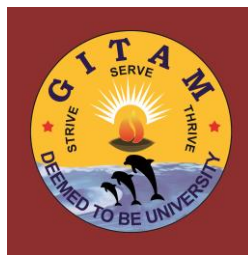


**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT  
(GITAM)**

(Deemed to be University, Estd. u/s 3 of UGC Act 1956)

**VISAKHAPATNAM \* HYDERABAD \* BENGALURU**

**Accredited by NAAC with 'A+' Grade**



**REGULATIONS and SYLLABUS**

of

**MASTER OF SCIENCE  
in  
ELECTRONIC SCIENCE**

(w.e.f 2019-2020 Admitted Batch)

Website: [www.gitam.edu](http://www.gitam.edu)

**Master of Science in Electronic Science  
REGULATIONS  
(W.e.f. 2019-20 admitted batch)**

**1. ADMISSION**

1.1 Admission into M.Sc. **Electronic Science** program of GITAM University is governed by GITAM University admission regulations.

**2. ELIGIBILITY CRITERIA**

2.1. A pass in B.Sc. degree with a minimum aggregate of 50% marks / a pass in any degree with minimum aggregate of 50% marks along with Mathematics, Physics and Chemistry/Electronics/Computer science or any related subject of equivalence as one of the subject.

2.2. Admission into M.Sc. **Electronic Science** (Master of Science in **Electronic Science**) will be based on an All India GITAM Science Admission Test (GSAT) conducted by GITAM University and the rule of reservation, wherever applicable.

**3. CHOICE BASED CREDIT SYSTEM**

Choice Based Credit System (CBCS) is introduced with effect from the admitted Batch of 2015-16 based on UGC guidelines in order to promote:

- Student Centered Learning
- Cafeteria approach
- Inter-disciplinary learning

Learning goals/ objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

**4. STRUCTURE OF THE PROGRAM**

4.1 The Program Consists of

- i) Foundation Courses (compulsory) which give general exposure to a Student in communication and subject related area.
- ii) Core Courses (compulsory).
- iii) Discipline centric electives which
  - a) are supportive to the discipline
  - b) give expanded scope of the subject
  - c) give their disciplinary exposure
  - d) nurture the student skills
- iv) Open electives are of general nature either related or unrelated to the discipline.
- v) Practical Proficiency Courses, Laboratory and Project work.

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each Lecture / Tutorial hour per week.
- One credit for two hours of Practical per week.
- Eight credits for project.

4.4 The curriculum of the Four semesters M.Sc. **Electronic Science** program is designed to have a total of 93 credits for the award of M.Sc. **Electronic Science** degree.

## **5. MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be in English.

## **6. REGISTRATION**

Every student has to register himself / herself for each semester individually at the time specified by the Institute / University.

## **7. ATTENDANCE REQUIREMENTS**

- 7.1. A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend that end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors
- 7.2. However, the Vice Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine grounds and on payment of prescribed fee.

## **8. EVALUATION**

- 8.1. The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).
- 8.2. A student has to secure an aggregate of 40% in the course in continuous and semester end examinations the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.
- 8.3. Practical / Viva voce etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

**Table 1: Assessment Procedure**

<b>S. No.</b>	<b>Component of assessment</b>	<b>Marks allotted</b>	<b>Type of Assessment</b>	<b>Scheme of Examination</b>
1	Theory	40	Continuous evaluation	(i) Three mid semester examinations shall be conducted for 15 marks each. The performance in best two shall be taken into consideration. (ii) 5 marks are allocated for quiz. (iii) 5 marks are allocated for assignments.
		60	Semester-end examination	The semester-end examination shall be for a maximum of 60 marks.
	Total	100		
2	Practical's	100	Continuous evaluation	60 marks for performance, regularity, record/ and case study. Weightage for each component shall be announced at the beginning of the semester. 40 marks (30 marks for experiment(s) and 10 marks for practical Viva-voce.) for the test conducted at the end of the Semester conducted by the concerned lab Teacher.
	Total	100		
3	Project work	200	Project evaluation	150 marks for evaluation of the project work dissertation submitted by the candidate.  50 marks are allocated for the project Viva-Voce.  The project work evaluation and the Viva-Voce shall be conducted by one external examiner outside the University and the internal examiner appointed by the Head of the Department.

**9. SUPPLEMENTARY EXAMINATIONS & SPECIAL EXAMINATIONS:**

9.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations in April/May.

- 9.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during November/December
- 9.3 A student who has completed his/her period of study and still has “F” grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

## **10. PROMOTION TO THE NEXT YEAR OF STUDY**

- 10.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 60% of the credits till the previous academic year.
- 10.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the BoS to continue his/her further studies

## **11. BETTERMENT OF GRADES**

- 11.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in ‘n’ (where ‘n’ is no.of semesters of the program) theory courses of any semester of his/her choice, conducted in summer vacation along with the Special Examinations.
- 11.2 Betterment of Grades is permitted ‘only once’, immediately after completion of the program of study.

## **12. REPEAT CONTINUOUS EVALUATION:**

- 12.1 A student who has secured ‘F’ grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured ‘F’ grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.
- 12.2 A student who has secured ‘F’ grade in a practical course shall have to attend Special Instruction classes held during summer.
- 12.3 A student who has secured ‘F’ grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A student who has secured ‘F’ grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.
- 12.4 The RCE will be conducted during summer vacation for both odd and even semester students. Student can register a maximum of 4 courses. Biometric attendance of these RCE classes has to be maintained. The maximum marks in RCE be limited to 50% of Continuous Evaluation marks. The RCE marks are considered for the examination held after RCE except for final semester students.
- 12.5 RCE for the students who completed course work can be conducted during the academic semester. The student can register a maximum of 4 courses at a time in slot of 4 weeks. Additional 4 courses can be registered in the next slot.
- 12.6 A student is allowed to Special Instruction Classes (RCE) ‘only once’ per course.

### 13. GRADING SYSTEM

13.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

**Table 2: Grades & Grade Points**

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab. (Absent)	0	-

13.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing an average GPA (average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program.

Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same.

### 14. GRADE POINT AVERAGE

14.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$\text{GPA} = \frac{\sum [C * G]}{\sum C}$$

Where

C = number of credits for the course,

G = grade points obtained by the student in the course.

14.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken, in all the semesters up to the particular point of time.

14.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

**Table 3: CGPA required for award of Class**

<b>Class</b>	<b>CGPA Required</b>
First Class with Distinction	$\geq 8.0^*$
First Class	$\geq 6.5$
Second Class	$\geq 5.5$
Pass Class	$\geq 5.0$

\* In addition to the required CGPA of 8.0 or more the student must have necessarily passed all the courses of every semester in first attempt.

**15. ELIGIBILITY FOR AWARD OF THE M.Sc. Electronic Science Degree**

15.1 Duration of the program: A student is ordinarily expected to complete M.Sc **Electronic Science** program in four semesters of two years. However a student may complete the program in not more than four years including study period.

15.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

15.3 A student shall be eligible for award of the M.Sc **Electronic Science** Degree if he / she fulfills all the following conditions.

- a) Registered and successfully completed all the courses and projects.
- b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.
- c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and
- d) No disciplinary action is pending against him / her.

15.4 The degree shall be awarded after approval by the Academic Council.

**16. DISCRETIONARY POWER:**

Not with standing anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding

**Department of Electronics and Physics**  
**GITAM Institute of Science**  
**GITAM (Deemed to be University)**  
**(Estd u/s 3 of UGC Act 1956)**

**M.Sc. Electronic Science**  
**Scheme of Instruction and Syllabus**

**I SEMESTER**

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction			Scheme of Examination		
					Hours per Week		Total	Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEL 701	Linear and Digital Electronics	PC	4	4	0	4	3	60	40
2	SEL 703	Electronic Communication	PC	4	4	0	4	3	60	40
3	SEL 705	Control Systems	PC	4	4	0	4	3	60	40
4	SEL 707	Programming Language C and Data Structures	PC	4	4	0	4	3	60	40
5	SSE 701/ SSE 703	Skill Enhancement Course*	SEC	2	0	3	3	3	--	100
6	SEL 721	Analog and Digital Electronics Lab	PP	3	0	6	6	3	--	100
7	SEL 723	Programming C Language and Data Structures Lab	PP	3	0	6	6	3	--	100
Total			---	24	16	15	31	--	240	460

**\* Skill Enhancement Course (Choose one of the following)**

1. SSE 701: Basic Computer Concepts
2. SSE 703: Information Technology Tools



## II SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction			Scheme of Examination			
					Hours per Week		Total	Duration in Hrs.	Maximum Marks		
					L/T	P			Sem. End Exam	Con. Eval	
1	SEL 702	Microwave and Mobile Communication	PC	4	4	0	4	3	60	40	
2	SEL 704	Microprocessors & Microcontrollers	PC	4	4	0	4	3	60	40	
3	SEL 706	Electronic Measurements and Instrumentation	PC	4	4	0	4	3	60	40	
<b>Program Elective – 1 (One To Be Chosen)</b>											
4	SEL 742	Radar Systems and Satellite Communication	PE	4	4	0	4	3	60	40	
	SEL 744	Antenna Theory and Radio Wave Propagation	PE	4	4	0	4	3	60	40	
	SEL 746	Opto Electronic Devices	PE	4	4	0	4	3	60	40	
	SEL 748	Information Theory	PE	4	4	0	4	3	60	40	
5	SAE 702	Professional Communication Skills	AEC	2	0	3	3	3	--	100	
6	SEL 722	Communication Lab	PP	3	0	6	6	3	--	100	
7	SEL 724	Microprocessor and Microcontroller Lab	PP	3	0	6	6	3	--	100	
Total				---	24	16	15	31	--	240	460

### III SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction			Scheme of Examination		
					Hours per Week		Total	Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEL 801	Embedded Systems	PC	4	4	0	4	3	60	40
2	SEL 803	Networking	PC	4	4	0	4	3	60	40
3	SEL 805	Digital Signal Processing	PC	4	4	0	4	3	60	40
<b>Generic Elective – 1 (One To Be Chosen)</b>										
4	SEL 841	Switching Theory and Logic Design	GE	4	4	0	4	3	60	40
	SEL 843	Industrial Electronics	GE	4	4	0	4	3	60	40
	SEL 845	Digital Image Processing	GE	4	4	0	4	3	60	40
	SEL 847	Neural Networks	GE	4	4	0	4	3	60	40
	SEL 849	Robotics	GE	4	4	0	4	3	60	40
<b>Open Elective (One To Be Chosen)</b>										
5	SOE 861	Fundamentals of Electronics	OE	2	3	0	3	3	60	40
	SOE 863	Bio-medical Instrumentation	OE	2	3	0	3	3	60	40
6	SEL 821	Embedded Systems Lab	PP	3	0	6	6	3	--	100
7	SEL 823	Networking Lab	PP	3	0	6	6	3	--	100
8	SEL 825	Comprehensive Viva	PP	2	0	0	0	0	--	50
Total			---	26	19	16	35	--	300	450

#### IV SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction			Scheme of Examination		
					Hours per Week		Total	Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEL 802	VLSI & VHDL	PC	4	4	0	4	3	60	40
<b>Generic Elective -2 (One to be Chosen)</b>										
2	SEL 842	Advanced Embedded Systems	GE	4	4	0	4	3	60	40
	SEL 844	Advanced Networking	GE	4	4	0	4	3	60	40
	SEL 846	Sensors	GE	4	4	0	4	3	60	40
	SEL 848	Non Destructive Testing of Materials	GE	4	4	0	4	3	60	40
3	SEL 822	DSP and VHDL Lab	PP	3	0	6	6	3	--	100
4	SEL 892	Project work	PP	8	0	0	0	3	--	200
Total			--	19	8	8	16	--	120	380

**M.Sc. ELECTRONIC SCIENCE**  
**I-SEMESTER**  
**SEL 701 LINEAR and DIGITAL ELECTRONICS**

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** To understand the functionality of basic electronic devices and their applications.

