M.Sc. ELECTRONICS

1. Introduction: -

M.Sc. Electronics is a four-semester course spread over the period of two years. The Department of Electronics, Shivaji University, Kolhapur, offers this course on its campus. It is designed to offer in depth knowledge of the subject starting from its basic concepts to the state-of-art technologies in use today. Students are also provided extensive laboratory training on the course content and the current requirements of industries and R & D. In the second year every student has to undertake a project, which is based on the specialization, he/she opts for. Four specializations are offered to the students in the areas of communications, Embedded Systems, Power Electronics and Computer Applications.

Special feature of the course is the inclusion of Mathematical Techniques at Sem-I and Signal and System at Sem-II with the objective of strengthening the mathematical foundations of Electronics students. In addition the course caters to the requirements of providing complete exposure to NET/SET syllabi for Electronics framed by the U.G.C.

2. Advantages of the course: -

The course revised in the year 2011 to be implemented from the academic year June 2012 provides exposure to the technologies in-vogue and trains them to take up projects relevant to the industrial needs, the R & D activities and self-employment opportunities. The student after passing the M.Sc. course has many opportunities of employment, self-employment and higher studies.

Employment Opportunities: -

- Electronics and Telecommunication Industries.
- I.T. Industries (India and Abroad).
- Process and Manufacturing Industries.
- Research and Development Laboratories.
- Employment in Academic and Other Govt. Organizations.

Educational Opportunities: -

- Higher studies in I.I.T, I.I.Sc., and CERE Pilani. For M.Tech. and Ph.D.
- Research in Shivaji University or any other University. M.Phil, M.Tech. and Ph.D.
- M.Tech. /M.E courses of Various Universities in India and Abroad.
- Higher Studies Like M.S. in relevant discipline and Research Opportunities in foreign universities.

− Joining Special courses on current technologies at Pune, Banglore, Mumbai, and CEDT.

3. Objectives of the Courses: -

The course is designed with a view to cater the present day requirements in Industries, R & D fields, higher studies and Self-employment. Moreover the course structure intends to inculcate strong laboratory skills so that the student can take up independent projects which will help to be an entrepreneur. The students passed out from the revised course will serve as quality human resource to take up the state-of-art research work of the Department.

4. Title of the Course : M.Sc. Electronics

5. Eligibility of the Course:

1.1.

Any students who has obtain the degree of B.Sc. of this University or the degree of any other statutory University recognized as equivalent, and has kept four semester terms in the University as a postgraduate student be admitted to the examinations for the degree of Master of Science in any of these subjects mentioned in R.M. Sc. No.3.

1.2

Any students shall be held eligible to the admission to the M.Sc. course provided he/she has passed the B.Sc. examination either with the principal subject or with a subsidiary / interdisciplinary / applied / allied subjects and has passed the entrance examination conducted by the University.

1.3

The students with B.Sc.(General Course) from other University shall be eligible if they qualify through the entrance examination and they score minimum 55% i.e. B+ marks in the subject at the B.Sc. examinations.

6. Fees for the Course

Class	Total Fees, Paying	Total Fees, EBC/PTC / STC/ Maji Saineek / FF	Total Fees, SC/NT/ST / OBC/ SBC	Total Fees, Paying	Total Fees, EBC/PTC / STC/ Maji Saineek / FF	Total Fees, SC/NT/ST / OBC/ SBC
M.Sc. Part I	Rs. 2790/-	Rs. 1610/-	Rs. 650/-	------	------	------
M.Sc. Part II	------	------	------	Rs. 2640/-	Rs. 1460/-	Rs. 500/-

For foreign students tuition fees is Rs. 5000/- per year.

Note : Fee Structure as revised by University from time to time.

7. Strength of the Students:

The intake capacity is 36 + 10 % of intake capacity permissible depending upon admission policy guidelines of the university for the academic year.

8. Admission/Selection procedure:

The admission to the M.Sc. Electronics course is by entrance examination. 50% of the marks scored in the entrance examination and 50% of the marks scored in the final year examination are added to prepare the merit list and admissions are given strictly on the basis of merit and following the rules of University for admission. The admission will be by round and the information regarding entrance examination result and the round of admission will be put up on the Shivaji University website: www.unishivaji.ac.in

9. Duration of the Course:

M.Sc. Electronics is a two year, four semester full time course.

10. Period of the Course:

From June to April end as specified in the University Calendar from time to time.

11. Teacher's Qualifications:

As prescribed by UGC from time to time.

12. Credit system implementation

M.Sc. Electronics is a four semester course. Every semester course consists of four theory courses and two laboratory courses each carrying weightage of 100 marks (4 credits). However, in the final semester, there will be one project in lieu of one practical. In order to qualify for two-year master's degree a student must acquire minimum of 40 credits (10 credits each semester) which are distributed as given below.

Sr. No.	Particular of Course	Credits
1.	compulsory courses	20
2.	elective courses	7
3.	practical courses including project	13
	Total Credits	40

The candidates securing grade point less than 4 (b grade) shall be declared to have failed in that subject. Under such circumstances his SGPA, CGPA and FGPA will not be calculated.

Credit as defined is the workload of a student in

1. Lectures
2. Practicals
3. Seminars
4. Private work in the library/home
5. Examination
6. Other assessment activities

The credit system permits students to

- Learn at their own pace.
- Choose electives from a wide range of elective courses offered by the University departments.
- Undergo additional courses and acquire more than the required number of credits.
- Adopt an inter-disciplinary approach in learning.
- Make best use of the expertise of available faculty in and out of department.

Semester - I

Paper	**Theory**		**Practical**		**Total**	**Credits**
	Internal	**External**	**Internal**	**External**		
ELE 11 Audio and Video Engineering	**20**	**80**	---	---	**100**	**4**
ELE 12- Power Electronics	**20**	**80**	---	---	**100**	**4**
ELE 13 – Microwave Technology – I	**20**	**80**	---	---	**100**	**4**
ELE 14 - Computer Organization	**20**	**80**	---	---	**100**	**4**
ELE 15 - Mathematical Techniques	**50**	---	---	---	**50**	**2**
Practical course - I	---	---	**20**	**80**	**100**	**4**
Programming Language I	---	---	**10**	**40**	**50**	**2**
Mini-Project I	---	---	**10**	**40**	**50**	**2**

SEM- II

Paper	**Theory**		**Practical**		**Total**	**Credits**
	Internal	**External**	**Internal**	**External**		
ELE 21- Control Theory	**20**	**80**	---	---	**100**	**4**
ELE 22- PIC and RTOS	**20**	**80**	---	---	**100**	**4**
ELE 23 - Analog and Digital Circuit Design	**20**	**80**	---	---	**100**	**4**
ELE 24 – Microwave Technology–II	**20**	**80**	---	---	**100**	**4**
ELE 25- Signals and Systems	**50**	---	---	---	**50**	**2**
Practical Course – II	---	---	**20**	**80**	**100**	**4**
Programming Language-II	---	---	**10**	**40**	**50**	**2**
Mini-Project II	---	---	**10**	**40**	**50**	**2**

