedback: TMH
4. A.K.Sawhney, A course in mechanical measurements & Instrumentation: Dhanpat Rai & sons.
5. C.S.Rangan, G.R.Sharma, V.S.V.Mani, Instrumentation, Devices & Systems: TMH.
6. R.S.Khandpur, Handbook of Analytical Instruments: TMH.
7. A.James, Diefenderfer, Principles of Electronic Instrumentation: W.B.Saunders.
8. M.Sayer & A. Mansingh, Measurement, Instrumentation & Experiment design in Physics & Engineering: PHI.

Theory Tutorials (PH-413)

1. Concept of Measurement
2. Errors
3. Uncertainty Analysis
4. Chi-square Test
5. Statistics of occupation number calculation of thermo dynamical quantities
6. Blackbody radiation and photon statistics
7. Evaluation of second virial coefficients.
8. Fluctuations of thermo dynamical variables

M.Sc. (Electronics): Semester – I

EL- 414: C and CAD for Electronics

Unit 1 Programming, higher level languages, operating systems, compiling programs, writing a program variables, data types and constants arithmetic expressions,

Unit 2 IF statement, switch statement, flags, the conditional expression operator, the FOR statement, the WHILE statement, the DO statement, arguments and local variables, returning fraction results, functions calling top down programming, functions and arrays global variables, automatic and static variables, Recursive Functions.

Unit 3 Initializing array elements, characters arrays, multidimensional arrays, strings, functions and structures, initialize structures, arrays of structures, structures within structures, structures containing arrays, structure variables.

Unit 4 Pointers and structures, pointers and functions, pointers and arrays, operations on pointers, pointers to functions, pointers and memory addresses, bit operations, bit fields.
Characters I/O, get char and put char, formatted I/O printf and scanf, file I/O, special functions for handling files.

Unit 5 Simulation Program for Integrated Circuit Emphasis (SPICE): Introduction, circuit description, DC circuit analysis: Resistors, Modeling of elements, Independent sources, Dependent source, DC output variables, Types of output, Types of DC analysis, Transient analysis: Capacitor and inductor, modeling of transient sources, Transient sources, Transient output variables, Transient output commands, Transient response, Switches.

Unit 6 Simulation Program for Integrated Circuit Emphasis (SPICE): AC circuit analysis: AC output variable, Independent AC source, Magnetic elements, Transmission lines, Op-Amp Circuit: DC linear model, AC linear model, Non linear macro model.

Recommended Books:

1. S. G. Kochar, Programming in C, CBS Publication, (1991).
2. B. W. Kernighan and D.M. Ritchie, The C Programming Language, PHI (1988).
3. Madhusudan Mothe, C for Beginners, Shroff Publisher and distributers Pvt. Ltd. (2009)
4. Muhammad H. Rashid, SPICE for Circuits and Electronics using PSPICE, Prentice Hall of India private limited (1990).

Theory Tutorials (EL- 414)

1. Writing program to understand different data types in C.
2. Writing program to understand sequential and selection control flow in C.
3. Writing program to understand Iteration control flow in C.
4. C-language program related to Array.
5. SPICE simulations for different digital circuits.

M.Sc. - (Electronics) : Semester - I

EL-415: Practicals

1. To design, build & test variable voltage regulator using IC -741.
2. To design, build & test Schmitt Trigger Circuit.
3. To design, build and test a Bistable multivibrator.
4. To design, build & test Binary to Gray Code Converter.
5. To design the basic RAM memory cell & its Conversion to 2x1 RAM.
6. To design, build & test UJT as a relaxation oscillator.
7. Study of Characteristics of Photodiode.
8. To design, build & test Phase Shift Oscillator.
9. To design, build & test Astable Multi-vibrator.
10. To design, build & test Monostable Multi vibrator.
11. To design, build & test mod N-counter using IC 7493 & other Gates.
12. To design, build & test Digital to Analog Converter.
13. To design, build & test 4-bit BCD Up/Down counter using IC 7493.
14. To design, build & test 4-bit binary Up/Down counter using D-flip-flops and NOT gates.

Recommended Books:

1. Ramakant A. Gayakwad,OP-AMPS & Linear Integrated Circuits : PHI (2002).
2. David A. Bell, Solid State Pulse Circuit :, Reston Publishing Comp., Inc. Reston, Virginia (1981).
3. Albert P. Malvino & Donald P.Leach, Digital Principles & Application : McGraw-Hill, International Editions (2010).

Laboratory Tutorial (EL – 415)

1. Study of FM & PM Modulation.
2. Study of Double Sideband (DSB) & Single Sideband (SSB) amplitude Modulation.
3. Study of Water Level Measurement System.
4. Study of Pressure Measurement.
5. Study of Analog Signal Sampling & Reconstruction.

Syllabus

OF

Course Work

for

MASTER OF SCIENCE (M.Sc.)

ELECTRONICS

Choice Based Credit System (CBCS)

DEPARTMENT OF PHYSICS,
VEER NARMAD SOUTH GUJARAT UNIVERSITY,
UDHANA MAGDALLA ROAD,
SURAT -395007. (GUJARAT)

Proposed Structure for M.Sc. Syllabus

Effective from June 2017

SEMESTER- II

M. Sc. (ELECTRONICS)

Sr. No.	Course Code	Course Title	L	T	Cr.
1	EL-421	Digital Signal Processing	4	1	4
2	EL-422	Op Amp & Circuit Designing	4	1	4
3	EL-423	Electromagnetic Fields and Waves	4	1	4
4	EL-424	Electronic Communication-I	4	1	4
5	EL-425	Practicals	9	1	8
			25	05	24