### **UNIT-I**

#### **BJT and FET Devices**

**Bipolar Junction Transistor:** Configurations, Characteristics, Biasing, Frequency response and Applications of BJT. **Field Effect Transistor:** Construction, Characteristics and Applications of FET. **MOSFET:** Introduction, Depletion and Enhancement types. **Feedback concepts:** Introduction, Practical feedback circuits, Oscillator operation, Types of oscillators.

### **UNIT-II**

#### **Operational Amplifiers**

Op-amp basics, parameters, Differential and Common mode operation, virtual ground, **Practical op-amp circuits**, Integrator, Differentiator and Summing amplifier, **Op-amp Applications**- Constant gain multiplier, Voltage to Current and Current to Voltage Converter, Instrumentation Amplifier, Active Filter Design, Oscillator, Logarithmic and Anti Logarithmic Amplifiers, Schmitt trigger.

### **UNIT-III**

#### **Power Supplies**

**Rectifiers**- Half wave, Full wave and Bridge rectifiers, Filter considerations, Zener diode voltage regulator, Transistor voltage regulation (series and shunt), IC voltage regulators-78XX and 79XX, Variable Power supply Design, **Linear ICs:** IC 555 (Timer) and its **applications** - Astable, Monostable and PLL (IC 565).

### **UNIT-IV**

#### **Combinatorial Logic Circuits**

**Simplification of Boolean expressions:** Algebraic method, Karnaugh map method, EX-OR, EX-NOR gates, Encoder and Decoder, Multiplexer and De-multiplexer, **Digital Arithmetic Operations and Circuits:** Binary addition, Subtraction, Multiplication and Division, Design of Adders, Subtractors and Parallel binary adder, **Applications of Boolean Algebra:** Magnitude comparator, Parity generator and checker, Code converters, Seven segment decoder /driver display, ALU design.

### **UNIT-V**

#### **Sequential Logic Circuits**

**Flip-Flops:** NAND latch, NOR latch, R-S, J-K, T-flip-flops, D-Latch, **Counters:** Asynchronous (ripple) counter, Counters with MOD number  $< 2^n$ , Down counter, Synchronous counters, Up-down counter, Ring counter, Johnson counter, **Registers:** Shift registers, PIPO, SISO, SIPO, PISO, State diagrams.

#### **Text Books**

1. Electronic Devices and Circuit Theory - R. Boylestad and L. Nashelsky- 11<sup>th</sup> Edition – Pearson, 2008
2. Digital Systems principals and applications - Ronald J Tocci, 10<sup>th</sup> Edition –Pearson, 2003
3. Digital Design - Morris Mano, 4<sup>th</sup> Edition- Pearson, 2006
4. Op-Amp Applications - Ramakanth Gaykward, 4<sup>th</sup> Edition, PHI, 2000
5. Linear IC Applications - D. Roy Chowdhary, New Age International, 2<sup>nd</sup> Edition, 2004

**M.Sc. ELECTRONIC SCIENCE**  
**I-SEMESTER**  
**SEL 703 ELECTRONIC COMMUNICATION**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand the basic communication methods and their applications.

**UNIT-I**

**Amplitude Modulation**

*Sinusoidal A.M:* Introduction, Modulation Index, Frequency Spectrum, Average Power. BJT Collector modulator, A.M Broadcast Transmitter and Super heterodyne receiver, Output S/N ratio, DSBSC modulation, balanced modulators- single and diode ring, QAM, VSB, **SSB modulation:** SSB generation and reception. ISB, FDM, Output S/N ratio in SSB.

**UNIT-II**

**Angle Modulation**

*Sinusoidal F.M:* Introduction, Modulation Index, Frequency spectrum, Average Power, Deviation ratio, Phase Modulation, Equivalence between PM and FM, **Modulator Circuits-** Varactor diode, JFET. **FM Transmission-** Direct and Indirect methods, **FM Detection-** Slope detector, balanced double tuned detector, Foster-Seeley discriminator and PLL detector, Amplitude limiter, Pre-emphasis and De-emphasis, FM broadcast receiver, Differences between wideband and narrowband FM, Noise in FM.

**UNIT-III**

**Pulse Communication**

*Digital line wave forms:* Symbols, Bits and Bauds, Functional notation for pulses, Line codes and waveforms, Unipolar NRZ, RZ, Polar line codes, M- array encoding, ISI and Pulse shaping, HDBn Signaling, **Pulse Modulations-** Generation and Detection of PAM, TDM, PWM, and PPM.

**UNIT-IV**

**Sampling and Pulse Code Modulation**

Sampling Theorem, Signal Reconstruction, Pulse Code Modulation (PCM) Quantization, Non-uniform Quantization, T1 carrier system, Differential PCM, Delta modulation, Adaptive Delta modulation, Comparison with PCM, **Digital carrier systems:** ASK, FSK, PSK, DPSK, QPSK, Digital multiplexing, Eye patterns.

**UNIT-V**

**Fiber Optic Communication**

Introduction, Historical back ground, Advantages and Applications of optical fiber communication, Nature of light, Basic optical laws and definitions, fiber modes and configurations, scattering, bending, core and cladding losses, Optical Sources and Detectors, **Optical receivers-**Receiver operation, Analog and Digital receivers, Wavelength Division Multiplexing, Fiber connectors, Measurement of attenuation and dispersion.

**Text Books**

1. Electronic Communications-Dennis Roddy and John Collins - Prentice Hall, 4<sup>th</sup> Edition,1995
2. Modern Digital and Analog Communication System - B.P.Lathi-Oxford University Press-3<sup>rd</sup> Edition,2009
3. Optical Fiber Communication - Gerd Keiser- Tata Mcgraw Hill-4<sup>th</sup> Edition, 2010
4. Principles of Communication System - H.Taub and D.Schilling, Tata Mcgraw Hill, 2<sup>nd</sup> Edition,2008
5. Fiber Optics Communication Systems - Agrawal GP, Publisher: JW, 4<sup>th</sup> Edition , 2010

**M.Sc. ELECTRONIC SCIENCE**  
**I-SEMESTER**  
**SEL 705 CONTROL SYSTEMS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** It is aimed to introduce principles and applications of control systems in everyday life and industrial automation.

**UNIT-I**

**Fundamental of Control Systems**

Control system components, Open Loop and Closed Loop control systems and their differences-Examples of control systems and applications - Feedback control systems, Representation of Control Systems-Block diagrams and transfer function of single and multivariable systems. Signal flow graphs-Basic elements, properties, SFG of feedback control system, gain formula and Applications.

**UNIT-II**

**Mathematical Modeling of Systems**

Transfer function and Impulse Response functions. Modeling of state space- Correlation between transfer function and state space, Representation of scalar differential equation Modeling of Mechanical Translational, Rotational and Electrical systems, LRC circuit cascaded elements, field and armature controlled DC motor

**UNIT-III**

**Time Response Analysis**

Time response of continuous data systems, typical test signals, Characteristic Equation of Feedback control systems– first and second order systems, Transient response of second order system. Time domain specifications for unit step response. Steady state error-linear continuous data control system. Generalized error coefficient and its evaluation, Correlation between static and dynamic error coefficients

**UNIT-IV**

**Stability Analysis of Systems**

The concept of stability, Routh's stability criterion, limitations of Routh's stability and applications to control systems, Root Locus Method-Introduction, Basic properties of root loci ,Nyquist stability criterion- fundamentals, Number of encirclements and enclosures, principle of argument, Nyquist path.

**UNIT-V**

**Analysis and Design of Control Systems**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin. Compensation techniques, Lag, Lead, Lead-Lag Controllers design.

**Text Books**

1. Modern Control Engineering - Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> Edition, 2009
2. Automatic Control Systems - Benjamin C.Kuo Wiley Publisher, 9<sup>th</sup> Edition, 2009.
3. Control Systems Engineering - NISE 7<sup>th</sup> Edition, John Willey, 2005
4. Control Systems Engineering - I.J.Nagrath and M. Gopal, New Age Intl., 2008
5. Control Systems - N.K.Sinha, New Age International (P) Limited Publishers, 3<sup>rd</sup> Edition, 1998

**M.Sc. ELECTRONIC SCIENCE  
I-SEMESTER**

**SEL 707 Programming Language C and Data Structures**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To introduce basic structure of C programming language for solving of numerical methods.

**UNIT-I**

**Introduction to C Language**

Structure of the C program, Data types, Input and output functions: printf, scanf; **C – Operators:** Arithmetic operator, Relational operator, Logical operator, Ternary operator, Increment operator, Comma operator, Bitwise operator, Operator precedence, example programs

**UNIT-II**

**Control Structures**

Control structures, *if* statement, Scope of an *if* clause, *if...else* statement, *if...else...if* statement, *switch* statement, *while* loop, *do...while* loop, *for* loop, *for* loop with a comma operator, *break* statement, *continue* statement, Arrays and Strings : Accessing Array Elements – Initializing Of Array – Multidimensional Arrays – Strings – Arrays of Strings – String functions – Storage classes

**UNIT-III**

**Functions and Pointers**

Functions, concept of (system) stack, function call, Parameter passing, Call by reference, Calling function, Recursion, Pointers: - Address Operator – Pointer Variables –Dereferencing Pointers – Pointers To Pointers – Pointers and Arrays – Array Of Pointers

**UNIT-IV**

**Searching and Sorting Techniques**

Arrays, array applications, Manipulations on the list using an array, Bubble sort, Binary search, merging of two sorted lists, Merge sort, Quick sort. *Stacks, Queues:* stack and queues, its applications Circular queues

**UNIT-V**

**Trees and Graphs**

Concept of trees, Binary trees, Binary tree traversal, Binary search tree, Counting the number of nodes in a binary search tree, Searching for a target key in a binary search tree, deletion of a node from a binary search tree.

**Text Books**

1. C & Data Structures - P.S. Deshpande and O.G. Kakde, Dreamtech Press, 2005.
2. C Programming and Data Structures, 3rd Edition-E. Balagurusamy, Tata McGraw Hill, 2007.
3. Mastering C - K R Venugopal, S R Prasad- Tata McGraw Hill- 1<sup>st</sup> Edition
4. Data Structures – A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg and Behrouz A. Forouzan, Thomson Course Technology, 2005.

**M.Sc. ELECTRONIC SCIENCE I – SEMESTER  
SKILL ENHANCEMENT COURSE  
SSE 701: BASIC COMPUTER CONCEPTS**

Hours per week: 3  
Credits: 2

Continuous Evaluation: 100 Marks

**Preamble:** The course gives an understanding about the characteristics and classification of computers, various components of computer along with different operating systems that are available. It gives a hands on training on the packages MS-Word, MS-Power Point and MS-Excel. The course also comprehends AI tools.

**Objectives:**

- To introduce components of digital computer and their working along with the outline of Operating Systems.
- To give hands on training on MS-Word, Power Point and Excel features.