SEM III

Paper	**Theory**		**Practical**		**Total marks**	**Credits**
	Internal	**External**	**Internal**	**External**		
ELE 31 Computer Networking	**20**	**80**	----------	----------	**100**	**4**
ELE 32- Digital Signal Processing	**20**	**80**	----------	----------	**100**	**4**
ELE 33 – ELECTIVE - I	**20**	**80**	----------	----------	**100**	**4**
ELE 34 – ELECTIVE - II	**20**	**80**	---------	----------	**100**	**4**
ELE 35- Technical Writing (Non-Credit)	--------	---------	----------	----------	-------	----
Practical course - III	----------	---------	**20**	**80**	**100**	**4**
Project	----------	----------	**20**	**80**	**100**	**4**

SEM IV

Paper	**Theory**		**Practical**		**Total Marks**	**Credits**
	Internal	**External**	**Internal**	**External**		
ELE 41 Mechatronics	**20**	**80**	----------	----------	**100**	**4**
ELE 42- Advanced Industrial Control	**20**	**80**	----------	----------	**100**	**4**
ELE 43 – ELECTIVE I	**20**	**80**	----------	----------	**100**	**4**
ELE 44 – ELECTIVE II	**20**	**80**	---------	----------	**100**	**4**
ELE 45 –Project Management (Non-Credit)	---------	----------	----------	----------	---------	------
Practical course – IV	----------	---------	**20**	**80**	**100**	**4**
Project	----------	----------	**20**	**80**	**100**	**4**

ELECTIVES

SEM –III

Elective Groups	Papers
Embedded System	ELE-33. FPGA Based System Design
	ELE-34. Microcontroller Based System Design and ARM Architecture
Communication	ELE-33. Digital Communication
	ELE-34. Satellite Communications
Power Electronics	ELE-33. Industrial Automation
	ELE-34. Microcontroller Based System Design and ARM Architecture
Computer Applications	ELE-33. Soft Computing
	ELE-34. Advances in Software Design

SEM –IV

Elective Groups	Papers
Embedded System	ELE-43. ARM Programming and Embedded Communication Protocols
	ELE-44. System Design using EDA Tools
Communication	ELE-43. Fiber Optics Communications
	ELE-44. Cellular Mobile Communications
Power Electronics	ELE-43. Power Electronics Circuit Analysis & System Design
	ELE-44. Advanced Drives and Controls
Computer Applications	ELE-43. Computer Algorithms
	ELE-44. Advanced Computer Networking.

How much time a student gives for the examination per semester?

1) Four Theory papers per semester each of 3 hours duration. Total time required is 12 hours

2) Two practical papers with 2 experiments per paper. Total 4 Practicals each of 3 hours duration. Total time required is 12 hours.

Total time for a semester examination is 12 + 12 = 24 hours.

Time required for the other activities.

- Seminars – as per the requirement of the course
- Discussions - as per the requirement of the course
- Library – Book issue, Journal reference, Internet access. Reading magazines and relevant information
- Private work – Project material, Books purchase, Xerox, availing outside facilities etc
- Home – Study, Notes preparation, Journal Writing, Computations etc.

Types of credits

1. Credit by examination – Tests (theory and Practicals), Seminars
2. Credit by non examination –Proficiency in state National and International sports achievements, Social service (NSS), Military services (NCC), Colloquium and debate, Cultural programs etc.

Credits by lectures and practicals

- 1 credit is equivalent to 15 contact hours
- Total instructional days as per the UGC norms are 180
- For the M.Sc. course there are 4 theory papers with 4 hours teaching per week Therefore the instructional days for theory papers in a semester are 4 x 15(weeks) = 60 days.
- There are 2 practicals each of 3 hrs. duration for the one practical paper.
- There is 1 practical of 3 Hrs. duration for Programming language
- There is 1 Miniproject of 3 Hrs. duration.
- The total practical workload is of 12 hours. Thus the instructional days for the practical course of 4 practicals are 2(practical papers) x 15 = 30 days.
- The time for which a student is busy in a semester is 60(theory) + 30(practical) = 90 days.
- With 4 credits per subjects there will be 4 x 4 = 16 credits for the theory papers and 4 x 2 = 8 credits for the practicals. Every practical /project of 50 marks carries 2 credits.

- Number of credits for the M.Sc. course per semester will be 16+8 = 24.
- Total number of credits for the entire M.Sc. course will be 4 x 24 = 96.

At M.Sc. I and II the students are taking two courses in Mathematical Techniques. For which there shall be 2 credits at SEM-I and 2 credits at sem-2. These 4 credits at M.Sc. - I will be awarded on the basis of unit-wise tests conducted internally by the department for these two papers.

Total credits for M.Sc. Course = 96 + 4 = 100.

- Total credits for the M.Phil. Course are 24

Sr. No.	Particulars of Course	Credits
1.	Theory	12
2.	Seminar	02
3.	Dissertation	08
4.	Viva-voce	02
Total Credits		24

The implementation of the credit system:

- Under the credit system every semester duration will be of at least 15 weeks.
- The examination must be scheduled in one month's time.
- The students must get at least 3 weeks time for the examination preparations.
- Every theory paper syllabus should consist of 4 units (sub units allowed) each carrying 1 credit.
- In order to have uniformity in the credit transfer internal examination, all the P.G. departments shall have equal weightage of 80 external +20 internal.

Theory paper	Contact hours	credits
Unit –I (sub units if any)	15	1
Unit –II (sub units if any)	15	1
Unit –III (sub units if any)	15	1
Unit –IV (sub units if any)	15	1

- **The practical course credit distribution for Sem I and II**

Practical paper	practical	contact hours	credits	no of practicals
Unit –I	1	3	2	6
Unit –II	2	3	2	6
Unit –III	Programming Language	3	2	6
Unit –IV	Miniproject	3	2	6

- **The practical course credit distribution for Sem III and IV**

Practical paper	practical	contact hours	credits	no of practicals
Unit –I	1	3	2	6
Unit –II	2	3	2	6
Unit –III	Project	3	2	6
Unit –IV	Project	3	2	6

- A project of 100 marks will carry 4 credits. Where a project of 100 marks is offered to the student, the student will have to perform 1 project and 1 practical paper (two practicals) for semester III and IV. Time for the explanation for the practical course (contact hours) will be one week (12 hrs).
- This makes the practical workload of a student equal to 30 days in a semester.

Grades, grade point and average grade points calculations

- Table showing the grades, grade points and marks scored by a student

Grades	Grade points	Marks out of 100
A+	9	91 to 100
A	8	81 to 90
A-	7	71 to 80
B+	6	61 to 70
B	5	51 to 60
B-	4	41 to 50
C+	3	31 to 40
C	2	21 to 30
C-	1	11 to 20
F	0	0 to 10

Seminar Grade Point Average (SGPA):-It is a semester index grade of a student.