Faculty Code: **Science** Subject Code: EL Level Code: **04**

Name of Program**: M.Sc.** Subject: **ELECTRONICS**

External Examination Time Duration: **03 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
M.Sc.	**2**	**EL-421**	**Core**	**04**	**30**	**70**	**100**
		EL-422	**Core**	**04**	**30**	**70**	**100**
		EL-423	**Core**	**04**	**30**	**70**	**100**
		EL-424	**Core**	**04**	**30**	**70**	**100**
		EL-425	**Practical**	**08**	**60**	**140**	**200**
			TOTAL	**24**	**180**	**420**	**600**

Faculty of Science **M.Sc. ELECTRONICS**

DEPARTMENT OF PHYSICS, VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT -395007

M. Sc. Syllabus 2017

M.Sc. (Electronics): SEMESTER-II

EL - 421: Digital Signal Processing

Unit 1 **BASIC PRINCIPLES OF DGITAL SIGNAL PROCESSING**

Introduction, Building Blocks of a Digital Signal Processor, The sampling process, Sampling and holding, DAC, ADC, Counter ramp type ADC, Successive approximation type ADC, Flash converter, z-transformer and the Discrete Fourier-transformer.

Unit 2 **SIGNAL AND FUNCTIONS IN SIGNAL PROCESSING**

Introduction, The Delta (Impulse) Function, The Unit-step Function, The Unit-ramp Function, The Parabolic and Exponential Functions, The Sinusoidal Function, Methods for Plotting Various Types of Signals, Even and odd functions, Periodic and Non-periodic functions.

Unit 3 **SYSTEM PROPERTIES AND TRANSFORMATIONS**

Properties of Systems: Introduction, Linearity, Causality, Time-variance, Stability, Memory.

Transformation: Introduction, The Fourier, the Laplace and Other Transformations, Properties of z-transforms and Discrete-time Fourier Transforms, Inverse z-transformation (IZT).

Unit 4 **DISCRETE FOURIER TRANSFORMATION DIGITAL FILTERS DESIGN**

Discrete Fourier Transformation: Introduction, Computation of DFT, Inverse Discrete Fourier Transformation (IDFT), Comparison between DTFT and DFT.

Digital Filter design: Introduction, Theory of Infinite-Impulse-Response (IIR) Filters, Finding the Expression for H(s) in the Digital Domain, Design of Butterworth Digital IIR Filters, Cheyshev Digital IIR Filters, The Inverse (Type-II) Cheyshev IIR Filter Design

Unit 5 **STRUCTURE FOR REALIZING DIGITAL IIR FILTERS**

Introduction, Direct-form I Structure of IIR Filters, Direct-form II (Canonical-form) Structure for IIR Filters, Transposed-forms Structure for IIR Filters, Parallel Structure for IIR Filters, Cascade-form Structures for IIR Filters ,Signal-flow Graphs in Filter-structure Realization, Lattice Structure of IIR Filters.

Unit 6 **APPLICATION OF DIGITAL SIGNAL PROCESSING**

Introduction, Application of DSP-Classification, Digital sinusoidal oscillator, Digital tone control, Digital comb filter, Removal of noise from picture, Applications in communication, Synthesis of Speech Signals.

Recommended Books

1. Digital signal processing, B. Somnathan Nair, Prentice Hall of India (2004).
2. Introduction to Digital signal processing, Roman Kuc, McGraw-Hill book company (1988)

Theory Tutorials (EL-421)

1. Theory of Analog Filter design
2. Design of Analog filters
3. Digital filter designin.

M.Sc. (Electronics) : Semester – II

EL- 422 : Op Amp & Circuit Designing

Unit 1 **Practical Op Amp.**

Practical Op amp, input off-set voltage, input bias current, input offset current, total out-put offset voltage, thermal drift, effect of variation in power supply voltage on offset voltage, change in input offset voltage and current with time, temperature sensitive parameters, noise, CMRR

Unit 2 **General Linear Application**

DC AC Amplifiers, AC Amplifies with a single Supply Voltage, The Peaking Amplifier, Summing, Scaling and Averaging Amplifiers, Inverting and non-inverting Configuration, Differential Configuration, Instrumentation Amplifier, Differential Input and Differential Output Amplifier, Voltage-to-Current Converter with Floating Load, Voltage-to-Current Converter with Grounded Load, Current-to-Voltage Converter, Very High Input Impedance Circuit, The Integrator, The Differentiator, PSpice Simulation

Unit 3 **Single Supply Op Amp Design Technique**

Single supply versus dual supply, circuit analysis, various simultaneous equation, feedback theory, block diagram for math and manipulations, feedback equation and stability, bode analysis of feedback circuits, loop gain plot, second order equation

Unit 4 **Interfacing an Op Amp to an Analog to Digital Converter**

System Information, Power Supply Information, Input Signal Characteristics, Analog to Digital Converter Characteristics, Operational Amplifier Characteristics, Architectural Decisions

Unit 5 **Interfacing DACs to Loads**

Load Characteristics, Understanding the DAC and its Specifications, DAC Error Budget, DAC Errors and Parameters, DC Errors and Parameters, AC Errors and Parameters, Compensating for DAC Capacitance, Increasing Op Amp Buffer Amplifier Current and Voltage, Current Boosters, Voltage Boosters, Power Boosters, Single Supply Operation and DC Offsets

Unit 6 **Sine Wave Oscillators**

Understanding a Sine Wave Oscillator, Requirements for Oscillation, Phase Shift in the Oscillator, Gain in the Oscillator, Active Element (Op Amp) Impact on the Oscillator, Analysis of the Oscillator Operation (Circuit), Sine Wave Oscillator Circuits, Wien Bridge Oscillator, Phase Shift Oscillator, Single Amplifier, Phase Shift Oscillator, Buffered, Bubba Oscillator, Quadrature Oscillator

1. Ramakant A. Gayakwad,OP-AMPS & Linear Integrated Circuits : PHI (2002).
2. Op Amps for everyone, 3rd Ed, Bruce Carter, Ron Mancini, Texas Instruments, Elsevier (2009).
3. David A. Bell, Solid State Pulse Circuit, Reston Publishing Comp., Inc. Reston, Virginia. (1988).
4. Albert P. Malvino & Donald P.Leach, Digital Principles & Application : McGraw-Hill, International Editions (2006).