**Basics of Computers:** Definition of a Computer - Characteristics and Applications of Computers – Block Diagram of a Digital Computer – Classification of Computers based on size and working – Central Processing Unit – I/O Devices, Primary, Auxiliary and Cache Memory – Memory Devices. Software, Hardware, Firmware and People ware – Definition and Types of Operating System – Functions of an Operating System – MS-DOS –MS Windows, UNIX.

**MS-Word**

Features of MS-Word – MS-Word Window Components – Creating, Editing, ormatting and Printing of Documents – Headers and Footers – Insert/Draw Tables, Table Auto format – Page Borders and Shading – Inserting Symbols, Shapes, Word Art, Page Numbers, Equations – Spelling and Grammar – Thesaurus – Mail Merge.

**MS-PowerPoint**

Features of PowerPoint – Creating a Blank Presentation - Creating a Presentation using a Template - Inserting and Deleting Slides in a Presentation – Adding Clip Art/Pictures -Inserting Other Objects, Audio, Video- Resizing and Scaling of an Object –Slide Transition – Custom Animation.

**MS-Excel**

Overview of Excel features – Creating a new worksheet, Selecting cells, Entering and editing Text, Numbers, Formulae, Referencing cells – Inserting Rows/Columns –Changing column widths and row heights, auto format, changing font sizes, colors, shading.

**Reference Books:**

1. Fundamentals of Computers ,V.RajaRaman, PHI Learning Pvt. Ltd, 2010.
2. Microsoft Office 2010 Bible,John Walkenbach, Herb Tyson, Michael R. Groh andFaithe Wempen, Wiley Publications, 2010.



### **Course Outcomes:**

- Able to understand fundamental hardware components that make up a computer's hardware and the role of each of these components
- Understand the difference between an operating system and an application program, and what each is used for in a computer.
- Acquire knowledge about AI tools.
- Create a document in Microsoft Word with formatting that complies with the APA guidelines.
- Write functions in Microsoft Excel to perform basic calculations and to convert number to text and text to number.
- Create a presentation in Microsoft PowerPoint that is interactive and legible content

## **M.Sc. ELECTRONIC SCIENCE I – SEMESTER SKILL ENHANCEMENT COURSE SSE 703: INFORMATION TECHNOLOGY TOOLS**

Hours per week: 3

Continuous Evaluation: 100 Marks

Credits: 2

**Preamble:** The course enables the student to understand networking concepts related to Internet and introduce the social Networking sites and working of Email. It gives orientation of Block Chain technology. It give hands on training in SPSS, R Programming and creation of simple HTML documents.

### **Objectives:**

- To enable the student to understand networking concepts related to Internet and introduce the social Networking sites and working of Email.
- To give orientation of Block Chain technology.
- To give hands on training in SPSS, R Programming and creation of simple HTML documents

**Introduction to Internet:** Networking Concepts, Data Communication –Types of Networking, Internet and its Services, Internet Addressing –Internet Applications–Computer Viruses and its types –Browser –Types of Browsers.

**Internet applications:** Using Internet Explorer, Standard Internet Explorer Buttons, Entering a Web Site Address, Searching the Internet– Introduction to Social Networking: twitter, tumblr, LinkedIn, facebook, flickr, skype, yahoo!, google+, youtube, WhatsApp, etc.

**E-mail :** Definition of E-mail, Advantages and Disadvantages, User Ids, Passwords, Email Addresses, Domain Names, Mailers, Message Components, Message Composition, Mail Management, Email Inner Workings.

**WWW-**Web Applications, Web Terminologies, Web Browsers ,URL–Components of URL, Searching WWW –Search Engines and Examples.

**Block Chain technology:** What is Block Chain, Blockchain Architecture, How Block chain Transaction Works? Why do we need Blockchain? Block chain versions, Block chain Variants, Block chain Use Cases, Important Real-Life Use Cases of Block chain Bitcoin cryptocurrency: Most Popular Application of Block chain, Block chain vs. Shared Database, Myths about Block chain, Limitations of Block chain technology.

**SPSS :** SPSS Commands, Descriptive Statistics, Hypothesis Testing, Test of Difference, Analysis of Variance- One Way ANOVA, Non Parametric Tests, Correlation Analysis, Regression Analysis.

**R Programming:** Becoming familiar with R, Working with Objects, Introduction to Graphical Analysis.

**HTML:** WEB Terminology, Structure of HTML Document, HTML – Head and Body tags, Semantic tags- HR- Heading, Font, Image & Anchor tags, Different Types of Lists using Tags, Table Tags, Image Formats – Creation of Simple HTML Documents.

**Reference Books:**

- In-line/On-line : Fundamentals of the Internet and the World Wide Web by Raymond Greenlaw and Ellen Hepp, 2<sup>nd</sup> Edition, TMH.
- Microsoft Office 2010 Bible by John Walkenbach, Herb Tyson, Michael R. Groh and Faithe Wempen, Wiley Publications.

**Course Outcomes:**

- Enable to understand the basic networking concepts, types of networks, Internet Explorer and www.
- Outline the Block chain architecture, Bitcoin Crypto currency and Limitations of Block Chain.
- Choose different statistical tests to be performed on the data sets.
- Demonstrate the R programming with simple graphs.

To make use of commands to structure HTML document

**M.Sc. ELECTRONIC SCIENCE**  
**I-SEMESTER**  
**SEL 721 ANALOG and DIGITAL ELECTRONICS LAB**

Hours per week: 6  
Credits: 2

Sessionals: 100 Marks

**Objective:** To design and analyze the analog and digital electronic circuits.

**Analog Experiments**

*Any 6 from the Following List*

1. Active Band pass filter (IC 741)
2. Monostable multi vibrator (IC 555)
3. Astable multivibrator (IC 555)
4. Voltage controlled oscillator (IC 555)
5. Wein bridge oscillator (IC 741)
6. Voltage regulator (IC 723)
7. Op-amp characteristics (IC 741)
8. Op-amp as Differentiator (IC 741)
9. Op-amp as Integrator (IC 741)
10. Saw tooth wave generator (IC 555)
11. Colpitt's oscillator (BF 194/ IC 741)
12. Twin T filter (IC 741)
13. Phase shift oscillator (IC 741)
14. Logarithmic amplifier (IC 741)
15. Triangular wave generator (IC 741)
16. Crystal oscillator (BC 548)
17. Tuned amplifier (BF 194)
18. SCR characteristics
19. Hartley oscillator (IC 741)
20. Clipping and Clamping circuits

**Digital Experiments**

*Any 6 from the Following List*

1. Implementation of logic gates
2. Study of Adder and Subtractor (IC 7483)
3. Binary to Gray code converter (IC 7486)
4. BCD to Excess-3 code converter (7486)
5. Design of Flip-Flops with basic gates
6. (IC 7486)
7. Encoder and Decoder (IC 74138, 74148)
8. Multiplexer and Demultiplexer
9. (IC 74151, 74154)
10. UP- Down counter (IC 74192,74193)
11. D to A converter (IC 7490, 741)
12. 4-bit counter using Flip-Flops (IC 7490)
13. 4-bit shift register (IC 7476, 7400)
14. 4-bit magnitude comparator (IC 7485)
15. Parity generator (IC 7486, 7404)
16. Study of ALU (IC 74181)
17. Appliance Timer
18. Frequency counter

## M.Sc. ELECTRONIC SCIENCE

### I - SEMESTER

#### SEL 723 Programming C Language and Data Structures LAB

Hours per week: 6

Credits: 2

Sessionals: 100 Marks

**Objective:** To develop and implement programs in C and data structures.

#### Any 12 from the Following List

1. Arranging words in alphabetical order
2. Finding of largest and smallest from a set of numbers
3. Multiplication of two square matrices
4. Write functions for (i) reverse the string (ii) converting integer into string
5. Write functions for (i) string copy (ii) string compare (iii) Replace a sub-string with another string
6. Program to sort a series of elements.
7. Program to exchange elements of two arrays using pointers.
8. Write a C program to find the number of and sum of all integers greater than 100 and less than 200 that are divisible by a given integer  $x$ .
9. Given a number, write a C program using *while* loop to reverse the digits of the number. For e.g. the number 12345 should be printed as 54321.
10. Write a C program to read  $n$  numbers into an array, and compute the mean, variance and standard deviation of these numbers.
11. Write a C program to read in an array of names and to sort them in alphabetical order.
12. Write a C program to sort a sequence of  $n$  integers using Quick sort technique and then search for a key in the sorted array using Binary search technique.
13. Write an interactive C program to create a linear linked list of customer names and their telephone numbers. The program should be menu-driven and include features for adding a new customer, deleting an existing customer and for displaying the list of all customers.
14. Write a C program to implement a queue in which insertions, deletions and display can be performed.

**M.Sc. ELECTRONIC SCIENCE  
II-SEMESTER**

**SEL 702 MICROWAVE and MOBILE COMMUNICATION**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand various communication techniques using microwaves for mobile communication.

**UNIT-I**

**Microwave Wave Line of Sight Propagation**

Free space transmission equation, Atmospheric effects and Terrain effects on Free Space transmission, Fresnel zone clearance, Ground reflections, Statistical properties of fades. **Intermodulation Noise:** Sources of Intermodulation noise, Methods of testing IM noise, noise due to feeder mismatch, Multiple reflections in long feeders, Inter-channel interference.

**UNIT-II**

**Repeater Design Considerations**

Active Repeaters, Branching filter network, Passive Repeaters- Antenna-reflector configuration, Passive Repeaters Systems. **Troposcatter communication:** Physical properties of tropo-sphere, short term, long term and combined fading. Path geometry, Effective earth radius, calculation of angular distance and diversity techniques in Tropo-scatter communication systems- Diversity systems combining techniques

**UNIT-III**

**Introduction to Cellular Mobile Systems**

Why Cellular Mobile Telephone Systems, A basic cellular system, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, Hexagonal shaped Cells, Planning a cellular system, Analog and Digital cellular systems. **Elements of Cellular Radio Systems Design:** Concept of frequency reuse channels, Co-channel interference reduction factor, Handoff mechanism, Cell splitting.

**UNIT-IV**

**Co-channel Interference Reduction**

Co-channel interference, Real time co-channel interference measurement, Design of omni-directional and Directional Antenna systems, lowering the Antenna height. **Frequency Management and Channel Assignment:** Frequency Management, Frequency, Spectrum utilization, Setup channels, Channel assignment- fixed and non fixed assignment.

**UNIT-V**

**Cellular Wireless Communication Systems**

**First generation:** AMPS. **Second generation cellular systems:** GSM - Specifications, Architecture and Air Interface, **North American TDMA** - Architecture, TDMA structure, Channels. **2.5 G Systems:** GPRS and EDGE specifications and features, **3G systems:** UMTS and CDMA 2000 Standards and Specifications

**Text Books**

1. Mobile Cellular Telecommunications - William - C Y Lee, Tata McGraw Hill- 2<sup>nd</sup> Edition, 1995
2. Advanced Electronic Communication Systems - Wayne. Tomaasi- Prentice Hall- Gale 2<sup>nd</sup> Edition, 1994
3. Wireless Digital Communications - Dr. Kamilo Feher- Pearson Education, 1<sup>st</sup> Edition, 2001
4. Wireless Communication, Principles & Practice - T.S. Rappaport PHI, 2001

# M.Sc. ELECTRONIC SCIENCE

## II-SEMESTER

### SEL 704 MICROPROCESSORS & MICROCONTROLLERS

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** The student will be able to know the functionality and programming of the micro processors/micro controllers.