1. Seminar Grade Point Average (SGPA):-It is a semester index grade of a student.
   SGPA = (g1xc1) + (g2xc2) +----- + (g6xc6)/ Total credits offered by the student in a semester.

2. Cumulative Grade Point Average (CGPA):- It is a cumulative index grade point average of a student
   CGPA = (g1xc1) + (g2xc2) +----- + (g6xc6)/ Total number of credits offered by a student upto and including the semester for which the cumulative average is required.

3. Final Grade Point Average (FGPA):- It is a final index of a student in the course

   FGPA = $(n / \sum ci \times gi) / (n/ cl)$

   Where ci - credit of the course (paper) (4)
   gi - grade pints secured (see the table for conversion)
   n - number of courses(number of papers offered)
   cl - Total number of credits for the entire M.Sc course (96)

Illustration with an hypothetical case:

For M.Sc I.(or II/II/IV)

1. Papers	I	II	III	IV	Practicals	I	II	III	IV
2. Credits	4	4	4	4		2	2	2	2 = 24
3. Grade points obtained	7	6	8	6		7		7	= 41
4. ∑ ci x gi	28	24	32	32		28		28	= 164
5. ∑ ci x gi / cl	= 164 /24 = 6.83								
6. Overall grade	= 6.83								

The cumulative grade point average is the sum of SGPA of a student in every semester.

Suppose it is 164 (6.83) for Sem-I, 170 (7.08) for Sem-II, 168(7.0) for Sem-III and 176(7.33) for Sem-IV ,

The cumulative average for Sem -I and Sem-II will be = 334/48 = 6.958 = 6.96.

Final Grade Point Average for all the semesters = 678 /96 = 7.0265 =7.03

Rules to obtain the credits:

1. A student from the same department only will be eligible for opting for the Elective of his/her choice.

2. It will be mandatory for a student admitted for a Elective Group to opt for at least three papers related to that Elective Group. One paper can be offered as credit from other elective group.

3. A student from the other department will be offered credits of his choice in multiples of 4. A theory paper or the practical course can be offered as the credit. However number of such admissions will depend upon the seats available, classroom seating capacity and the laboratory facilities.

4. Core Courses - Core courses are those, knowledge of which is deemed essential for students registered for a particular Master's programme. As such all core courses shall be mandatory and a student must pass in all the core courses prescribed for the programme. Core courses shall be uniformly spread over all four semesters.

5. Elective/specialization Courses - Elective courses are intended to:

- Allow students to specialize in one or more branches of the broad subject area; or
- Acquire knowledge and skills in a related area that may have applications in the broad subject area; or
- Bridge any gap in the curriculum and enable acquisition of essential skills (e.g. statistical,

computational, language, communication skills, etc); or

- Help pursue an area of interest to the student

6. Students are encouraged to have credits from the Management course.
7. Students can select any one elective group for SEM-III and SEM- IV.
8. Students are able to take any one paper from any other elective group during SEM-III and SEM- IV. (such a transfer is allowed based on the availability of seats)
9. Additional Credits can be obtained by any student during Sem III and IV (maximum 4 credits for each semester). These additional credits are not added to main credits and can be considered as extra credit.
10. Attendance: As per the university rule the attendance of the student must be at least 75 %. For attendance in the classroom or laboratory student will have to sign the attendance sheet. Merely 'P' for present or 'A' for absent will not be considered valid.
11. A teacher offering the course will be responsible for maintaining the attendance and the performance sheets of all the students offering that course.

Nature of the internal examination:

- For every theory paper there will be two internal examination(s) carrying 20 marks each. The average of the marks scored in these two examinations will be taken for the final score out of 20.
- The nature of this examination will be as follows.

There will be two questions asked in the internal examination.

Test-1 will carry 20 marks and it will be short answer type (any 5 out of 7 each carrying 4 marks)

Test-2 will carry 20 marks and it will be objective type (Part- A multiple choice and Part-B true or false)

No student will be allowed to take reexamination if he/she remains absent unless the reason is genuine. The decision regarding such cases will be taken in a Department committee meeting. The result of the internal assessment will be declared after one week from the date of examination. The student will be shown the answer papers by the concerned teachers.

The assessment of the practicals (examination): -

1) Every practical a student performs day to day in the laboratory shall be of three hours durations. A student will have to write his journal sheet for the experiment that he/she has performed in the laboratory on the very day and get the same checked from the concerned teacher before leaving the laboratory.

2) The experiments distribution semester-wise shall be as follows:

There will be at least 12 experiments for every semester up to IV semester for practical course I, II,III and IV.

For programming language I and II 18 practical each.

3. The total number of experiments to be performed by the student during his/her four semesters shall be as detailed below.

Semester	No of Experiment
I	12 (Practical Course – I) + 6 (Programming Language-I) + 6(Mini-project)
II	12 (Practical Course – II)+ 6(Programming Language-II) + 6(Mini-project)
III	12(Practical Course – III)+12(Project Phase I)
IV	12 (Practical Course – IV)+12(Project Phase II)

The project work will be distributed over the Semester III and IV.

M.Sc. ELECTRONICS COURSE

The course numbering is of the type '**ELE XY Title**' ELE stands for Electronics

X stands for semester

Y stands for paper number

Title stands for title of the paper

Structure and titles of the Semester Courses.

ELE-11 Audio and Video Engineering

Unit I

Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying systems, Equalizers and Mixers, Electronic music synthesizers, Commercial Sound, Theater sound system.

Unit II

Recording and Reproduction Systems: Disc recording, Magnetic recording, Video tape recording, VCD and DVD recording, Dish antenna, Distortion and Noise reduction in Audio and Video System, Wireless reading device and Wi-Fi

Unit III

Television systems: PAL, NTSC and SECAM.
Video Systems: Monochrome TV, Colour TV standards, Luminance and chrominance signals, Video Telephone and Video Conferencing, Video text service, Digital TV, HDTV, Satellite TV, 3DTV.

Unit IV

Developments: Image formatting, Data compression, UTRC test charts, and Remote controls.
Displays: TFT-LCD, LED, OLED, QLED.

Reference Books:

1. R.G. Gupta, Audio and Video System, Tata McGraw-Hill Publishing.
2. S. P. Bali, Colour Television, Theory and Practice, Tata Mc Graw Hill.
3. A. M. Dhake, Television engineering, Tata Mc Graw Hill
4. Bernard Grob, Basic Television Engineering, Mc Graw Hill.
5. Kiver, Kaufman, Television Electronics, Golgotia Publication
6. R. R. Gulati, Monochrome and Colour Television, New age International Pub.-2003
7. Guy E. Blelloch, Introduction to Data Compression, blellochcs.cmu.edu, Sep. 2010
8. Steven W. Smith, Digital Signal Processing (*Scientists and Engineers guide*); California Technical Publishing. California, Second edition; 1999

ELE- 12 Power Electronics

Unit 1. AC to DC Converter

Revision of single phase converter, power factor improvement, single phase dual converter and series converter, Three phase half converters with resistive and Inductive loads, three phase semiconverter with resistive and inductive load. Three phase full converter with resistive and inductive load.