Theory Tutorials (EL- 422)

1. Computer simulation of Summing, scaling and averaging amplifiers
2. Computer simulation of active filters.
3. Computer simulation of oscillator.
4. Study of sample-and-hold circuit.
5. Study of A/D and D/A converter.

M. Sc.- (Electronics) : Semester - II

EL-423:- Electromagnetic Fields and Waves

Unit-1 Multipole expansion

Multipole expansions for a localised charge distribution in free space, Linear quadrupole potential and field, static electric and magnetic fields in material media, Boundary conditions.

Unit-2 Maxwell's equations

Displacement current, Maxwell's equations, Maxwell's equations in matter, boundary conditions, The continuity condition, Poynting's theorem, Maxwell's stress tensor

Unit-3 Electromagnetic waves

Waves in one dimension, boundary conditions: reflection and transmission, polarization, Electromagnetic waves in Vacuum, energy and momentum in electromagnetic wave, Electromagnetic waves in matter, Reflection and transmission at normal and oblique incidence, Electromagnetic waves in conductors, frequency dependence of permittivity, skin depth

Unit-4 Potentials and fields

Scalar and vector potential, Gauge transformations, Coulomb and Lorentz gauge, Retarded potentials and Lienard-Wiechert potentials, the fields of a moving point charge

Unit-5 Wave Guides

Rectangular wave guides, Transverse magnetic waves in rectangular wave guides, transverse electric waves in rectangular wave guides, TM and TE waves in circular wave guides

Unit-6 Plasma Physics and magnetohydrodynamics

Introduction of plasma physics and magnetohydrodynamics, magneto-hydrodynamic equations, magnetic diffusion, viscosity and pressure, magneto hydrodynamic flow between boundaries with crossed electric and magnetic fields, pinch effect, instabilities in a pinched plasma column, magneto hydrodynamic waves, plasma oscillations, De bye screening. Applications of plasma physics and controlled thermonuclear reactions.

Reference Books:

1. Introduction to Electrodynamics by David J. Griffiths. (1999)
2. Classical Electricity and Magnetism by Panofsky and Phillips, (2005)
3. Classical Electrodynamics by J. D. Jackson (1975)
4. Electromagnetic waves and Radiating systems by Jordan and Balmain
5. Foundations of Electromagnetic Theory by Reitz and Milford, (2008)
6. An Introduction to Magnetohydrodynamics by P A Davidson, Cambridge University Text, (2001)
7. Introduction to Plasma Physics and Controlled Fusion by F F Chen, Springer; 2nd ed. (1984)

Theory Tutorials

(Discussion and problem solving/exercise sessions)

1. Calculation of multipole moments of discrete and continuous charge configuration.
2. Problem involving gauge other than Coulomb and Lorentz gauge.
3. Problem monopole and charge quantization.
4. Problem on Brewster angle, spreading of a wave propagating in a dispersive medium,
5. Problem on magnetic flux through a perfectly conducting loop.
6. Problem of net force on the hemisphere of uniformly charged solid sphere using Maxwell's stress tensor.
7. Problems on reflection and transmission coefficients
8. Energy associated with the skin depth of a conductor.
9. Radiation due to a cube with charge at alternate corners.
10. Problems on TE modes

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

M.Sc. (Electronics): Semester – II

EL- 424: Electronic Communication-I

Unit 1 **Review of General communication system:**

Spectral analysis: Fourier series, Exponential form of Fourier series, Examples of Fourier series, Sampling function, Response of a linear system, Normalized power in a Fourier expansion, Power spectral density, Effect of transfer function on power spectral density, Fourier transform, Example of Fourier transform, Convolution, Convolution, Power and energy transfer through a network, Correlation between waveforms, Power & cross correlation, Autocorrelation, Autocorrelation of a periodic waveform, Autocorrelation of non-periodic waveform of finite energy

Unit 2 **Amplitude Modulation:**

Frequency Translation, Frequency multiplexing, Practicality of antenna, Narrow banding, Method of frequency translation, Amplitude modulation-DSB: Demodulation, Multiplier modulator, Non linear modulator, Switching modulator, Demodulation of DSB-SC signal, Amplitude modulation, Sideband & carrier power, Generation of AM signal, Demodulation of AM signal, Amplitude modulation-SSB: Time domain representation of SSB signals, Generation of SSB signal, Demodulation of SSB-SC signals.

Unit 3 **Angle modulation:**

Concept of instantaneous frequency, generalized concept of angle modulation, Narrow-band Angle modulation, Wideband FM (WBFM), Generation of FM waves: Indirect method of Armstrong, Direct generation, Demodulation of FM signals, Phase locked loop, Analysis of phase locked loop. Stereophonic FM broadcasting, Comparisons: Frequency and phase modulation, Frequency and Amplitude modulation,

Unit 4 **Noise and Noise in AM systems:**

External & internal noise, Noise calculations, Noise figure, Noise temperature, Noise in Amplitude modulation system: Advantage of super-heterodyne principle: Single channel, SSB-SC, DSB-SC, Envelope demodulator.

Unit 5 **Noise in FM systems:**

Calculation of output signal & noise powers, Pre-emphasis & de-emphasis: Single Channel, Pre-emphasis & de-emphasis in commercial FM broadcasting.
Sampling theorem: low pass signals, Pulse amplitude modulation, Other forms of pulse modulation, Time division multiplexing, Bandwidth required for transmission of PAM signals, Comparison of FDM & TDM systems.

Unit 6 **Quantization of signals:**

Quantization error, Pulse code modulation, PCM system, Companding & Differential PCM Delta modulation & Adaptive Delta modulation. Digital carrier schemes : FSK, PSK & DPSK.