### Microprocessors

#### UNIT-I

Architecture of 8086, Instruction set of 8086- Data transfer-Arithmetic, Branch-Loop - Flag manipulation-Logical, shift and rotate- Stack and I/O instructions. Interrupts and Interrupt Applications, Assembly language Programming: Multiplication, division, greatest and smallest numbers in an array, arranging in ascending and descending order, Architectures of 80286 and Pentium processor

#### UNIT-II

Interfacing of memory and I/O devices, I/O mapped I/O, Memory mapped I/O, Data Transfer: Parallel programmed data transfer, Interfacing devices: 8255- I/O Ports and Programming, 8251- Serial communication interface, 8253- Programmable interval timer, 8257- DMA controller, 8259 - Interrupt controller, 8279 -Key board display controller.

### Microcontrollers

#### UNIT-III

Comparison of Microprocessors and Microcontrollers, Evolution of Microcontrollers, architecture of 8051, registers, ports, Interrupt Structure, Timer/counters, Addressing modes, Instruction set of 8051. **ALP-** Multiplication, Division, Greatest and Smallest numbers in an Array, Arranging in Ascending and Descending order, Delay and Subroutines, Calculation of Time delay, Architecture of AVR microcontroller, Registers and Ports

#### UNIT-IV

Interfacing of Memories, Interfacing of Unidirectional & Bi-directional Buffers, Latches, Decoders, Interfacing of DAC and ADC with Microcontroller, Serial memories, RS-232/485 communication interface, CAN, Zigbee

#### UNIT-V

Applications of 8051 Microcontrollers: Displays-7 segment and LCD, Multiple Interrupt Invoking, Interfacing of serial memories- I<sup>2</sup>C, SPI, Measurement of Frequency, Temperature measurement and controlling, Stepper motor interfacing, Keyboard interface, Relays

#### Text Books

1. Microprocessor and Interfacing - Douglas V. Hall (McGraw-Hill), 2<sup>nd</sup> Edition, 1992
2. The 8051 Microcontroller Architecture, Programming & Applications - Kenneth J. Ayala, Penram International Publishing (India) - 3<sup>rd</sup> Edition, 2004
3. The 8051 Microcontroller and Embedded Systems - Muhammad Ali Mazidi, Pearson Education - 2<sup>nd</sup> Edition, 2007
4. Advanced Microprocessors and Peripherals - A K Ray, Tata Mc Graw Hill, 2<sup>nd</sup> Edition, 2006

## M.Sc. ELECTRONIC SCIENCE

### II-SEMESTER

#### SEL 706 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** To analyze and monitor the control of basic instruments those are used to measure the electrical and biological signals.

#### UNIT-I

##### Fundamental Measurements

Accuracy, Precision, Types of errors, Standards of measurements, *Electronic Instruments:* RMS, FET voltmeters, Electronic multi-meter, Q meter, LCR meter, Power meter, Measurement of Inductance, Capacitance and Effective resistance at high frequency, *CRO-* study of various stages in brief, measurement of voltage, current, phase and frequency, Digital storage oscilloscope.

#### UNIT-II

##### Instruments for Generation and Analysis of waveforms

Function generator, wave analyzers- Harmonic distortion analyzer, spectrum analyzer and spectrum analysis. *Recording Instruments:* X-Y, Strip chart, Magnetic tape recorder *Transducers:* Classification of transducers, Strain Gauze, LVDT, Thermocouple, Piezo-electric and photoelectric transducers, Flow measurement transducer.

#### UNIT-III

##### Data Acquisition Systems

D/A conversion- Linear weighted and ladder type. A/D conversion- Digital ramp ADC, Successive approximation method, Data loggers, Signal Conditioning of the inputs, Computer based data systems, *Electronic Indicating instruments:* Seven Segment Display, Fourteen Segment Display, LCD and LED display devices.

#### UNIT-IV

##### Bio-Medical Instrumentation

Basic Medical Instrumentation System, Origin of Bioelectric signals, Recording Electrodes, Electrode-tissue interface, Skin contact impedance, Biosensors, Measurement of Heart rate, Blood pressure measurement, blood flow meter. *Bio-Medical Instruments:* ECG, EEG, EMG, Electronic Pace maker.

#### UNIT-V

##### Medical Imaging Systems

Radiography, X-Ray machine, CT scanner, *Nuclear Medical Imaging systems:* Physics of Radio Activity, Radiation Detectors, Gamma Camera, NMR imaging. Ultrasonic Imaging Systems, Angiography and Fluoroscopy

#### Text Books

1. Electrical and Electronic Measurements and Instrumentation - Sawhney, Dhanpat Rai Publications., 3rd Edition, 2005
2. Hand Book of Biomedical Instrumentation - Khandpur, Tata Mcgraw Hill, 2nd Edition
3. Medical Instrumentation: Application & Design - John G. Webster, Houghton Mifflin & Co., Boston
4. Biomedical Instrumentation - Marvin D. Wirs, Chilton Book Co., London, 1973

**M.Sc. ELECTRONIC SCIENCE  
II-SEMESTER**

**SEL 742 RADAR SYSTEMS and SATELLITE COMMUNICATION**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand basic principles of different types of radar systems and satellite systems with their applications.

**UNIT-I**

Simple RADAR, Overview of frequencies, Radar Equation, Accuracy and Resolution, Integration time and the Doppler shift, Surveillance radar, Antenna beam-width consideration, Pulse repetition frequency, unambiguous range and velocity, Pulse length and sampling, Radar cross section, Clutter noise, Tracking Radar, Sequential lobbing, Conical scanning.

**UNIT-II**

Signal and Data Processing, Properties of clutter, Moving Target Indicator, Processing Plot extraction, Tract Association, Initiation and Tracking, Radar Antenna, Antenna parameters, Antenna Radiation Pattern and aperture distribution, Parabolic reflector, Cosecant squared antenna pattern, Stabilization of antennas

**Satellite Communication**

**UNIT-III**

Satellite System, Historical development of satellites, communication satellite systems, orbiting satellites, satellite frequency bands, satellite multiple access formats, Satellite orbits and inclination, Look angles, orbital perturbations, Space craft and its subsystems, altitude and orbit control system

**UNIT-IV**

Telemetry, Tracking and Command, Power system, Transponder, Reliability and space qualification, launch vehicles, Multiple Access Techniques, Time division multiple access, Frequency division multiple access, Code division multiple access, Space domain multiple access

**UNIT-V**

Earth Station technology, Subsystem of an earth station, Transmitter, Receiver Tracking and pointing, Small earth station, different types of earth stations, Basic principles of special communication satellites, VSAT, GPS, RADARSAT, INTELSAT

**Text Books**

1. Introduction to Radar Systems - MI Skolnik , 3<sup>rd</sup> Edition, 2001
2. Satellite Communication - Robert M. Gagliardi, 2<sup>nd</sup> Edition , 2006
3. Understanding Radar Systems - Simon Kingsley and Shaun Quegan, Mc Graw hill , 1999
4. Satellite Communication - Manojit Mitra, PHI, 1<sup>st</sup> Edition, 2005



**M.Sc. ELECTRONIC SCIENCE  
II-SEMESTER**

**SEL 744 ANTENNA THEORY and RADIO WAVE PROPAGATION**

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** To introduce basic theory and operation of various antennas for the propagation of radio waves.

**UNIT-I**

**Antenna Basics**

Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna field zones.

**UNIT-II**

**Point Sources and Arrays**

Introduction, point sources, power patterns, radiation intensity, field patterns, phase patterns. Array of two isotropic point sources, principles of pattern multiplication, examples of pattern synthesis by pattern multiplication, non-isotropic point sources, broad side array with non-unipolar amplitude distribution, broad side versus end fire array, direction of maxima fire arrays of an isotropic point sources

**UNIT-III**

**Electric dipoles and thin linear antennas**

Introduction, short electric dipole, fields of a short dipole, radiation resistance of short dipole, radiation resistances of  $\lambda/2$  Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

**UNIT-IV**

**Loop, Slot, Patch and Horn Antenna**

Introduction, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Balunets principle and complementary antennas, impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas. **Antenna Types:** Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna.

**UNIT-V**

**Radio Wave Propagation**

Introduction, Ground wave propagation, free space propagation, surface wave, diffraction, troposphere wave propagation, Tropospheric scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

**Text Books**

1. Antennas - John D. Krauss, 3<sup>rd</sup> Edition, McGraw Hill International edition, 2006
2. Antennas and Wave Propagation by Harish and Sachidananda: Oxford Press, 1<sup>st</sup> Edition, 2007
3. Antennas and Propagation for Wireless Communication Systems - Sineon R Saunders, John Wiley, 2<sup>nd</sup> Edition, 2007.
4. Antennas and Wave Propagation - G S N Raju, Pearson Education, 3<sup>rd</sup> Edition, 2009

**M.Sc. ELECTRONIC SCIENCE**  
**II-SEMESTER**  
**SEL 746 OPTO ELECTRONIC DEVICES**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand communication theory using optical fibers.

#### **UNIT-I**

##### **Overview of Optical fiber Communication**

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, Optical fiber waveguides, Ray theory, single mode and multimode fibers, cutoff wave length, and mode field diameter. Optical Fibers: fiber materials, Photonic crystal, fiber optic cables.

#### **UNIT-II**

##### **Transmission Characteristics of Optical fibers**

Introduction, Attenuation, Absorption, Scattering losses, Bending loss, Dispersion, Intra-modal dispersion, Inter-modal dispersion, **Optical Sources and Detectors:** Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, comparison of photo detectors.

#### **UNIT-III**

##### **Fiber Couplers and Connectors**

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber Splices, fiber connectors and fiber couplers. **Optical receiver:** Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, Eye diagrams, Coherent detection, Burst mode receiver operation, Analog receivers

#### **UNIT-IV**

##### **Analog and Digital Links**

**Analog links:** Introduction, overview of analog links, CNR, Multichannel transmission techniques, **Digital links:** Introduction, point-to-point links, System considerations, link power budget, rise time budget, transmission distance for single mode links, line coding, error correction, modal noise and chirping.

#### **UNIT-V**

##### **WDM Concepts and Components**

Operational Principles of WDM, Passive components: 2x2 Fiber Coupler, 2x2 Waveguide coupler, Star couplers, Mach-Zehnder interferometer multiplexers, Tunable sources, Tunable filters. **Optical Amplifiers:** Basic Applications and Types of Optical Amplifiers, Semiconductor Optical Amplifiers, EDFA.

#### **Text Books**

1. Optical Fiber Communication - Gerd Keiser, 3<sup>rd</sup> Edition, MGH
2. Optical Fiber Communications - John M. Senior, Pearson Education, 3<sup>rd</sup> Edition, 2010
3. Fiber Optic Communication - Joseph C Palais, 5<sup>th</sup> Edition, Pearson Education, 2005

**M.Sc. ELECTRONIC SCIENCE**  
**II-SEMESTER**  
**SEL 748 INFORMATION THEORY**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** This course helps the student to understand theory of sending and receiving of information.

**UNIT-I**

**Information Theory**

Information, Entropy, Information rate, Classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels, BSC, BEC, Channel capacity, Shannon limit.