Unit 2. Chopper

Introduction, Classification of choppers, Control strategies, stepup and stepdown chopper, Class A, Class B, Class C, and Class D chopper, , current and voltage commutated chopper.

Unit 3. Inverters

Introduction, Classification of Inverters, Transistorized Inverters, Single phase half bridge and full bridge with resistive and inductive loads, voltage control techniques for single phase inverters, series inverters, parallel inverters, Thyristerised inverters, three phase transistor inverters(120 & 180 conduction).

Unit 4. Power conditioners and applications

Transient suppression, EMI, RFI, CVI, voltage regulators, tap changing regulators, solid state regulators, UPS (online and offline), reliability of UPS system, Batteries used for UPS and Comparison of UPS system. Application of Power Electronics - RF heating, Dielectric Heating, Electronic Blast

Reference Books :

1. Power Semiconductor drives-S.B.Dewan, G.R.Sleman, A.Strauphan (Wiley Int.Publ.-John Wiley Sons.)
2. Power Electronics – By P.C.Sen.
3. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson Education India, 01-Sep-2003
4. Power Electronics –C.W.Lander(MHI Publication

ELE- 13 Microwave Technology- I

Unit 1 : Electromagnetic Waves

Microwave spectrum, Microwave applications, electric field, magnetic field, Maxwell's equations, Conditions at a boundary surface, em waves in in a homogeneous medium- solution for free-space conditions, uniform plane-wave propagation, uniform plane waves, wave equations for a conducting medium, Sinusoidal time variations, conductors and dielectrics, polarization, reflection by perfect conductor-normal incidence, reflection by a perfect conductor-oblique incidence, reflection by perfect dielectric-normal incidence, reflection by a perfect insulator, conductor-oblique incidence, Poynting vector

Unit 2 : Transmission Lines

Distributed constants of a line, A-C steady state solution for Uniform line, Variation of Zo, α and β with frequency, Various exponential forms of A-C steady state solution, solution in terms of Eg, Zg and Z_R, hyperbolic form of the solution, Interference and standing wave patterns, insertion ratio and insertion loss, Half-wavelength and Quarter wavelength lines, short sections as circuit elements, measurement of standing waves, impedance matching, Coaxial connectors, Smith chart

Unit 3 : Waveguides, cavity resonators* and *Passive Microwave Devices

Solution of wave equations in rectangular and circular waveguides, TE and TM modes, power loss and power transmission, excitation of modes, characteristics of standard waveguides, field components of rectangular cavity resonators, expression for Q.

Passive Microwave Devices

Terminations, Attenuators, Phase changers, directional couplers, Hybrid Circuits, Faraday rotation, Gyrator, Isolator, circulator, S parameters

Unit 4 : Microwave Tubes and Solid state Devices

Limitations of conventional tubes at microwave frequencies, Klystrons-Reentrant Cavities, velocity-modulation process, bunching process, output power and beam loading, Multicavity Klystron Amplifiers-beam-current density, output current and output power of two-cavity klystron, Reflex Klystrons-velocity modulation, power output and efficiency, electronics admittance, Helix Traveling-wave tubes(TWTs)-slow wave structures, amplification process, convection current, axial electric field, wave modes, gain consideration, Magnetron Oscillators- cylindrical magnetron

Microwave solid state devices - Tunnel diode, GaAs diode, LSA diode, InP diode, CdTe diode, Read diode, IMPATT diode, TRAPATT diode a d BARITT diode.

Reference Books :

1. Peter A. Rizzi, *Microwave Engineering: Passive Circuits.* New Delhi : PHI, 2001

2. Edward C. Jordan, *Electromagnetic waves and Radiating Systems*. New Delhi : Prentice-Hall of India Pvt. Ltd., 2003

3. Walter C. Johnson, *Transmission lines and Networks*. New Delhi : McGraw- Hill Book Comp., 1988

4. John D. Ryder, *Networks Lines and Fields.* New Delhi : PHI, 1983

5. F. E. Terman, *Electronic and Radio Engineering*. New York: McGraw Hill Book Comp. 1955

6. H.R.L. Lamont, *Waveguides.* London : Methuen and Company Limited, 1963

7. Samuel Y. Liao, *Microwave Devices and Circuits*. New Delhi : PHI, 2001

8. Robert E. Collin, *Foundations for Microwave Engineering.* New Delhi : McGraw Hill Book Company,

9. D.M.Pazar, *Microwave Engineering,* Singapore : John Wiley and Sons (ASIA) Pte. Ltd., 2004

ELE- 14 Computer Organization

Unit 1:

Introduction : Computer system organization – hardware and software components, Operating system, Computer booting process, Instruction set architectures, Chronology of Microprocessor Development w.r.t. CISC families such as INTEL, AMD and MOTOROLA, RISC families, development of POWER PC, Alpha SPARC. Overview of Operating systems.

Unit 2:

Fundamental Architectures: Defining a Computer Architecture, Von Neumann and Harvard Architectures, bus topologies, pipelining, Superpipelining, Superscalars, Very Long Instruction Word (VLIW) architectures, multithreaded processors.

Unit 3:

Parallel Processors – Flynn's taxonomy. SIMD, MIMD and multi-computer approaches.

Implementation Considerations: memory technologies, Hierarchical Memory Systems, caches, prefetching techniques, virtual memory, pipelining, ternary logic, packaging considerations, wafer scale integration.

Unit 4:

Implementation of Functional Units: Memory Management, Arithmetic Logic Unit, Floating Point Unit, Branch Unit, Vector Unit, Load/Store Unit. Development Tools: Microcomputer Development Systems (MDS), In Circuit Emulator (ICE), Assembler, Editors, Logic Analyser.

Text / Reference Books:

1. Linda Null and Julia Lobur, The Essentials of Computer Organization and Architecture, ISBN:076370444x, Jones and Bartlett Publishers © 2003

2. David A. Patterson, John L. Hennessy, Computer Organization and Design, The Hardware/Software Interface, Third Edition (The Morgan Kaufmann Series in Computer Architecture and Design), Publisher: Morgan Kaufman, ISBN-10: 1558606041.