Recommended Books:

1. H. Taub and D. L. Schilling Principles of communication systems, McGraw-Hill. (1986).
2. G. K. Mithal, Radio Engineering : Applied Electronics Vol. II (1987)
3. B. P. Lathi, Modern Digital & Analog communication systems, Prism Books Pvt. Ltd. (2011)
4. G. Kennedy, Electronic communication systems, McGraw-Hill, (2011)
5. J. G. Proakis and M. Salehi,, Fundamentals of communication systems: Pearson Education (2014).
6. D. Roddy and J. Coolem, Electronic communications, PHI (1995).
7. K. Samshanmugum, Digital and Analog communication systems, Johan Wiley & Sons (1979).

Theory Tutorials (EL- 424)

1. Review of Fourier series and Fourier transform
2. Parseval's theorem
3. Introduction to modulation & demodulation
4. Normalized power
5. Comparison of FDM & TDM
6. Phase locked loop application
7. Natural & Flat-top sampling
8. Elements of a digital communication system source encoder / decoder, channel, modulator - demodulator & other functional blocks

M.Sc. - (Electronics) : Semester - II

EL-425: Practicals

1. To design, build & test Wein-bridge Oscillator using IC-741.
2. To design, build & test second order Band Pass Filter.
3. To design, build & test Analog to Digital Converter.
4. To design, build & test a ROM using diode matrix for BCD to seven segment Code conversion for 7-segment LED display.
5. To design, build & test Half-Adder & Half-Subtractor using multiplexer.
6. To design, build & test 4-bit Binary counter with Up and Down control input.
7. To design, build & test load independent voltage to current converter.
8. Study of Characteristics of Thermistor, Varactor Diode.
9. Study of Instrumentation Amplifier.
10. Study of LVDT and Strain gauge.
11. Study of Capacitive transducer and Thermistor.
12. To design, build & test a 4-bit Serial input parallel output right Shift resistor.
13. Study of the Tri-state PIPO resistors using D-flip flops.
14. Study of PCM Encoder & Decoder.

Recommended Books:

1. Ramakant A. Gayakwad, OP-AMPS & Linear Integrated Circuits : PHI (2002).
2. David A. Bell, Solid State Pulse Circuit, Reston Publishing Comp., Inc. Reston, Virginia. (1988).
3. Albert P. Malvino & Donald P.Leach, Digital Principles & Application : McGraw-Hill, International Editions (2006).

Laboratory Tutorial (EL – 425)

1. Study of PAM, PWM, & PPM Modulation & De-modulation.
2. Study of FSK & PSK.
3. Study of Thermocouple.
4. Study of Piezo-electric Transducer & LDR.
5. Study of displacement measurement using Inductive Pick up.

Syllabus

OF

Course Work

for

MASTER OF SCIENCE (M.Sc.)

ELECTRONICS

Choice Based Credit System (CBCS)

DEPARTMENT OF PHYSICS,
VEER NARMAD SOUTH GUJARAT UNIVERSITY,
UDHANA MAGDALLA ROAD,
SURAT -395007. (GUJARAT)

Proposed Structure for M.Sc. Syllabus

SEMESTER- III

M.Sc. (ELECTRONICS)

Sr. No.	Course Code	Course Title	L	T	Cr.
1	EL-531	Microwave	4	1	4
2	EL-532	Optoelectronics	4	1	4
3	EL-533	Solid State Devices	4	1	4
4	EL-534	Instrumentation	4	1	4
5	EL-535	Practicals	9	1	8
			25	05	24

Faculty Code: **Science** Subject Code: EL Level Code: **04**

Name of Program**: M.Sc.** Subject: **ELECTRONICS**

External Examination Time Duration: **03 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
M.Sc.	3	EL-531	Core	04	30	70	100
		EL-532	Core	04	30	70	100
		EL-533	Core	04	30	70	100
		EL-534	Core	04	30	70	100
		EL-535	Practical	08	60	140	200
			TOTAL	24	180	420	600

Faculty of Science **M.Sc. ELECTRONICS**

DEPARTMENT OF PHYSICS, VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT -395007

M.Sc. Syllabus 2017

M.Sc. (Electronics): SEMESTER-III

EL - 531: Microwave

Unit 1 Microwave frequencies, Tunnel diode, Backward diode, MIS tunnel diode, Avalanche Transit Time Devices: IMPATT diode, TRAPATT diode, BARITT diode

Unit 2 Transferred Electron Devices: Gunn- effect diode-GaAs diode, Ridley – Watkins – Hilsum(RWH) Theory, Modes of operation, Limited Space-charge Accumulation Diodes.

Unit 3 Microwave Transmission Lines: Transmission line equations and Solutions, Reflection and Transmission coefficient, Standing wave and Standing wave ratio, Line Impedance and Admittance, Smith chart, Impedance matching.

Unit 4 Circular waveguides, Microwave cavities, Microwave hybrid Circuits, Directional Couplers, Circulators & Isolators.

Unit 5 Klystrons: Reentrant cavities, Velocity-modulation process, Bunching process, Output power & beam loading, Reflex klystrons: Velocity modulation, Power output & efficiency, Electronic admittance, Strip lines: Micro strip lines, Parallel strip lines.

Unit 6 Helix Traveling wave tubes: Slow-Wave structures, Amplification process, Convection current, Axial electric field, Wave modes, Gain consideration, Magnetron oscillators: Cylindrical, Linear, Coaxial, Voltage- Tunable, Inverted coaxial & Frequency, Agile coaxial magnetrons.

Recommended Books

1. Samuel Y. Liao, Microwave Devices & circuits: Prentice Hall of India Private Limited (1996).
2. M. L. Sisodia & Vijay Laxmi Gupta, Microwaves: Introduction to Circuits, Devices and Antennas : New Age International (P) Limited (2009).
3. S. M. Sze, Physics of semiconductor Devices: John Wiley & Sons, New York (2006).