**UNIT-II**

**Source coding: Text, Audio and Speech**

**Text:** Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm, **Audio:** Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I, II, III, Dolby AC3 **Speech:** Channel Vocoder, Linear Predictive Coding

**UNIT-III**

**Source coding: Image and Video**

Image and Video Formats, GIF, TIFF, SIF, CIF, QCIF, Image compression: READ, JPEG, Video Compression: Principles, I, B, P frames, Motion estimation, Motion compensation, H.261, MPEG standard

**UNIT-IV**

**Error Control Coding: Block Codes**

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC

**UNIT-V**

**Error control coding: Convolution Codes**

Convolution codes, Code tree, Trellis, State diagram- Encoding, Decoding: Sequential search and Viterbi algorithm, Principle of Turbo coding

**Text Books**

1. Information Theory, Coding and Cryptography - R Bose, TMH, 3<sup>rd</sup> Edition, 2002
2. Multimedia Communications: Applications, Networks, Protocols and Standards - Fred Halsall Pearson Education Asia, 4<sup>th</sup> Edition, 2001
3. Introduction to Data Compression - K Sayood, Elsevier, 3<sup>rd</sup> Edition
4. Introduction to Error Control Codes - S Gravano, Oxford University Press, 2001
5. Digital Communication - Amitabha Bhattacharya, TMH, 2006

**M.Sc. ELECTRONIC SCIENCE II - SEMESTER**  
**SAE 702 PROFESSIONAL COMMUNICATION SKILLS**

Hours per week: 3  
Credits: 2

Continuous Evaluation: 100 Marks

**Objectives**

To enable students to

- acquaint themselves with basic English grammar
- acquire presentation skills
- develop formal writing skills
- develop creative writing skills
- keep themselves abreast with employment-readiness skills

**UNIT-I**

**Back To Basics**

Tenses, Concord – Subject Verb Agreement, Correction of Sentences-Error Analysis, Vocabulary building

**UNIT -II**

**Oral Presentation**

What is a Presentation? Types of Presentations, Technical Presentation – Paper Presentation  
Effective Public Speaking, Video Conferencing,

**UNIT- III**

**Documentation**

Letter –Writing, E-mail Writing & Business Correspondence, Project Proposals, Report Writing, Memos, Agenda, Minutes, Circulars, Notices, Note Making

**UNIT- IV**

**Creative Writing**

Paragraph Writing, Essay writing, Dialogue Writing, Précis Writing, Expansion of Hints, Story Writing

**UNIT V**

**Placement Orientation**

Resume preparation, group discussion – leadership skills, analytical skills, interviews –Types of Interviews, Preparation for the Interview, Interview Process

**Text Books :**

1. Essentials of Business Communication by Rajendra Pal and J S KorlahaHi, Sultan Chand & Sons, New Delhi.
2. Advanced Communication Skills by V. Prasad, Atma Ram Publications, New Delhi.
3. Effective Communication by Ashraf Rizvi, McGraw Hill Education; 1 edition (27 June 2005)
4. Interviews and Group Discussions How to face them, T.S.Jain, Gupta, First Edition, New Delhi.
5. High School English Grammar and Composition, P.C.Wren & Martin, N.D.V.Prasada Rao (Editor), S.Chand, 1995.

**M.Sc. ELECTRONIC SCIENCE**  
**II-SEMESTER**  
**SEL 722 COMMUNICATION LAB**

Hours per week: 6  
Credits: 2

Sessionals: 100 Marks

**Objective:** To get handful experience on analog and communication systems.

**Communication Lab (Any 10 from the following)**

1. Amplitude modulation and detection
2. Frequency modulation and detection
3. P.A.M, P.W.M, and P.P.M generation using I.C 555 and Detection
4. Design of Mixer
5. Phase locked Loop (PLL)
6. Design of Chebyshev second order low pass / high pass filter
7. P.C.M generation and Reception
8. A.S.K, F.S.K and P.S.K generation and Reception
9. Propagation and Bending losses in optical fibers
10. Characteristics of Fiber optic LED and Detector
11. Measurement of speed of light in optical fibers
12. Measurement of Bit Error Rate (BER)
13. Measurement of Numerical Aperture

**Microwave Lab (Any 2 from the following)**

1. Measurement of signal power
2. Measurement of VSWR
3. Characteristics of Reflex Klystron
4. Electronic Tuning Range
5. Electronic Tuning Sensitivity
6. Double minima Method
7. Measurement of Frequency and Wavelength of Reflex Klystron
8. Plot of Reflex Klystron directly on CRO
9. Measurement of  $D_{\min}$  for a given Load

## **M.Sc. ELECTRONIC SCIENCE**

### **II-SEMESTER**

#### **SEL 724 MICROPROCESSOR and MICROCONTROLLER LAB**

Hours per week: 6

Credits: 2

End Examination: 60 Marks

Sessionals: 40 Marks

**Objective:** The students will be able to program the micro controllers / processors.

#### **8086 programming (Any 5 from the following)**

1. Addition / Subtraction of 32-bit integers
2. Hexadecimal to ASCII and vice versa
3. Search for character sequence in a String
4. Addition of an array of integers
5. Bubble sorting of an array of integers
6. Counting no. of 1's in a word using shift and rotate instructions
7. Packed and unpacked BCD Arithmetic
8. Counting positive values, zeros and negative values in an array of integer
9. 64 bit Addition

#### **8086 Interfacing (Any 5 from the following)**

1. Interfacing of 8255 I/O Programming.
2. Interfacing of 8253 programmable Interval Timer
3. Interfacing of Stepper Motor
4. Interfacing of Seven Segment Display
5. Interfacing of 8279 Programmable Keyboard
6. Interface of A/D converter
7. Interface of D/A converter
8. Traffic Controller interface
9. Square wave generator

#### **8051 Microcontroller (Any 5 from the following)**

1. Addition, Subtraction (8-bit and multi Bytes)
2. Multiplication, Division of 8-bit and 16-bit.
3. Temperature measurement
4. Ascending and Descending order and Alphabetical order.
5. Real Time Clock.
6. LED Interface.
7. Interfacing A/D converter
8. Interfacing D/A Converter
9. Interfacing Logic controller
10. Interfacing Traffic Controller
11. Interfacing of Keyboard
12. Interfacing of Seven Segment Display

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 801 EMBEDDED SYSTEMS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To introduce concept of embedded systems and their applications in the industries.

**UNIT-I**

**Introduction to Embedded Systems**

Introduction, Application areas, Categories of Embedded Systems, Overview of Embedded system architecture, Specialties of Embedded systems, Recent trends, Hardware architecture, Software architecture, Application software, Communication software, Process of generating executable images, Core Platform Development, Development tools, Communication Interfaces

**UNIT-II**

**ARM Microcontrollers**

Introduction to 32- bit Microcontrollers, ARM7TDMI and ARM9TDMI pipelines, Registers, Modes, Exception handling, Instruction sets. Thumb instruction set, Jazelle, ARM Processor Core, JTAG, Working with Audio codec, JPEG Encoder, MP3 Decoder, File Transfer Between two Embedded Reference Boards, Interfacing of IRDA card

**UNIT-III**

**Introduction to Real Time Operating Systems**

Architecture of the Kernel, Task and Task scheduler, Interrupt Service Routines, Management function calls of Semaphores, Mutex, Mail boxes, Message queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem. Embedded Operating Systems, Real Time Operating Systems and Handheld operating systems

**UNIT-IV**

**Basic Design using Real Time Operating Systems**

Overview, Principles, an Example, Encapsulating Semaphores and Queues, Hard Real Time Scheduling consideration, Saving Memory Space, Saving Power. **RFID systems:** RFID systems, Tags, and Readers, Application development using RFID.

**UNIT-V**

**Embedded C and Linux**

Introduction to KEIL, Compilation steps, Header files in KEIL, Writing programs in Embedded C, Debugging Techniques. **Programming in Linux-** Overview of Unix/Linux, Feature of Linux, Linux Commands, File manipulation Commands, Editor, Directory Commands, Input/ Output redirection, file protection, Process Commands, System Programming.

**Text Books**

1. Embedded/ Real-Time Systems: Concepts, Design & Programming, Black Book - K. V. K Prasad, Dreamtech Press, 1<sup>st</sup> Edition, 2003
2. An Embedded Software - Primer B. David A. Simon. Pearson Education, 1<sup>st</sup> Edition , 2004
3. Embedded Microcomputer Systems - Jonathan W. Valvano , 3<sup>rd</sup> Edition, 2011

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 803 NETWORKING**

Hours per week: 4

Credits: 4

End Examination: 60 Marks

Sessionals: 40 Marks

**Objective:** The students will be able to understand the computer networking and devices.

**UNIT-I**

**Data Communication, Data Networking and the Internet**

Data Communications, Communications model, Data Communications, Networks Protocol, Architecture, TCP/IP, and Internet based Applications: The Need for Protocol Architecture; TCP/IP, Protocol Architecture, OSI Model, Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity.

**UNIT-II**

**Transmission Media**

Guided Transmission Media, Wireless Transmission, Signal Encoding Techniques: Digital Data, Digital Signals, Digital Data, Analog Signals, Analog Data, Digital Signals, Analog Data, Analog Signals. Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection; Line Configurations.

**UNIT-III**

**Data Link Control Protocols**

Flow Control; Error Control, High-Level Data Link Control (HDLC). Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, Circuit Switching and Packet Switching: Switched Communications Networks, Circuit Switching Networks, and Packet-Switching Principles.

**UNIT-IV**

**Routing in Switched Networks**

Routing in Packet-Switching Networks, Least-Cost Algorithms Congestion Control in Data Networks: Effects of Congestion, Congestion Control, Traffic Management, Congestion Control in Packet-Switching Networks. Local Area Network Overview: Topologies and Transmission Media, LAN Protocol Architecture, Bridges. High Speed LANs: The Emergence of High-Speed LANs, Ethernet.

**UNIT-V**

**Wireless LANs**

Overview; Wireless LAN Technology, IEEE 802.11 Architecture and Services. Internetwork Protocols: Basic Protocol Functions, Principles of Internetworking; Internet Protocol Operation, Internet Protocol. Internetwork Operation: Multicasting; Routing Protocols. Transport Protocols: TCP, UDP. Internet Applications: Electronic Mail: SMTP and MIME, Internet Directory Service: DNS.

**Text Books**

1. Data and Computer Communications-William Stallings, Pearson Education, 8<sup>th</sup> Edition, 2007
2. Computer Networks - Andrew S. Tanenbaum, Pearson, 3<sup>rd</sup> Edition, 1996
3. Data Communications and Networking - Behrouz A. Forouzan, Tata McGraw-Hill, 4<sup>th</sup> Edition, 2006



**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 805 DIGITAL SIGNAL PROCESSING**

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** To get basic knowledge on processing analog and discrete signals using different methods.

#### **UNIT-I**

##### **Classification of Signals and Systems**

Introduction, Classification of Signals, and Systems, Manipulations of Discrete-time Signals, Representations of Systems. Fourier Analysis- Trigonometric Fourier series, Complex or Exponential form of Fourier series, Parseval's Identity for Fourier series, Power Spectrum of a Periodic Function, Fourier Transform, Properties of Fourier Transform, Fourier Transform of some signals.

#### **UNIT-II**

##### **Laplace Transform to System Analysis**

Definition, Region of Convergence (ROC), Laplace Transforms of Functions, Convolution Integral, Partial Fraction Expansions, Network Transfer Function, Laplace Transform of Periodic Functions, and application of Laplace Transform.  $z$ -Transform- Introduction, Properties of  $z$ -transform, Inverse  $z$ -transform

#### **UNIT-III**

##### **Linear Time Invariant Systems**

Introduction, Difference Equation and its Relationship with System Function, Impulse Response and Frequency Response, Discrete and Fast Fourier Transforms - Introduction, Discrete Convolution, Discrete-Time Fourier Transform (DTFT), Fast Fourier Transform (FFT), Decimation in Time and Decimation in Frequency algorithms, Computing an Inverse DFT, Fast Convolution.