3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, McGraw Hill Higher Education, Fifth Edition

4. Jerry C. Whitaker (Editor), The Electronics Handbook, CRC Press and IEEE Press (1996), Section VII: Microelectronics and Section XIX: Computer Systems

5. Stalling, Computer Organization

6. D.V. Hall, Microprocessors and Interfacing, McGraw Hill (1986)

7. Barry B. Brey, The Intel Microprocessors, Prentice Hall Of India Ltd. (1997)

ELE - 15 Mathematical Techniques

Unit 1 – Functions, Limits and Continuity:

Real functions and their graph, concept of limit of function, concept of continuous function.

Unit 2 – Differentiation:

Derivative at a point, interpretation of a Derivative at a point, derivative of a function. Differentiability, product rule, quotient rule, derivative of implicit and logarithmic function.

Unit 3 – Integration:

Infinite integrals, geometrical interpretation, properties of indefinite integrals. Integration by parts, Partial fraction, substitution.

Unit 4 – Fourier Series:

Definition of Fourier Series, calculation of coefficients in easy cases, elementary proportion, Fourier series exponential term, Fourier analysis of half, full wave rectifiers, sweep circuits.

Unit 5 – Laplace Transform:

Laplace Transform and its existence, Laplace Transform of standard functions, properties of Laplace Transform, Laplace Transform of periodic functions, Laplace Transform of some special functions, inverse Laplace Transform, circuit analysis using Laplace Transform (R, RC, LC, RLC circuits).

Reference Books:

1. Numerical Mathematical Analysis, J.B. Scarborough, Oxford and IBM Publishing Company (1979)

SEM - II

ELE- 21 Control Theory

Unit 1: Introduction:

Basic Concepts of Control System, Open loop and Closed loop systems, Classifications, effect of feedbacks on Control System performance. Transfer function, modeling and representation of Control system, concept of pole and zero, Linear mathematical physical systems, Electrical analogy, Block reduction techniques, Signal flow graph, Mason's gain formula.

Unit 2: Time Domain Analysis and stability

Type and Order of Control system, Typical tests signal, Time Response of first and second order systems to unit step input. Steady state errors. Time Domain Specifications of Second Order System, Dominant Closed loop Poles of Higher Order Systems. Concept of Stability: absolute, relative and marginal, nature of system response, stability analysis using Hurwitz's criterion, Routh's criterion. Basic properties of Root Loci, construction of Root loci. Angle and magnitude condition for stable systems, concept of inverse root locus and root contour.

Unit 3:. Frequency Domain and State Variable Analysis

Steady state response of a system to sinusoidal input, Relation between time and frequency response for second order systems. Frequency response specifications. Stability Analysis with Bode Plots, Polar Plots, conformal mapping, Nyquist stability criterion. Introduction to state space analysis, State space representation for i) Electrical Network ii) nth order differential equation iii) Transfer function. State model from transfer function using: Direct, parallel, cascade, decomposition method.

Unit 4: Control system components and controllers (only theoretical treatments)

Modeling and transfer function of control system components- Potentiometer, DC and AC Servomotors, gear trains, tacho-generators. Design concepts of P, PI, PD, PID controllers, Compensator Networks-lag and lead.

Reference Books:

1. I.J. Nagrath, M.Gopal "Control Systems Engineering", 5th Edition, New Age International Publication

2. Ogata Katsuhiko, "Modern Control Engineering", 4th Edition, PHI.

3. Kuo B.C. Automatic Control System, PHI, New Delhi

4. Schaum's Series book "Feed back Control Systems".

5. Les Fenical "Control Systems", 1st Edition, Cengage Learning India.

6. Norman S. Nise "Control Systems Engineering", 4th edition, Wiley

7. Samarjeet Ghosh, "Control Systems Theory & Applications", 1st edition, Pearson education.

8. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education.

9. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.

ELE- 22 PIC and RTOS

Unit 1)

Introduction to microchip PIC microcontroller: PIC microcontroller features, scaling of PIC MCU families, overview of baseline, midrange, enhanced midrange, and high-end core devices.

Core architecture: PIC Architecture, Program memory, Addressing Modes, Instruction set.

MPLAB IDE overview: Using MPLAB, Toolbars, Select Development Mode And Device Type, Project, Text Editor, Assembler, MPLAB Operations.

Unit 2)

PIC MCU Hardware: reset, clock, control registers, register banks, program memory paging, Ports, interrupts, Timer and Counter, watchdog timer, power up timer, sleep mode, state machine programming.

Overviews of PIC tools – Development softwares, compilers, debug tools.

Unit 3)

Introduction to RTOS, Scheduler, objects, services. Tasks, task states and scheduling, synchronization, communication and concurrency.

Kernel objects: Semaphores, queues, pipes, event registers, signals, and condition variables.

Exceptions and interrupts: Introduction, Exception v/s Interrupt, Applications of exceptions and interrupts.

Unit 4)

RTOS concepts: Timer and timer services: Introduction, Real-time clock and system clock, Programmable interval timers, Timer ISRs, Timing wheels, soft timers.

I/O subsystem: Basic I/O concepts, The I/O subsystem. Memory Management: Introduction, Dynamic memory allocation in Embedded systems, Fixed-size memory allocation, blocking v/s non-blocking memory functions, H/W memory management units

Reference Books:

1. Ajay V Deshmukh, Microcontrollers: theory and applications, TMH. New Delhi, 2006

2. Myke Predko, Programming & Customizing PICmicro Microcontrollers, TMH, 3rd edition, 2008. ISBN: 9780070223509.

3. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers, Newnes. 2007 ISBN-10: 0750686154

4. David W Smith, PIC in Practice, Second Edition: A Project-based Approach, Newnes.2006 ISBN-10: 0750668261

5. John Morton, PIC: Your Personal Introductory Course, Third Edition, Newnes.2005 ISBN-10: 0750666641

6. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, CMP Books. 2003 ISBN-10: 1578201241

7. David E. Simon, An Embedded Software Primer, Addison-Wesley. 1999 ISBN-10: 020161569X

8. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 2nd Edition McGraw-Hill Education, 2009 ISBN-10: 0070151253

9. Jean J. Labrosse, MicroC OS II: The Real Time Kernel, Publisher: CMP Books, ISBN-10: 978157820103

ELE- 23 Analog and Digital System Design

Unit I

Zener series and shunt regulators, transistors as series and shunt regulators, regulator design with discrete components and IC 741/78xx, current sources and their design with discrete components and ICs, SMPS design.

Unit II

Design of multivibrators, (AMV, MMV, BMV) using ICs (555, 741), schimitt trigger, triangular waveform generator, design of oscillators (wein bridge, phase shift colpitt, harltey) using 741, PLL IC LM565, VCO LM566, analog multiplexer IC4051/52, design of RF tuned amplifier,

Unit III

CMOS-TTL and TTL-CMOS interfaces, design of counter using FF and counter ICs, Oscillator design using Schmitt trigger (7414), inverter and NAND gate, MMV using gates and ICs (74/54121, 74221), design of binary to gray code converter, design of BCD to excess-3, excess-3 to BCD converter, design of full adder using MUX, design of 16-1 using 4 4-1 MUXs, design of parity checker, memory interfacing, RAM ROM and EEPORM

Unit IV

Design of ON OFF, proportional and PID controller, design of capacitance and inductance meter, design of DVM using 7107, design of frequency synthesizer, design of digital multimeter.