Theory Tutorials (EL-531)

1. Microwave measurements.
2. Frequency measurements.
3. Slotted line techniques for VSWR measurement.
4. Attenuation measurements.
5. Power measurements.
6. Reflecto-meter techniques.
7. Measurement of Cavity Q.

M.Sc. (Electronics) : Semester – III

EL- 532 : Optoelectronics

Unit 1 Introduction to fiber propagation using a ray model, Introduction, Step index fiber: numerical aperture & multipath dispersion, Propagation & multipath dispersion in graded index fiber, Material dispersion, Refractive index of the bulk media: theory & experimental values, The combined effect of Material dispersion and Multipath dispersion, Root- mean- square Pulse widths and Frequency response: RMS pulse widths, Frequency response, Total RMS pulse width.

Unit 2 Electromagnetic wave propagation in step index fibers, Modes and Rays, Wave propagation modes in an ideal step index fiber, Weakly guiding solutions, Time dispersion in step index fibers, Single mode fibers.

Unit 3 Electromagnetic wave propagation in graded index fibers, Modes in graded index fibers: introduction, Approximate solution, Number of propagating modes, Variation of the propagation constant, The equivalence of the WKB approximation and the ray model, Intermode dispersion in graded index fiber: Neglecting & including material dispersion, Intramode dispersion in graded index fibers, Total dispersion in graded index fibers, Mode coupling.

Unit 4 Measurements, Attenuation measurements: Cutback attenuation measurement method & OTDR, Fibers fault location, Dispersion measurements: Time & Frequency domain dispersion measurements, Refractive index profile measurements: End reflection technique, Transmitted & reflected near field techniques, Interferometric methods, Focusing method, Measurement of optical source characteristics: LED response time, Harmonic distortion, Intermodulation distortion, Eye Pattern.

Unit 5 Optical fiber fabrication and cabling: Fiber materials, Fiber fabrication, outside vapor phase oxidation, vapor phase axial deposition, Modified Chemical Vapor deposition, Double crucible method, Mechanical properties of fibers, Fiber optic cables.

Unit 6 Sour to fiber power launching, Source output pattern, Power coupling calculation, Power launching versus wavelength, Equilibriums numerical aperture, Lensing schemes for coupling improvement, Non imaging microsphere, Laser diode to fiber coupling, Fiber – to – fiber joints, Mechanical misalignment fiber related losses, Fiber end face preparation, Splicing techniques, Optical fiber connectors,

Recommended Books:

1. J. Gowar, Optical Communication Systems: PHI (1993).
2. G. Keiser, Optical Fiber Communications: McGraw- Hill (2008).
3. C. K. Kao , Optical Fiber systems Technology, Design & Applications: McGraw- Hill (1987).

Theory Tutorials (EL- 532)

1. The electromagnetic wave equation in an Isotropic medium Subject to cylindrical boundary conditions.
2. Electromagnetic waves in graded index fiber: The WKB Approximation
3. Ray trajectories in graded index fiber.
4. Source- fiber coupling.
5. Fiber couplers.

M. Sc.- (Electronics) : Semester - III

EL-533:- Solid State Devices

Unit-1 Introduction:

Carrier transport phenomena: Mobility, Resistivity and Hall Effect, Recombination process, Phonon spectra, optical thermal and high field properties of semiconductor, basic equation for semiconductor device operation.

Unit-2 P-N Junction Diode:

Depletion region and depletion capacitance, Abrupt and linearly graded junctions, Current-Voltage characteristics, Ideal case- Shockley equation, Generation and recombination, High injection condition, Diffusion capacitance, Junction breakdown, Thermal instability, Tunneling effect, Avalanche multiplication, Terminal function, Heterojunction .

Unit-3 Bipolar transistor:

Bipolar transistors, Static characteristic, Microwave transistors, Cutoff frequency, Microwave characterization, Device geometry and performance, Power transistors, switching transistor.

Unit-4 Thyristor:

Basic characteristic, Shockley diode and three terminal Thyristor: Static I-V Characteristic, Turn-On and Turn-Off time, Cathode short and dV/dt Effect, Maximum operation frequency. Related power thyristor: Reverse conducting Thyristors, Light activated Thyristor, DIAC and TRIAC, Uni- Junction Transistor and trigger Thyristor.

Unit-5 M-S Contact:

Energy band relation, Schottky effect, Characterization of barrier height, General expression of barrier height, Measurement of barrier height, Barrier height adjustment, Ohmic contact.

Unit-6 (Optical Devices):

Optical absorption: Photon absorption coefficient, Electron –Hall pair generation, Solar cell: PN Junction solar cell, Conversion efficiency and solar concentration, Heterojunction solar cell, Amorphous silicon solar cell, Photo-detectors, PIN photodiode, Phototransistor, Light emitting diode, Laser diode.

Reference Books:

1. D. A. Neamen, Semiconductor Physics and devices, Tata McGraw-Hill Publishing Company Limited. (2002).
2. S. M. Sze, Physics, of semiconductor devices, Wiley-Interscience, (1981).
3. B. G. Streetman, Solid State Electronic Devices, Prentice-Hall of India Private Linlited 3rd Ed. (1994).
4. R. M. Warner and B. Z. Grang, Transistors, John Wiley, (1983).

Theory Tutorials

EL-533: Solid State Devices

1. Importance and Effects of carrier transportation in semiconductors.
2. Applications of diodes.
3. Transient behavior of the Diode.
4. Applications of switching transistor.
5. Comparison between microwave transistor and switching transistors.
6. Applications of Laser's.
7. Circuit design for photo detection techniques.
8. Applications of LED.
9. Circuit design for power control using power devices.

M.Sc. (Electronics): Semester – III

EL- 534: Instrumentation

Unit 1 **Introduction:**

Functional elements of an instrument, Input - Output configuration of measuring instruments & instrument Systems, Methods of correction for interfacing & modifying inputs

Unit 2 **Filtering & Signal analysis:**

Passive & active filters, Types of filters, Frequency transformation, Realization of practical filters, Signal analyzers, Frequency analysis, methods of analysis, Application of Signal analysis.