#### **UNIT-IV**

##### **Finite Impulse Response (FIR) Filters**

Introduction, Frequency Response of Linear Phase FIR Filters, Design Techniques for FIR Filters Infinite Impulse Response (IIR) Filters- Introduction, IIR Filter Design by Approximation of Derivatives, Impulse Invariant Method, Bilinear Transformation Realization of Digital Linear Systems- Block Diagram and the Signal-flow Graph realization, Basic Structures for IIR Systems, Basic Structures for FIR Systems.

#### **UNIT-V**

##### **Applications of Signal Processing**

Introduction, Voice Signal Processing, Spectral analysis of Sinusoidal signals, Spectral analysis of Non Stationary signals, and Spectral analysis of Random signals, **Applications to Radar** - Digital Matched Filters for Radar signals, Doppler Processing to MTI Radars, Applications to Image Processing

#### **Text Books**

1. Digital Signal Processing - Alan V. Oppenheim and Ronald W. Schaffer, PHI, 1st Edition, 1999
2. Digital Signal Processing - S. Salivahanan, A. Vallavaraj and C. Gnanapriya, McGraw - Hill, 2nd Edition, 2011
3. Digital signal processing - Sanjit K. Mitra, TMH edition, 4th Edition, 2011
4. Theory and Application of Digital Signal Processing by Lawrence R. Rabiner and Bernard Gold, Prentice Hall, 1st Edition, 1975

**M.Sc. ELECTRONIC SCIENCE**

## **III-SEMESTER**

### **SEL 841 SWITCHING THEORY AND LOGIC DESIGN**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** This course introduces the student to design logic circuits.

#### **UNIT-I**

##### **Number Systems & Codes**

Philosophy of number systems, complement representation of negative numbers-binary arithmetic-binary codes-error detecting & error correcting codes, Boolean Algebra and Switching Functions: Fundamental postulates of Boolean Algebra - Basic theorems and properties, switching functions, Canonical and Standard forms

#### **UNIT-II**

##### **Minimization of Switching Functions**

Map method, Prime implicants, Don't care combinations, Minimal SOP and POS forms, Combinational Logic Design: Design using conventional logic gates, Encoder, Decoder, Multiplexer, De-Multiplexer, Modular design using IC chips, MUX Realization of switching functions Parity bit generator, Code-converters

#### **UNIT-III**

##### **Programmable Logic Devices, Threshold Logic**

Basic PLD's-ROM, PROM, PLA, PLD Realization of Switching functions using PLD's. Capabilities and limitations of Threshold gate, Synthesis of Threshold functions, Multigate Synthesis.

#### **UNIT-IV**

##### **Sequential Circuits**

Classification of sequential circuits - Synchronous, Asynchronous, Pulse mode, Level mode with examples, Basic flip-flops-Triggering and excitation tables, Steps in synchronous sequential circuit design, Design of modulo-N Ring & Shift counters, Serial binary adder, sequence detector.

#### **UNIT-V**

##### **Algorithmic State Machines**

Salient features of the ASM chart, Simple examples, System design using data path and control subsystems, control implementations, examples of Weighing machine and Binary multiplier.

#### **Text Books**

1. Switching & Finite Automata Theory - Zvi Kohavi, TMH, 2<sup>nd</sup> Edition.
2. Digital Design - Morris Mano, PHI, 3<sup>rd</sup> Edition, 2006
3. An Engineering Approach to Digital Design - Fletcher, PHI
4. Digital Logic, Application and Design, - John M. Yarbrough, Thomson.
5. Fundamentals of Logic Design - Charles H. Roth, Thomson Publications, 5<sup>th</sup> Edition, 2004
6. Digital Logic Applications and Design - John M. Yarbrough, Thomson Publications, 2006

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 843: INDUSTRIAL ELECTRONICS**

Hours per week: 4

Credits: 4

End Examination: 60 Marks

Sessionals: 40 Marks

**Objective:** To learn about the advanced electronic devices for high power applications in industries.

### **UNIT-I**

#### **Characteristics of Devices**

PNPN Diode, Schottky Diode, Silicon Carbide Diodes, Freewheeling diodes, SCR Triggering, Series and Parallel connection of SCRs, DIAC, TRIAC, UJT, Power Diodes, Control Characteristics of Power devices. **Controlled Rectifier:** Single-phase Half wave and Full wave Converters, Three phase Rectifiers- Bridge rectifiers- Half controlled and Fully controlled.

### **UNIT-II**

#### **Inverter, Chopper and Cycloconverter**

Voltage driven, Current driven, Bridge, Parallel, Control of output voltage- PWM Schemes, Harmonic reduction, Types of Choppers, step-up and step-down Cycloconverter. **Motor Control:** D.C. and A.C. Motor control reversible drives, closed loop control, commutator less D.C. Motor control. **3-phase AC motor control-** Speed control of Induction Motor using Inverter.

### **UNIT-III**

#### **Switched Mode Power Supplies**

Basic principle, step-up and step-down circuits, Integrated circuits for Switched Mode regulators, Induction Heating, Effect of frequencies and Power requirements, Dielectric heating and Applications. BJT switching characteristics and limits, Power MOSFETS-Steady state and switching characteristics, IGBT series and parallel operation

### **UNIT-IV**

#### **Programmable Logic controllers (PLC's) - Ladder Diagram**

Fundamentals, symbol, PLC configurations, Block diagram, Fundamentals, PLC programming, Physical components vs. Program components, Discrete Position Sensors, Encoders, Transducers and Advanced Sensors, **Switches** - AC switches, switches for BUS Transfer, Solid State Relays. Gate Drive Circuits-MOSFET and BJT base drive, Isolated Gate and Base drives.

### **UNIT-V**

#### **Microwave Semiconductor Devices**

Tunnel diode, Gunn diode, IMPATT and TRAPATT diodes, Varactor diode, PIN diode **Microwave oscillators:** High frequency limitations of conventional tubes, Two cavity and Multi-cavity Klystron, Reflex Klystron, Traveling wave tube, Magnetron oscillator, Forward wave crossed field amplifier and Backward wave crossed field amplifier.

#### **Text Books**

1. Power Electronics - P. C. Sen, Tata McGraw Hill Publishing Co., Ltd.,2008
2. Power Electronics and Control - S.K. Dutta, Prentice Hall of India Pvt. Ltd.1986
3. Power Electronics: Circuits, Devices and Applications - Rashid, 3<sup>rd</sup> Edition,2004
4. Industrial and Power Electronics - G.K. Mithal.
5. Microwave Devices and Circuits - Samuel Y. Liao, Pearson, 2<sup>nd</sup> Edition, 1997
6. Power Electronics, Converters, Applications and Design - Net Mohan, Tore M. Undeland and William P. Robins, 3<sup>rd</sup> Edition, John Wiley and Sons, 2006
7. Power Electronics: Principles and Applications J.M. Jacob, Thomson, Vikas Publications.

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 845 DIGITAL IMAGE PROCESSING**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To get basic knowledge on processing of digital image signals.

**UNIT-I**

**Fundamentals of Image Processing**

Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels, distance measures, connectivity, Image geometry, Photographic film. Histogram: Definition, Decision of contrast basing on histogram, operations basing on histograms like image stretching, Image sliding, Image classification. Definition and Algorithm of Histogram equalization

**UNIT -II**

**Image Transforms**

2-D Fast Fourier Transform, Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform

**UNIT -III**

**Image Enhancement (By FREQUENCY Domain Methods)**

Design of Low pass, High pass, edge enhancement, smoothening filters in Frequency Domain. Butterworth filter, Homomorphic filters in Frequency Domain, Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain

**UNIT -IV**

**Image Compression**

Definition, a brief discussion on, Run length encoding, contour coding, Huffman Code, Compression due to change in domain, Compression due to quantization, Compression at the time of image transmission, Brief discussion on image compression standards

**UNIT -V**

**Image Segmentation**

Detection of discontinuities, edge linking and boundary detection, thresholding, Region oriented segmentation. **Image Restoration** Degradation model, Algebraic approach to restoration, Inverse filtering, least mean square filters, constrained least squares restoration, Interactive restoration.

**Text Books**

1. Digital Image processing - R.C. Gonzalez & R.E. Woods, Addison Wesley, Pearson 2<sup>nd</sup> Edition, 2002.
2. Fundamentals of Digital Image processing - A. K. Jain, Prentice Hall of India, 1989
3. Digital Image processing using MATLAB - Rafael C. Gonzalez, Richard E Woods and Steven L, PEA, 2004
4. Digital Image Processing - William K. Pratt, John Wiley, 3<sup>rd</sup> Edition, 2004

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 847 NEURAL NETWORKS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** This course is designed to analyze neural networks and their application.

**UNIT-I**

Fundamentals of artificial Neural Networks, Biological neurons and their artificial models, Neural processing, learning and Adaptation, Neural Network Learning Rules, Hebbian, Perceptron, delta, widrow, hoff, correlation, winner, take, all, outstar learning rules.

**UNIT-II**

Single Layer Perceptions, Multi player Feed forward Networks, Error back propagation training algorithm, problems with back propagation, Boltzmann training, Cauchy training, Combined back propagation /Cauchy training.

**UNIT-III**

Hopfield networks, Recurrent and Bi-directional Associative Memories, Counter Propagation Network, Artificial Resonance Theory (ART)

**UNIT-IV**

Applications of neural networks, Hand written digit and character recognition, Traveling salesman problem, Neuro controller, inverted pendulum controller.

**UNIT-V**

Applications of neural networks - Cerebellar model articulation controller, Robot kinematics, Expert systems for Medical Diagnosis.

**Text Books**

1. Introduction to artificial Neural System - S.M. Zurada, Jaico Publishing House, 1992
2. Neural Computing, Theory and Practice - Philip D. Wesserman, Van Nostrand Rein Hold, New York, 1<sup>st</sup> Edition , 1989
3. Neural Networks and Fuzzy Systems - Bart Kosko, Prentice Hall, 1<sup>st</sup> Edition, 1992

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 849 ROBOTICS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand the concepts of mechanical electronics.

**UNIT-I**

**Introduction**

Automation and Robotics, Definition, Basic Structure of Robots, Classification of Robots based on coordinate system, Present trends and future trends in robotics, Overview of robot subsystems. **Components of Robot System:** Manipulator, Controller, Power conversion unit etc., Specifications of robot

**UNIT-II**

**Dynamics & Kinematics**

Dynamic constraints, velocity & acceleration of moving frames, Robotic Mass Distribution and Inertia, Tension, Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators. Homogeneous co-ordinate vector operations, matrix operations, co-ordinate reference frames,

**UNIT-III**

**End Effectors and Actuators**

Different types of grippers, vacuum & other methods of gripping, overview of actuators, Internal and External sensors, position, relocking and acceleration sensors, proximity sensors, force sensors, touch slip laser range finder, camera.

**UNIT-IV**

**Motion Planning and Controllers**

On-off trajectory, relocking and acceleration profile, Cartesian motion of manipulator, joint interpolated control, Jacobean in terms of D-H matrix, Obstacle avoidance, Basic control system, control loops of robotic system, Fuzzy controllers.

**UNIT-V**

**Robot Vision**

Machine Vision system, description, sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic assembly sensors and Intelligent Sensors. Object recognition.