Reference Books:

1. Introduction to system design using ICs- B.S. Sonde, Wiley Western Ltd.
2. Circuit Consultants Handbook , Hemmnigway
3. Microprocessor and Microcontroller – BPB handbook
4. Digital Fundamentals, Floyd, USB, New Delhi
5. Designing with OP-AMP analog and digital ICs, S.Francio, McGraw Hill.
6. Application and Design with analog ICs, J.Michel Jacob, Printice Hall of India

ELE- 24 Microwave Technology - II

Unit 1 : Strip lines and MICs

Microstrip Lines-characteristic impedance, losses, Quality factor Q, Parallel Strip Lines-distributed parameters, characteristic impedance, attenuation losses, Coplanar Strip Lines, Shielded Strip Lines

Technology of MMICs-materials, processes involved in fabrication of MMICs, epitaxial growth of semiconductor layer, growth of dielectric layers, diffusion, ion implantation, electron beam technology for pattern delineation

Technology of Hybrid MICs - dielectric substrates, thick film technology and materials, thin film technology and materials, methods of testing, encapsulation, mounting of active devices, Lumped elements for MICs - design of lumped elements, fabrication of lumped elements, circuits using lumped elements, comparison with distributed circuits

Unit 2 : Microwave Measurements

Detection of microwave power, Measurement of microwave power - bridge circuit, thermistor parameters, waveguide thermistor mounts, barretters, theory of operation of barretters, direct reading barretter bridges, Measurement of wavelength – single line cavity coupling system, transmission through two line cavity coupling system, Frequency pulling by reactive load, Typical wave meters, measurement of VSWR, measurement of attenuation – Definition of Attenuation, Methods of Measurement

Unit 3 : Microwave Antennas

Classification of microwave antennas, General characteristics of microwave antennas, E plane and H plane sectoral horns, Pyramidal horn, methods of analyzing reflector operation, design of paraboloid of revolution by aperture method, exciters for paraboloids of revolution, Casegrain Reflectors

Unit 4 : Radar and Radio Aids to Navigation

Radar equation, Radar receiver, Radar transmitter, Pulse radar, Duplexer, Doppler Effect, CW radar, FMCW radar, MTI radar, conical-scan tracking radar, Loran, Radio Range, Aircraft landing systems, Radio Direction Finding,

Reference Books :

1. Samuel Y. Liao, Microwave Devices and Circuits. New Delhi : Prentice-Hall of India, 2001

2. K.C. Gupta and Amarjit Singh, Ed., Microwave Integrated Circuits, Wiley Eastern Ltd. 1978
3. Carol G. Montgomery, Ed., Techniques of Microwave Measurement, Vol.1. New York : Dover Publications, Inc., 1966
4. Edward L. Ginzton, Microwave Measurements, New York : McGraw-Hill Book Company, Inc., 1957
5. A.Z. Fradin, Microwave Antennas. Oxford : Pergamon Press, 1961
6. F. E. Terman, Electronic and Radio Engineering, New York : McGraw Hill Book Company, 1955
7. Merill I Skolink, Introduction to Radar Systems, New Delhi : TMH Publishing Comp., 1997
8. Constantine A. Balanis, Antanna Theoty : Analysis and Design, Singapore : John Wiley and sons (ASIA) Pte. Ltd., 2002
9. Annapurna Das and Sisir K.Das, Microwave Engineering, New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2000

ELE- 25 Signals and Systems

Unit 1: Introduction

Introduction to signals, Classification of signals, Elementary signals, Signal operations, Signal implementation with MATLAB, Introduction to systems, Examples of systems, Classification of systems.

Unit 2: Continuous-time systems

Continuous-time signals and systems, Time-domain analysis of LTIC system, Representation of LTIC systems, Impulse response of a system, Convolution integral, Graphical method for evaluating the convolution integral, Properties of the convolution integral, Impulse response of LTIC system.

Unit 3: Fourier & Laplace Transforms and CT System

Signal representation using Fourier series, Orthogonal, Properties of exponential CTFS, Application of Fourier series, Continuous-time Fourier transform, CTFT for aperiodic signals, Inverse Fourier transform, Properties of the CTFT, CTFT of periodic functions, LTIC systems analysis using CTFT, MATLAB exercises, Laplace transform, Inverse Laplace transform, Properties of the Laplace transform, Solution of differential equations, Characteristic equation, zeros, and poles, Stable and causal LTIC systems, LTIC systems analysis using Laplace transform, Block diagram representations.

Unit 4: Case Studies

Continuous-time filters, Filter classification, Non-ideal filter characteristics, Design of CT low pass filters, Frequency transformations, Case studies for CT systems: Amplitude modulation of baseband signals, Mechanical spring damper system, Armature-controlled dc motor.

Reference Books:

1. Simon Haykin, Barry Van Veen- 'Signals & system' - IInd Edition Wiley publication
2. Michael J. Roberts.-'Fundamentals of signals & systems'- Tata McGraw Hill, 2007.
3. Alan V. Oppenheim, Alan S. Wilsky, S. Hamid Nawab -'Signals & system' -IInd Edition - Pearson Education.
4. Charles L. Philips, John M. Parr, Eve A. Rislein 'Signals, system & transform' , IIIrd Edition, Pearson Education.
5. B.P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford University Press, 2004.
6. Charles Phillips, "Signals , Systems and Transforms" , 3rd Edition, Pearson Education.
7. Nagoor Kani, Signal and Systems, Tata McGraw Hill Education Private Ltd, New Delhi, 3rd reprint, 2011

SEM III

ELE- 31 Computer Networking

Unit 1: Unix Operating System:

Introduction, applications Unix Shell, Kernel and Application layer, file system features and benefits, File Management in utilities: pwd, cd, ls, cat, mv, ln, rm, rmdir, find, cut and paste etc., Internal file structure, Directory and directories used by Unix system, The Shell: Shell commands, I/O redirection, pipes and filters, pipe fitting, wildcard, matching background processing, shell script shell variables, shell as programming language, Unix vi editor.

Unit 2: Computer Networking:

LAN, Cabling and Topologies: Various transmission media, Twisted and untwisted pairs, coaxial cables, fiber-optic cables and characteristics, wireless LAN, Cabling Topologies: hierarchical, bus, ring, star, collapsed star, mesh. Origin and definition of LAN, types and uses of LAN, LAN components: NIC N/W cables, hubs, and OS, LAN types: MAP, ARCnet, Apple Talk etc., MAN and WAN, repeaters, Bridges, Routers, Gateways, Backbones etc.