Unit 3 **Optical Instruments**:

Spectroscopic Instrumentation, Visible & infrared Spectroscopy, Spectrometer design, Refraction & diffraction, Lenses & refractive optics, Dispersive elements, Spectrophotometers: Single beam null-type spectrophotometers, Double-beam ratio-recording Spectrophotometers, Atomic absorption spectrophotometers, Atomic absorption Instrumentation.

Unit 4 **Electrodes, Sensors & Transducers:**

Sensor error sources, Tactics & signal processing for improved sensing, Electrodes for biophysical sensing, Medical surface electrodes, Micro electrodes, Temperature transducers. Electro-Cardiography; Leads and electrodes of ECG, ECG Waveform, ECG recorder, Holter monitor, Vector Cardiography, Cardiac stress test, signals, ECG Preamplifier, ECG Machine, ECG Machine Maintenance.

Unit 5 **Medical Laboratory Instrumentation:**

Audio meter, Galvanic skin response, Biofeedback instrumentation, Test on blood, Blood gases, Auto analyzers, Electrophoresis, Colorimeter, Spectrophotometer, Flame photometer.

Unit 6 **Advance Biomedical Instruments:**

Instrumentation for measuring anatomical & Physiological parameters of the brain, cerebral angiography, Cranial X-rays, Brain Scans, Electroencephalography, EEG electrodes & the 10-20 System, EEG amplitude and frequency bands, EEG diagnostic uses & sleep patterns, EEG system, Preamplifiers & EEG system specifications.

Recommended Books:

1. E. O. Doebelin, Measurement Systems, Applications and Design: McGraw-Hill (2003).
2. C. S. Rangan, G. R. Sharma, V. S. V. Mani, Instrumentation, Devices & Systems: TMH (1997).
3. M. Sayer & A. Mansingh, Measurement, Instrumentation & Experiment design in Physics & Engineering: PHI (2004).
4. R. S. Khandpur, Handbook of Analytical Instruments: TMH (2006).
5. J. J. Carr & J. M. Brown, Introduction to Biomedical Equipment Technology: Pearson Education, Inc. (2000).
6. Mandeep Singh, Introduction to Biomedical Instrumentation, PHI, (2010).
7. A. K. Sawhney, A course in mechanical measurements & Instrumentation: Dhanpat Rai & sons (2001).

Theory Tutorials (EL- 534)

1. Review of Autocorrelation & Crass correlation functions.
2. Lock-in-Amplifier operation & related Problems.
3. Review of Laplace Transform.
4. Design of various types of filters.
5. Grating Spectrometer, Absorption Spectrometer & Double beam absorption Spectrometer.
6. ECG Faults & Troubleshooting.
7. Blood (Purpose & Components).
8. Blood tests (Cells & Chemistry).

EEG System artifacts, faults, troubleshooting & maintenance

M.Sc. - (Electronics) : Semester - III

EL-535: Practicals

1. To design, build and test (i) BCD to Excess-3 code converter (ii) Excess-3 to BCD cod converter.
2. To design, build and test digital comparator.
3. To design build and test parity generator.
4. To design build and test irregular counter using J-K flip flop.
5. To design build and test Window detector using analog comparator.
6. To design build and test heat detector using analog comparator.
7. To design build and test TTL interface using analog comparator.
8. To design, build and test analog multiplexer and de-multiplexer.
9. To design, build and test variable duty cycle using IC 555.
10. Study of Delta Modulator and Adaptive Delta Modulator.
11. Study of PCM Modulation and De Modulation.
12. Laser Experiments
13. Microwave Experiments.
14. Experiments of fiber optics.
15. Programming exercise in Assembly & C language for Microcontrollers.

Recommended Books:

1. A. P. Malvino, D. P. Leach, Digital principal and applications, Tata McGraw-Hill Company Ltd. (2006).
2. R. A. Gaikwad, Op. Amps and linear Integrated circuits PHI (2002).
3. S. G. Kochar, Programming in C, CBS Publication, (1991).
4. H. Taub & D. L. Schilling, Principle of Communication System, McGraw Hill International Edition (1986).

Laboratory Tutorial (EL – 535)

1. Study of tools for fiber optics.
2. Study of CAD software (PCB Designing Software)
3. Designing of power supplies.
4. Study of frequency shift keying.
5. Study of phase-locked loops.
6. Study of optical communication system.
7. Study of time division multiplexing.

Syllabus

OF

Course Work

for

MASTER OF SCIENCE (M.Sc.)

ELECTRONICS

Choice Based Credit System (CBCS)

DEPARTMENT OF PHYSICS,
VEER NARMAD SOUTH GUJARAT UNIVERSITY,
UDHANA MAGDALLA ROAD,
SURAT -395007. (GUJARAT)

Proposed Structure for M.Sc. Syllabus

SEMESTER- IV

M.Sc. (ELECTRONICS)

Sr. No.	Course Code	Course Title	L	T	Cr.
1	EL-541	Laser and its Applications	4	1	4
2	EL-542	Integrated Circuits Technology	4	1	4
3	EL-543	Analog & Digital Electronics	4	1	4
4	EL-544	Electronic Communication – II	4	1	4
5	EL-545	Practicals	9	1	8
			25	05	24

Faculty Code: **Science** Subject Code: EL Level Code: **04**

Name of Program**: M.Sc.** Subject: **ELECTRONICS**

External Examination Time Duration: **03 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
M.Sc.	**4**	**EL-541**	**Core**	**04**	**30**	**70**	**100**
		EL-542	**Core**	**04**	**30**	**70**	**100**
		EL-543	**Core**	**04**	**30**	**70**	**100**
		EL-544	**Core**	**04**	**30**	**70**	**100**
		EL-545	**Practical**	**08**	**60**	**140**	**200**
			TOTAL	**24**	**180**	**420**	**600**

Faculty of Science **M. Sc. ELECTRONICS**

DEPARTMENT OF PHYSICS, VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT -395007

M. Sc. Syllabus 2017

M. Sc. (Electronics): SEMESTER-IV

EL - 541: Laser and its Applications

Unit 1 LASER: Introduction, Einstein coefficients, Population inversion, Methods of population inversion, Threshold conditions, Laser rate equations: Two, three & four level systems, Variation of Laser power around threshold, Optimum output coupling.