**Text Books**

1. Fundamentals of Robotics: Analysis and Control - Robert J Schilling, PHI, New Delhi, 1<sup>st</sup> Edition, 1990
2. Robotic Engineering - Klafter, Thomas, Negin, PHI, New Delhi, 1<sup>st</sup> Edition, 1989
3. Robotics for Engineers - Yoram Koren, Mc Graw Hill, New York, 1<sup>st</sup> Edition, 1985
4. Fundamentals of Robotics - T.C. Manjunath, Nandu Publishers, Mumbai
5. Robotics and Control - R. K. Mittal, I. J. Nagrath, TMH, New Delhi, 6<sup>th</sup> Edition, 2003
6. MEMS and Microsystems Design and Manufacture - HSU, TMH, New Delhi, 1<sup>st</sup> Edition, 2008

**OPEN ELECTIVE**

## III-SEMESTER SOE 861 FUNDAMENTALS OF ELECTRONICS

Hours per week: 3

End Examination: 60 Marks

Credits: 3

Sessionals: 40 Marks

**Objective:** To get the knowledge of basic electronic devices and circuits.

### UNIT-I

#### BJT and FET Devices

**Bipolar Junction Transistor:** Configurations, Characteristics, Biasing, Frequency response and Applications of BJT. **Field Effect Transistor:** Construction, Characteristics, Biasing and Applications of FET. **MOSFET:** Introduction, Depletion and Enhancement type. **Feedback concepts:** Introduction, Practical feedback circuits, Oscillator operation, Types of oscillators.

### UNIT-II

#### Operational Amplifiers

Op-amp basics, parameters, Differential and Common mode operation, virtual ground, **Practical op-amp circuits**, Integrator, Differentiator and Summing amplifier, **Op-amp Applications**- Constant gain multiplier, Voltage to Current and Current to Voltage Converters, Instrumentation Amplifier, Active Filter Design, Oscillators, Logarithmic and Anti Logarithmic Amplifiers.

### UNIT-III

#### Power Supplies

**Rectifiers**- Half wave, Full wave and Bridge rectifiers, Filter considerations, Zener diode voltage regulator, Transistor voltage regulation (series and shunt), IC voltage regulators-78XX and 79XX, Variable Power supply Design, **Linear ICs:** IC 555 (Timer) and its **applications:** Astable, Monostable, PLL (IC 565).

### UNIT-IV

#### Combinatorial Logic Circuits

**Simplification of Boolean expressions:** Algebraic method, Karnaugh map method, EX-OR, EX-NOR gates, Encoder and Decoder, Multiplexer and De-multiplexer, **Digital Arithmetic Operations and Circuits:** Binary addition, Subtraction, Multiplication and Division, Design of Adders, Subtractors and Parallel binary adder, **Applications of Boolean Algebra:** Magnitude comparator, Parity generator & checker, Code converters, 7-segment decoder /driver display.

### UNIT-V

#### Sequential Logic Circuits

**Flip-Flops:** NAND latch, NOR latch, R-S, J-K, T-flip-flops, D-Latch. **Counters:** Asynchronous (ripple) counter, Counters with MOD number  $< 2^n$ , Down counter, Synchronous counters, Up-down counter, Ring counter. **Registers:** Shift registers, PIPO, SISO, SIPO, PISO.

#### Text Books

1. Electronic Devices and Circuit Theory - R. Boylestad and L. Nashelsky- 11<sup>th</sup> Edition –Pearson,2008
2. Digital Systems principals and applications - Ronald J Tocci, 10<sup>th</sup> Edition –Pearson, 2003
3. Digital Design by Morris Mano - 4thEdition, Pearson, 2006
4. Op-Amp Applications - Ramakanth Gaykward, 4<sup>th</sup> Edition, PHI, 2000
5. Linear IC Applications - D. Roy Chowdhary, New Age International, 2<sup>nd</sup> Edition, 2004

## OPEN ELECTIVE

## **III-SEMESTER**

### **SOE 863 BIOMEDICAL INSTRUMENTATION**

Hours per week: 3

End Examination: 60 Marks

Credits: 3

Sessionals: 40 Marks

**Objective:** To understand the working functionality and applications of medical instrumentation.

#### **UNIT-I**

##### **Biomedical signals & Physiological transducers**

Source of biomedical signal, Origin of bioelectric signals, recording electrodes, electrode tissue interface, skin contact impedance, Physiological transducers: Pressure, Temperature, optical fiber sensors

#### **UNIT-II**

##### **Recording Systems**

Basic recording system, General considerations for signal conditioners, Preamplifiers, Instrumentation Amplifier, Signal processing techniques. Writing Systems: Direct writing recorder, ink-jet recorder, Digital recorders. Biomedical Recording: ECG, EEG and EMG.

#### **UNIT-III**

##### **Patient Monitoring systems & Audiometers**

Measurement of heart rate, Blood pressure, Respiration rate, Arrhythmia monitor, Methods of monitoring foetal heart rate, Monitoring labor activity, Mechanism of hearing, Measurement of Sound, Basic Audiometer, Blood cell counters, Oximeter, Blood flow meter.

#### **UNIT-IV**

##### **Modern Imaging systems**

Basic principle & Block diagram of x-ray machine, Computed Tomography (CT), Magnetic Resonance Imaging System (NMR). Therapeutic Equipments: Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, Physiotherapy: Microwave Diathermy, Ultrasound therapy.

#### **UNIT-V**

##### **Patient Safety & Computer Applications in Biomedical Field**

Precaution, safety codes for electro medical equipment, Electric safety analyzer, Testing of biomedical equipment, PC based medical instruments, computerized critical care units, Planning & designing a computerized critical care unit.

#### **Text Books**

1. Electronics in Medicine & Biomedical Instrumentation - Nandini K. Jog, 2nd Edition, 2013
2. Textbook of Biomedical Instrumentation - K.N.Scott & A. K .Mathur
3. Biomedical Engineering by S .N. Sarbadhikari
4. Hand book of Biomedical Instrumentation - R. S. Khandpur , TMH, 2<sup>nd</sup> Edition, 2002
5. Biomedical Instruments: Theory and Design - Walter Welko- Witz and Sid Doutsch
6. Biomedical Instrumentation & Measurements - Lesile Cromwell, Fred J. Weibell & Erich A. Pfeiffer, PHI

**M.Sc. ELECTRONIC SCIENCE**



**III-SEMESTER**  
**SEL 821 EMBEDDED SYSTEMS LAB**

Hours per week: 6

Credits: 2

Sessionals: 100 Marks

**Objective:** To design, construct and verify the embedded based systems.

**Any 12 from the following**

1. AC load controlling system by using Relay
2. Temperature display system using LCD and LM35 temperature sensor
3. LDR based Light controlling system
4. Object obstacle identification system using IR transmitter and receiver
5. LEDs Display and moving LEDs controlling system
6. Discrete Switches interface to read inputs
7. Buzzer indication system when an interrupt triggers from Switches
8. Data Acquisition using Embedded System
9. Memory Interfacing
10. Integration of some applications on single board
11. Realization of Boolean expression using ports
12. Generation of different waveforms
13. Serial communication programs
  - a. Send a ASCII message to serial port (verify receipt of this message on a computer)
  - b. Send characters from computer and verify receipt of echo.

**M.Sc. ELECTRONIC SCIENCE**  
**III-SEMESTER**  
**SEL 823 NETWORKING LAB**

Hours per week: 6  
Credits: 2

Sessionals: 100 Marks

**Objective:** To get real time experience on creation of networking of computers.

The Experiments will be conducted based on methodology adopted for the certification of the following courses

1. CCNA = Cisco Certified Network Administrator
2. MCSE = Microsoft Certified Systems Engineer
3. MCSA = Microsoft Certified Solution Developer
4. MCSA = Microsoft Certified Systems Administrator
5. MCP = Microsoft Certified Professional
6. MCDBA = Microsoft Certified Database Administrator
7. MCDST = Microsoft Certified Desktop Support Technician
8. MCTS = Microsoft Certified Technology Specialist

**M.Sc. ELECTRONIC SCIENCE  
IV-SEMESTER**

**SEL 825 Comprehensive Viva**

Credits: 2

Continous Evaluation:50 Marks

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 802 VLSI DESIGN & VHDL**

Hours per week: 4

End Examination: 60 Marks

Credits: 4

Sessionals: 40 Marks

**Objective:** To understand the basics of VLSI design and device simulation by VHDL.

**UNIT-I**

**Review of Microelectronics and Introduction to MOS Technology**

Introduction to IC Technology; The IC Era; MOS and Related VLSI Technology; MOS Transistors; Enhancement and Depletion Mode Transistor Actions, NMOS Fabrication; CMOS Fabrication; Latch-up in CMOS Circuits, CMOS Inverter, BiCMOS Technology. **MOS and BICMOS Circuit Design Process:** MOS Layer; Stick Diagrams; Design Rules and Layout; CMOS Rules, Symbolic Diagrams.

**UNIT-II**

**Basic Circuit Concepts**

Sheet Resistance Concept Applied to MOS Transistors and Inverters; Area Capacitances of Layers; Standard Unit of Capacitance  $C_g$ , Inverter Delays; Driving Large Capacitive Loads; Propagation Delays; Wiring Capacitances; Choice of Layers. **Scaling of MOS Circuits:** Scaling Models and Scaling Factors; Limitations of Scaling

**UNIT-III**

**Subsystem Design and Layout**

Architectural Issues; Switch Logic; Gate (Restoring) Logic; **Subsystem Design Process:** Illustration of Design Processes. Design of ALU, Adders. System Timing Considerations, Real World of VLSI Design; Design Styles and Philosophy; Interface with the Fabrication House; CAD Tools for Design and Simulation, Test and Testability

**UNIT-IV**

**VHDL**

Hardware Description Languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, Logical operators, Entity and Architecture declaration, Introduction to behavioral, dataflow and structural models **VHDL Statements:** Assignment statements, sequential Statements and process, Conditional statements, Case statements, Array and Loops, Resolution functions, Concurrent statements, Packages & Libraries

**UNIT-V**

**Combinational Circuit Design**

VHDL Models and Simulation of Multiplexers, Encoders, Decoders, Code converters, Comparators, Implementation of Boolean functions etc. **Sequential Circuit Design:** VHDL Models and Simulation of Shift registers, Counters etc. **Design of Microcomputer:** Architecture of a simple Microcomputer system, Implementation of a microcomputer system using VHDL. **Design with CPLDs and FPGAs:** PLDs, ROM, PLAs, CPLDs and FPGA.

**Text Books**

1. Basic VLSI Design - Douglas A. Pucknell and Kamran Eshraghian, 3<sup>rd</sup> Edition, PHI, 2007
2. A VHDL Primer - Bhasker; Prentice Hall, 3<sup>rd</sup> Edition, 1999
3. Digital System Design using VHDL - Charles. H. Roth, PWS , 1<sup>st</sup> Edition, 1998
4. Digital Design & Modeling with VHDL & Synthesis – KC.Chang; IEEE ComputerSocietyPress,1997
5. CMOS VLSI Design- Circuits and System Perspective - Neil H. E. Weste, David Harris and Ayan Banerjee, Pearson Education, 4<sup>th</sup> Edition, 2011

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 842 ADVANCED EMBEDDED SYSTEMS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** The student will be able to know advance topics in embedded system design using Linux.