Unit 3: The O.S.I. reference model:

N/W architecture, OSI reference model, data transmission, FDM, TDM, circuit switching, message switching, packet switching, hybrid switching, LAN static and dynamic channel allocation, LAN protocols, IEEE standard 802 for LAN, comprises of LAN's, The Internet: Introduction, Architecture,

Unit 4: Internet addresses:

Three primary classes of IP addresses, Dotted decimal notation, network, broadcast and loopback address. Internet Protocol (IP) – Connectionless Datagram Delivery, Routing, Error and Control Messages. User Datagram Protocol (UDP): Introduction, Format of UDP Messages, UDP encapsulation, UDP port numbers. Transmission Control Protocol (TCP): Reliability of transmission, ports, connections and endpoints, Concept of sliding windows, TCP segment format, Establishing, closing and resetting a TCP connection, TCP port numbers, ATM Network.

Applications: Remote Login (TELNET), File transfer (FTP), Electronic Mail, (SMTP), Future of TCP/IP – Ipv6 (introduction)

Reference Books:

1. Unix for you – Pramod Koparkar, Tata McGraw Hill
2. Unix utilities – R. S. Tare, McGraw Hill.

3. Understanding Unix – J.R. Groff and P.N. Weiberg, Que Tech. Publication, Singapore.
4. Internetworking with TCP/IP – Volume I, II, III, Author – Douglas E. Comer, Prentice Hall of India.
5. TCP/IP Protocol Suite, Behrouz A Forouzan, McGraw Hill.
6. Computer Networks, Andrew S. Tanenbaum, PHI.

ELE- 32 Digital Signal Processing

Unit 1: Discrete Time Signals and Systems:

Discrete Time Signals: Representation, Standard Discrete Time Signals, Classification of Discrete Time Signals and systems, Simple Manipulations of Discrete Time Signals, Sampling of Analog signals, Aliasing, Sampling Theorem. Discrete Time System: Block diagram representation of Discrete Time Systems, Convolution Sum, Causality and Stability condition in terms of the Impulse Responses.

Unit 2: Z Transform and Analysis of Discrete Time System

Z transform and ROC, Inverse Z transform, Analysis of LTI Systems in Z domain: System Function of LTI system, Transient and Steady state responses, Causality and Stability of System. Solution of difference Equations. Frequency Domain Sampling: Discrete Fourier Transform, IDFT, The DFT as Linear Transformation, Properties of the DFT, Use of DFT in linear filtering, FFT Algorithms: Radix2 DIT and DIF algorithms to compute DFT and IDFT.

Unit 3: Design and Realization of Digital Filters

FIR Filter Structure and Design: Direct and cascade forms, frequency sampling and linear phase structure. Windowing method. Frequency sampling method of design. IIR Filter structure and Design: Direct form, Cascade form, Parallel form. Impulse invariance, Bilinear Transformation method of design.

Unit 4: DSP Architecture:

Architectural features of DSP processors: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSP, Multiple access memory, Multiport Memory, Pipelining, Special addressing modes, On-chip Peripherals. Different generation of DSP Processors, Fixed point and floating point numeric representation and Arithmetic, Introducing the TI 6000 platform, Features of TMS320C62X Processors, EDMA, Port Interface, External Memory Interface (EMIF), Interrupts, Timers, Basic Interfacing Techniques.

Reference Books:

1. John G Prokis, Manolakis, "Digital Signal Processing-Principles, Algorithms and Application", 4th Edition, Pearson Education Publication.
2. Salivahanam, A Vallavaraj, C. Guanapriya, "Digital Signal Processing", 1st Edition, Tata McGrawHill, New Dehli

3. P.Ramesh Babu, “Digital Signal Processing”, 4th Edition, Scitech Publication.
4. A. Ambardar, Digital Signal Processing: A Mpdern Introduction, Cengate Learning India Pvt Ltd, New Dehli 2007
5. P. Pirsch,“Architectures for Digital Signal Processing” John Wiley publication, New Delhi
6. Phil Lapsley, “DSP Processor Fundamentals: architectures and Features”, Wiley publication
7. S.K. Mitra, “Digital Signal Processing Computer Based Approach”, TMH. New Dehli. 2009
8. B.Venkataramani, M. Bhaskar, “Digital Signal Processors”, Architecture programming & applications, TMH, New Dehli

SEM IV

ELE- 41 Mechatronics

Unit 1 : Introducing Mechatronics, Sensors and Transducers, Signal Conditioning, Digital Signals, Digital Logic

Unit 2 : Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems

Unit 3 : Basic System Model, System Models, Dynamic Responses of System, System Transfer Functions, Frequency Response

Unit 4 : Closed-loop Controllers, Input/Output Systems, Communication Systems, Fault Finding, Mechatronic Systems

Reference Books

1. William.Bolton, *Mechatronics, fourth Edition,* New Delhi : Pearson Education in South Asia, 2011

ELE- 42 Advanced Industrial Controls

UNIT 1. PROCESS CONTROL AND INSTRUMENTATION

Pressure Systems - Pressure measurement Scale, Pressure measurement Instrument, Nonlinear Pressure Sensors, Electronic Pressure Sensors. Pressure control System.

Temperature Control - Temperature Measurement, Temperature indication Devices, Electronic Sensors.

Flow Control - System Concept, Flow unit of Measurement, Solid and Fluid flow measurement, Electronic Sensors, Flow meter placement.

Level Control Systems - Method of Measurement, Electronic Sensors. **Analytical Instrumentation** pH measurement and control, Humidity

UNIT 2 Industrial Process Techniques and Instrumentation

Industrial Process Techniques - Batch Process, Continuous Process, Measurement Devices(Sensors), Controllers, Monitoring Instruments, Instrumentation Symbology. **Process Control Methods** : - Open loop Control, Closed loop control, single variable control loop, selecting a controller, on-off control, continuous control, tuning the controller

UNIT 3 Industrial Detection Sensors and Interfacing

Limit Switches, Proximity detectors, Inductive proximity switches, capacitive proximity switches, Hall Effect sensors, photoelectric sensors, method of detection, photoelectric package style, operating specifications, ultrasonic sensors, Sensor Interfacing.

PROGRAMMABLE CONTROLLERS

Introduction to Programmable Controllers – Industrial motor control circuits, Relay ladder logic circuits, Building a ladder diagram, Motor control starter circuit, PLC programming unit, Input output selection, processor unit, Addressing, relarion of data file address and I/O modules. Fundamental PLC Programming.

UNIT 4 :- INTELLIGENT CONTROL

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. **Fuzzy Logic -** Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases.