Unit 2 Optical Resonators: Modes of a rectangular cavity and open planar resonator, Quality factor, Ultimate line width of the laser, Transverse & longitudinal mode selection, Q- switching, Techniques and for Q- switching, Mode locking in lasers, Techniques for mode locking.

Unit 3 Properties of laser beams and types of lasers: Coherence properties of laser light, Temporal Coherence, Spatial Coherence, Directionality, Ruby laser, Neodymium lasers (Nd: YAG & Nd: Glass) He- Ne laser, CO_2 laser, Argon ion laser, Dye laser, Semiconductor lasers.

Unit 4 Non-linear optics: Introduction, Second harmonic generation, Phase matching, Third harmonic generation, Optical mixing, Parametric generation light, self focusing of light, Multiphoton process: Multiquantum Photoelectric effect, Two photon processes, Theory of two photon processes, Experiments in two photon processes, Three photon processes, SHG & parametric generation of light in three photon process, Parametric light oscillator, Frequency up conversion, Phase conjugate optics.

Unit 5 Laser Spectroscopy: Rayleigh and Raman scattering, Stimulated Raman effect, Hyper- Raman effect Classical and Quantum mechanical treatment, Coherent anti stokes Raman Scattering, Spin Flip Raman laser, Free- electron laser, photo-acoustic Raman spectroscopy, Brillouin Scattering, Saturation Absorption spectroscopy, Doppler free two Photon spectroscopy.

Unit 6 Applications of LASER: Modulation Methods, Communications, Applications Using Focused Laser Radiation, Medical applications, Coherent Light Image And Data Processing, Holography, Photorefractive Holographic Recording, Laser For Fusion, Laser Cooling, Integrated Optics, Quantum Interference and Lasing Without Inversion.

Recommended Books:

1. Optical Electronics: A. K. Ghatak and K. Thyagarajan, Cambridge university press, (1990)
2. Lasers and Non – linear optics : B. B. Laud, Wiley Eastern Limited, (1992)
3. Introduction to Fiber Optics : Ajay Ghatak & K. Thyagarajan, Cambridge university press, (1999)
4. Principles of Lasers : Orazio svelto & David C. Hanna, Plenum Press- New York and London (1982)
5. Lasers and non linear optics: G. D. Baruha, Pragati Prakadhan, (2009)

Theory Tutorials (EL- 541)

PH- 542: Laser and its Applications

1. Applications of laser in pure and applied sciences.
2. Chemical lasers
3. Non- liners effects in Fibers
4. Kerr effect
5. Fourier transforms and Optical applications of laser
6. Coherence and stellar interferometry.
7. Components of a lightwave communication system:Optical fiber
8. Modulators and Dectectors of a lightwave communication system.

M.Sc. (Electronics) : Semester – IV

EL- 542 : Integrated Circuits Technology

Unit 1 **Refining and Growth of Silicon system**

Classification of ICs, Production of Electronics grade silicon, Czochralski and Float Zone Crystal Growing Methods, Oxygen and Carbon in Silicon, Segregation coefficients, Silicon shaping and wafer preparation, Vapor Phase Epitaxy (VPE), Molecular Beam Epitaxy (MBE).

Unit 2 **Oxidation**

Utility of Thermal Oxidation , Dry and Wet, High Pressure and Plasma Oxidation, Growth and properties of oxide layer on silicon, Oxide Charges, Effect of impurities on the oxidation rate, Growth and Properties of Thin Oxides, Oxide masking and Oxide Passivation.

Unit 3 **Photo Lithography**

Photo Lithography, Optical Lithography, Photo-mask, Photoresist and Process, Electron Lithography, X-ray Lithography, Ion Beam Lithography

Unit 4 **Reactive Plasma Etching and Metallization**

Etching – Wet Chemical Etching, Reactive Plasma Etching, Impurity Doping-Diffusion, Ion Implantation, Metallization-Desired Properties, Applications, Ohmic-contacts, Choices and Problems.

Unit 5 **VLSI Process Integration**

Integrated Elements: Isolation of Circuit elements, Bipolar Technology: NPN Transistors, PNP Transistors, Integrated Diodes; Semiconductor Resistors, Capacitors and Inductors, MOS Technology: NMOS and CMOS IC Technology.

Unit 6 **Assembly Techniques**

Design of typical ICs, Back side of preparation, Wafer sort, Device Separation, Die Bonding, Wire Bonding, Package Types and Considerations, Testing of ICs.

Recommended Books:

1. S.M. Sze, VLSI Technology, McGraw Hill International Edition. (1988)
2. Integrated Electronics by K. R. Botkar. (2004)
3. Electronic Devices & Components by J. Seymour (1981)
4. W.R. Wesiey & K.E. Bean, Semiconductor Integrated Circuit Processing Technology, Addison Wesley Publishing Co.
5. Petter Gise & Rechard Blanchard, Modern Semiconductor Fabrication Technology, Reston Book – Prentice Hall. (1986)
6. James W. Mayer and S.S. Lav, Electronic Materials Science: For Integrated Circuit in Si and GaAs, MacMillan Publishing Co. New Delhi. (1989).
7. David J. Elliott, Microlithography: Process Technology for IC Fabrication Mc Graw Hill Book Co. (1986)
8. R.L. Geiger, P.E. Allen and N.R. Stradev. VLSI Design Techniques for Analog and Digital circuits. (1990).