#### **UNIT-I**

##### **Introduction to Embedded Hardware and Software**

Terminology, Gates, Timing diagram, Memory, Microprocessor buses, Direct Memory Access, Interrupts basis, Built interrupts, Shared data problems, Interrupt latency - Embedded system evolution trends. **Operating System:** Initialization, memory model, interrupts and exceptions handling,

#### **UNIT-II**

##### **Memory and Interfacing**

Memory: Memory write ability and storage performance, Memory types, composing memory, Advance RAM interfacing communication basic, Microprocessor interfacing I/O addressing, Arbitration multilevel bus architecture, Serial protocol, Parallel protocols, Wireless protocols

#### **UNIT-III**

##### **Embedded Linux**

Embedded Linux Environment Host and target, Host/target Development setups, Host/target Debug setups, Embedded Linux Architecture, Boot-configuration, Linux Hardware support and Development tool

#### **UNIT-IV**

##### **Kernel Architecture**

Bus & interfacing – I/O – GNU cross-platform development tools, Linux kernel Getting kernel – Kernel configuration – Kernel compilation – Kernel installation, Root file system & boot loader.

#### **UNIT-V**

##### **Embedded LINUX on ARM**

Embedded Boards Interfacing: ADC/DAC interface and its applications, PWM, RTC, LCD display, Temperature measurement circuit using LM 35, Programming with GPIO, Busses: I2C, CAN, USB, Serial

#### **Text Books**

1. An Embedded Software Primer - David. E. Simon, Pearson Education, 1<sup>st</sup> Edition, 2004
2. Embedded Systems Design: A Unified Hardware/ Software Introduction by - Frank Vahid and Tony Givargis, John & Wiley Publications, 2<sup>nd</sup> Edition, 2002
3. Karim Yaghmour, "Building Embedded Linux Systems", O'Reilly Publications, 2nd Edition,
4. Christopher Hallinam, "Embedded Linux Primer", 2nd Edition, Prentice Hall Publication,
5. Daniel W Lewis , "Fundamentals of Embedded Software: Where C and Assembly meet", 1st Edition, Prentice hall

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 844 ADVANCED NETWORKING**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** The student will be able to understand the core concept of advanced networking.

**UNIT-I**

**Network as a Platform, Architecture of the Internet**

The Network Architecture, Fault-Tolerant Network Architecture, Scalable Network Architecture, **Communicating over the Network**-The Platform for Communications, Protocols, Using Layered Models, Network Addressing. **Application Layer Functionality and Protocols**-Applications: The Interface between the Networks, Application Layer Protocols and Services Examples.

**UNIT-II**

**OSI Transport Layer**

Roles of the Transport Layer, TCP: Communicating with Reliability, UDP: Communicating with Low Overhead. **OSI Network Layer**- IPv4 136, Networks: Dividing Hosts into Groups, Routing: How Data Packets Are Handled, Routing Processes: How Routes Are Learned. Testing the Network Layer

**UNIT-III**

**OSI Data Link Layer**

Data Link Layer: Accessing the Media, MAC Techniques: Placing Data on the Media, MAC: Addressing and Framing Data. **OSI Physical Layer**- Physical Layer: Communication Signals, Physical Signaling and Encoding: Representing Bits, Physical Media: Connecting Communication

**UNIT-IV**

**Ethernet**

Overview of Ethernet, Ethernet: Communication through the LAN, Ethernet Frame, Ethernet MAC, Ethernet Physical Layer, **Hubs and Switches**-Legacy Ethernet: Using Hubs, Ethernet: Using Switches, Switches: Selective Forwarding, Address Resolution Protocol (ARP).

**UNIT-V**

**Planning and Cabling Networks**

LANs: Making the Physical Connection, Device Interconnections, Developing an Addressing Scheme, Calculating the Subnets, Device Interconnections. **Configuring and Testing the Network**- Configuring Cisco Devices: IOS Basics, Applying a Basic Configuration Using Cisco IOS, Verifying Connectivity

**Text Books**

1. Network Fundamentals- CCNA Exploration Companion Guide - Mark A. Dye, Rick, Mc Donald, Antoon W. Ruffi. Cisco Press
2. Cisco Certified Network Associate- Study Guide - Todd Lammle, 2<sup>nd</sup> Edition
3. Data Communications and Networking - Behrouz A Forouzan, Tata McGraw Hill

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 846 SENSORS**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To introduce various sensors, their operation and applications in real time systems.

**UNIT-I**

**Chemical Sensors**

Physical Sensors, Surface Micro Machined Capacitive Pressure sensor, integrated flow sensor, Chemical and Biochemical Sensors, Conductivity sensor, Hydrogen Sensitive MOSFET, Tri-Oxide Sensors, Schottky diode type sensor, Solid Electrolyte, Electrochemical Sensors. Sensor Matrix for Two Dimensional measurement of concentrations.

**UNIT-II**

**Optical Sensors**

Holography, Echolocation and bio-holography, Sensors used in space and environmental applications. Application in meteorology, Natural resources application sensor used in Instrumentation methods.

**UNIT-III**

**Biomedical Sensors**

Biological Sensors in Human Body, Different types of Transducer system, Physiological Monitoring, chemo receptors, Hot and Cold receptors, Sensors for smell, sound, vision, taste.

**UNIT-IV**

**Aerospace Sensor**

Gyroscope laser and fibre optic gyroscopes, Accelerometers. Laser, Aerospace application of laser, Resolvers, Altimeters, Angle of attack sensors, servos.

**UNIT-V**

**Advanced Sensor Design**

Sensor design a sensor characteristics, Design of signal conditioning devices for sensors. Design of 2 and 4 wire transmitters with 4, 20 Ma output. Pressure Sensor using SiSi bonding, Catheter pressure sensors, TIP pressure sensors, High pressure sensors, Silicon accelerometers

**Text Books**

1. Sensors Hand Book - Sabaree Soloman, McGraw Hill ,1998
2. Medical Instrumentation Application and Design - J.G. Webster Houghton Mifilin Co.
3. Introduction to Medical Equipment Technology - Carr and Brown, Addison Wesley, 1999
4. Optical Fibre Sensors, Volume 1 & 2 - Culshaw B and Dakin J (Eds), Artech House, Norwood, 1989
5. Guided Weapon Control Systems - P. Garnell, Pergamon Press, 1980

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 848 Non-Destructive Testing and Evaluation of Materials**

Hours per week: 4  
Credits: 4

End Examination: 60 Marks  
Sessionals: 40 Marks

**Objective:** To understand the basic principles and applications of several types of NDT methods and to detect the inhomogeneities in the metals structures.

**UNIT – I**

**Structure of Metals and Defects**

*Classification of Materials:* Metals, Ceramics, Polymers and Composites, Primary and secondary bonding in solids, *Basic Crystal Structures:* FCC, BCC, HCP (structures only). *Imperfections in crystals:* Point Defects, Dislocations, Interfacial Defects, Volume Defects. *Failure:* Fundamentals of Fracture, Ductile Fracture, Brittle Fracture, Crack Initiation and Propagation, *Different forms of corrosion:* atmospheric corrosion, galvanic corrosion, pitting corrosion, stress corrosion cracking.

**UNIT – II**

**Introduction to NDT and Surface Methods**

*Introduction:* What Is NDT, Scope And Limitations Of NDT, Industrial Applications Of NDT. *Visual Inspection Method:* Basic principle, direct and indirect methods, magnifiers, Microscope, Baroscope. *Liquid Penetrant Method:* Liquid penetrant test basic concepts, Liquid penetrant system, Testing Procedure. *Magnetic Particle Method:* Magnetic materials, magnetization and demagnetization of materials, Magnetic particle test equipment.

**UNIT – III**

**Eddy Current Testing (ECT)**

*Introduction,* Technical Overview, Potential of the Method, Magnetic Induction (Self and Mutual), Coil Impedance, Phasor Notation and Impedance, Eddy Current Density and Skin Depth, Impedance Plane Diagrams, EC Probes, Measurement Equipment, applications, advantages, limitations.

**UNIT – IV**

**Ultrasonic Testing (UT)**

Principle of wave propagation, Reflection, Refraction Diffraction, mode conversion and attenuation, Ultrasonic transducers, Ultrasonic Equipment, A,B,C-Scan Presentation, Test indication and inspection, Ultrasonic Testing, Advantages and limitations of Ultrasonic testing.

**UNIT – V**

**Radiography Testing (RT)**

X-Ray radiography principle, equipment and methodology, Types of industrial radiation sources and Application- Radiographic exposure factors and techniques, Gamma Ray equipment, Radiographic procedure, Radiograph Interpretation, Film Processing methods, Precautions against radiation hazards.



**Text Books**

1. William D. Callister, - Materials Science and Engineering An Introduction, 7<sup>th</sup> Edition, John Wiley & Sons, Inc.
2. C. Hellier - Handbook of Non-Destructive Evaluation, McGraw-Hill Professional, 1<sup>st</sup> edition (2001).
3. Jayamangal Prasad, C. G. Krishnadas Nair, Non-Destructive Test And Evaluation Of Materials, 2<sup>nd</sup> Edition, Tata Mcgraw-hill.
4. P.J. Shull, Nondestructive Evaluation - Theory, Techniques, and Applications, Marcell Decker Inc., NY 2002.

**References**

5. Baldev Raj, T. Jayakumar, M. Thavasimuthu, Practical Non-destructive Testing, 2<sup>nd</sup> edition, Woodhead Publishing, 2002,
6. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).
7. Ravi Prakash, Non-Destructive Testing Techniques, 1st revised edition, New Age International Publishers, 2010.
8. Elements of Metallurgy and Engineering Alloys , edited by Flake C. Campbell, ASM International, 2008

**M.Sc. ELECTRONIC SCIENCE**  
**IV-SEMESTER**  
**SEL 822 DSP and VHDL LAB**

Hours per week: 6  
Credits: 2

Sessionals: 100 Marks

**Objective:** To write DSP algorithms and simulation of devices using VHDL.  
**DSP Lab (Any 6 from the following)**

1. Convolution (Digital)
  - Linear Convolution
  - Circular Convolution
2. Correlation (Digital)
  - Auto Correlation
  - Cross Correlation
3. Difference Equation (Digital)
4. Impulse response of a given system for 2<sup>nd</sup> order (Analog)
5. Fast Fourier Transform (FFT) (Analog)
6. Discrete Fourier Transform (DFT) (Digital)
7. To Compute Power Density Spectrum of a Sequence (8-Point) using FFT (Analog)
8. Sampling Theorem (Analog)
9. Design of FIR Filters using Windowing Method (Analog and Digital)
10. Kaiser Window (Low Pass/High Pass Filter)
  - Rectangular Window (Low Pass/High Pass Filter)
  - Triangular Window (Low Pass/High Pass Filter)
11. Design of IIR Filters (Analog and Digital)
  - Butterworth (Low Pass/High Pass Filter)
  - Chebyshev (Low Pass/High Pass Filter)
12. Design of FIR Filters (Analog and Digital)

**VHDL Lab (Any 6 from the following)**

1. Realization of Basic Logic Gates using VHDL
2. R-S, D and J-K Flip- Flops
4. 8-to-1 Multiplexer and 1-to-4 De-Multiplexer
5. 4-Bit Full Adder/ Subtractor
6. 4-Bit Comparator
7. 8-to-3 Encoder and 3-to-8 Decoder
8. 32-Bit ALU Design
9. 4-Bit Binary to Grey Code Converter
10. 4-Bit Ring Counter
11. 4-Bit Up-Down Counter
12. 4-Bit Shift Register

**M.Sc. ELECTRONIC SCIENCE  
IV-SEMESTER  
SEL 892 PROJECT WORK**

Hours per week: 6  
Credits: 8

Continuous Evaluation: 200 Marks