Theory Tutorials (EL- 542)

1. Features of Hybrid IC Technology.
2. Thick Film Technology.
3. Thick Film Design Guidelines.
4. Advantages and Application of Thick Film Hybrids.
5. Thin Film Technology.
6. Thin Film processing.
7. Thin Film Design Guidelines.
8. Advantages and Application of Thin Film Hybrids.
9. Elements of Crystallography.
   - (i) Periodic structure of crystal.
   - (ii) Miller indices.

M.Sc.- (Electronics) : Semester - III

EL-543:- Analog & Digital Electronics

Unit-1 Classification of Semiconductor Devices, The enhancement MOSFET, The enhancement MOSFET Volt-Ampere characteristics, Early effect, MOSFET Circuit Symbols, The MOSFET as a Resistance, MOSFET as an Analog Switch, NMOS amplifier, Small Signal analysis of MOSFET.

Unit-2 Complementary MOS devices, BIFET, BIMOS and BICMOS Circuits, Three Stage operational Amplifiers, other types of operational Amplifiers, MOS operational Amplifiers. Current Source, The Widlar Current Source, Three Transistors Current Sources.

Unit-3 The NMOS Inverter, Propagation Delay of on NMOS Inverter, NMOS Logic Gates, The CMOS Inverter, CMOS Logic Gates, Emitter-coupled Logic (ECL) Circuit, Architecture of Complete ECL Circuit, Advantages and Limitations of ECL Circuit, Comparison of Logic families.

Unit-4 Classification of Solid State Memory devices, Limitations of Read Only Memory (ROM), Programmable ROMS(PROMS), Erasable PROMS, FAMOS, Programmable Array Logic (PAL), Programmable Logic Arrays (PLA).

Unit-5 Very Large Scale Integrated Systems (VLSI), Dynamic MOS Shift registers, Ratioless shift Register stages. CMOS Domino Logic, Charge Coupled Devices (CCD), CCD structures, Integrated Injection Logic (I^2L), Microprocessor and Microcomputers.

Unit-6 High Frequency Response of Common-Emitter stage, The Common-Source Stage at High Frequency, The time-constant Method of obtaining the Response, General Analysis of Multistage Feedback Amplifiers, Multiloop Feedback Amplifiers, Effect of Feedback on Bandwidth, Stability, Test of Stability.

Reference Books:

1. Microelectronics, J.Millman and A.Grable, McGraw Hill, (1987).
2. Microelectronics Circuits, A.S.Sedra & K.C.Smith, Holt-Saunders, Japan, (1991).
3. Microelectronics- An Integrated Approach, Roger T. Howe, Charls G. Sodini. Pearson Education, Prentce Hall, First Edition, (2006).
4. Microelectronics Devices, Dipnakar Nagchoudhuri Pearson Education, Prentce Hall, Second Edition,(2002).
5. Electronics Devices and Circuit Theory, Robert Boylestad and Louis Nashelesky PHI - Prentice Hall of India Pvt. Ltd., Fifth Edition, (1994).

Theory Tutorials EL-543

-BJT's and FET's.

-VLSI Circuits design concepts.

-Low Frequency & High Frequency response Models.

-Bode Diagrams.

- Operational Transfer Functions & Frequency Transfer Functions.

-IC based Electronics Instruments.

M.Sc. (Electronics): Semester – IV

EL- 544: Electronic Communication – II

Unit 1 Digital Transmission : Advantages and disadvantages of digital transmission, Pulse code modulation (PCM), PCM sampling, Dynamic range, Coding efficiency, Signal – to – quantization noise ratio, Analog & Digital companding, Delta modulation PCM, Adaptive delta modulation PCM, Differential PCM, Pulse transmission, Intersymbol Interference.

Unit 2 Digital communications: Digital radio, Frequency shift keying, Phase shift keying (PSK), Quadrature amplitude modulation, Bandwidth efficiency, Probability of error and Bit error rate.

Unit 3 Satellite communications: Geostationary satellites, Antenna look angles, Satellite antenna radiation patterns: Footprints, Satellite system Parameters, Satellite System link equations, Link equations and Link budget.

Unit 4 Microwave radio communications and system gain: Advantages of Microwave radio communications, Frequency modulated microwave radio system, FM Microwave radio repeaters, Diversity, Protection switching arrangements, FM microwave radio stations, Path characteristics, System gain.

Unit 5 Telephone Switching: Elemental Phone System, central switching, A simple Exchange, Strowger Automatic Dialing System, Traffic load and service grade, Hierarchy of switching offices, Crossbar Switch, Common Control, Switching Matrices, Multiple stage switching, Two and Four wire connections, Time slot interchanging, Space array for digital signals, Combined space and time switching.

Unit 6 Spread Spectrum Modulation: Direct sequence spread spectrum, Use of spread spectrum with CDMA, Ranging using DS spread spectrum, Frequency Hopping spread spectrum, Generation and Characteristics, of PN sequences, Acquisition & tracking of an FH signal, Acquisition and tracking of a DS signal.

Recommended Books:

1. Wayne Tomasi, Advanced Electronic Communications systems : PHI. (2003)
2. H. Taub & D. L. Schilling, Principles of communication systems: McGraw-Hill. (1985)
3. B. P. Lathi, Modern Digital and Analog communication systems: Holt, Rinehart & Winston, Inc. (2010).

Theory Tutorials (EL- 544)

1. Sampling rate.
2. Digital Amplitude modulation.
3. Kepler's laws.
4. Satellite orbits.
5. Time division multiplexing.
6. Analog time division switching.
7. Comparison of TSI with space switching.
   Satellite multiple accessing: FDMA, TDMA, CDMA.

M.Sc. - (Electronics) : Semester - IV

EL- 545: Practicals

Project Work of Relevant Subject…..