Fuzzy logic & Neural network applications to Drives –

Fuzzy logic applications:- Design of Fuzzy PI controller for speed control of DC motor

Neural network applications: - PWM Controller-Selected harmonic elimination PWM-Space vector PWM-Vector controlled drive-feedback signal estimation-speed estimation and flux estimation of induction motor

Reference Books:

1. Industrial Electronics - Circuits, Instruments and Control techniques, Terry Bartelt, Cengage Learning.
2. Neural Networks: A comprehensive Foundation – Simon Haykins, Pearson Edition, 2003.
3. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
4. Genetic Algorithms- David E Goldberg.

SEM III

Embedded System

ELE 33 FPGA Based System Design

UNIT 1.

Introduction, Basic Concepts, Digital Design and FPGAs, FPGA-Based System Design, Summary, Problems.

Introduction, Manufacturing Processes, Transistor Characteristics, CMOS Logic Gates, wires, Registers and RAM, Packages and Pads, Summary

UNIT 2. FPGA Fabrics.

Introduction, FPGA Architectures, SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabrics, Architecture of FPGA Fabrics, Summary.

UNIT 3. Combinational Logic.

Introduction, The Logic Design Process, Hardware Description Language, Combinational Network Delay, Power and Energy Optimization, Arithmetic Logic, Logic Implementation for FPGAs, Physical Design for FPGAs. The Logic Design Process Revisited. Summary.

UNIT 4. Sequential Machines.

Introduction, The Sequential Machine Design Process, Sequential Design Styles, Rules for Clocking, Performance Analysis, Power Optimization, Summary.

Architecture.

Introduction, Behavioral Design. Design Methodologies. Design Example, Summary.

Reference Books:

1. FPGA based System design by Wayne Wolf
2. Digital Systems Design With FPGAs And CPLDs By Ian Grout, Elsevier(2008)
3. Unleash the System On Chip Using FPGAs and Handel C By Rajanish K. Kamat, Santosh A. Shinde, Vinod G Shelake, Springer (2010)

SEM III

Embedded System

ELE 34 Microcontroller Based System Design and ARM Architecture

Unit 1:

Review of microcontroller solutions for control/measurement systems, their analog and digital features (8051, PIC, AVR, MSP430): architectural benefits, Key characteristics, Digital I/O, interrupts, timer/counters, RTC, analog comparator, ADC, PWM, UART, I2C, clock oscillators, low power operating modes, watchdog timer, ISP/IAP techniques.

Unit 2:

System Design:

Minimum system with 89C51/PIC microcontrollers to monitor frequency, voltage, displacement, liquid level, weight, speed, traffic light control system with software development for above.

Isolation Techniques:

Realys, opto-couplers and their specifications, Interfacing of Relays and opto-couplers with microcontrollers, isolation methods for heavy and a.c. loads.

Signal Transmission:

V to I and I to V Conversion, V to F and F to V Conversion, Electrostatic Shielding and Grounding.

Unit 3:

Transducers and digital sensors for temperature, pressure and speed, signal conditioning, Instrumentation Amplifiers for RTD, thermocouple, bridge and LVDT, System design with 89C51 for measurement and control of temperature, pressure, speed using ON/OFF, Proportional and PID modes, stability aspects of the system, s/w development.

Unit 4:

ARM Architecture:

Introduction to ARM microprocessor and its features, Architecture, Programming model, Processor Operating States, registers, Exceptions, ARM organization – 3-stage/5-stage pipelined ARM organization.

Reference Books:

1. Datasheets of 8051 (P89C51RD2), AVR (ATMEGA32), PIC (16F877),TI MSP430 microcontrollers.

2. The 8051 Microcontroller – K.J. Ayala, Penram International.

3. Microcontrollers: theory and applications By Ajay V Deshmukh, TMH.

4. Microprocessors application in Process control – S.I. Ahson, Tata Negraw Hill.

5. Transducer Interfacing Handbook, D.H. Sheingold, Analog Devices Technical Handbook Norwood, USA.

6. ARM System-on-chip Architecture, Steve Furber, Addison Wesley.

7. ARM Architecture Reference Manual, David Seal, Addison-Wesley.

SEM III

Communication

ELE 33 Digital Communications

Unit 1:

Signals Analysis:

Complex Fourier spectrum, Fourier transform, Properties of F.T, sampling theorem, random signals and noise, correlation and power spectrum.

Unit 2:

Digital Communication Systems:

A/D and D/A converter, Coded communication, AM, PWM, PPM, PCM, delta modulation, adaptive delta modulation, quantization and noise consideration.

Digital Transmission and Reception: Timing, base band systems, ASK, FSK, PSK, QAM.

Unit 3 :

Error detection and coding:

Parity check, CRC, Hamming distance, Hamming codes, Cyclic codes, line synchronization codes, Manchester code, NRZ coding, Walsh codes.

Unit 4 :

Case studies:

Paging system, cellular telephone, global positioning satellite, Facsimile, Videotext.

Reference Books:

1. Analog and Digital Communication systems- M.S. Roden, 3rd Edition, Prentice Hall of India.

2. Modern Digital and Analog Communication Systems- B.P. Lathi.

3. Communication Techniques for digital and Analog signals – M. Kanefsky, John Wiley and Son.

4. Telecommunication – T.H. Brewster, McGraw Hill.

5. Principles of Digital communication, Das, Chatterjee and Mallick, Wiley Eastern Ltd.

SEM III

Communication

ELE 34 Satellite Communications

Unit 1 : Satellite Systems

History of satellite communications, Orbital mechanics, Look angle determination, Orbital perturbations, Satellite subsystems – AOCS, TTC and M, power systems, communications subsystems, satellite antennas, Satellite frequency bands, satellite Multiple access formats

Unit 2 : Modulation, Encoding and Decoding

Analog modulation, Digital Encoding, Spectral shaping, Digital decoding, Error correction Encoding, Block Waveform Encoding, Digital Throughput.

The Satellite Channel

Electromagnetic field propagation, Antennas, Atmospheric losses, receiver Noise, Carrier to Noise ratios, satellite link analysis, Frequency Reuse by dual polarization, Spot beams in satellite downlinks.

Unit 3 : The Satellite Transponder

The transponder model, the satellite front end, RF filtering of digital carriers, Satellite signal processing, Transponder Limiting, Non linear satellite amplifiers, Effect of non linear amplification on digital carriers.

Satellite Ranging System

Ranging system, Component Range Codes, Tone Ranging Systems

Unit 4 : Multiple access formats

FDMA - FDMA system, Nonlinear amplification with multiple FDMA Carriers, FDMA, FDMA Nonlinear analysis, FDMA characterization, AM/PM conversion with FDMA, Satellite switched FDMA.

TDMA -The TDMA system, preamble design, Satellite Effects on TDMA performance, Network synchronization, SS TDMA.

CDMA - Direct Sequence CDMA system, Performance of DS CDMA, satellite systems, Frequency Hopped CDMA, Antijam advantages of spectral spreading, Code Acquisition and Tracking

Reference Books

1. Robert M. Gagliardi, Satellite Communications, New Delhi : CBS Publishers and Distributors, 2000
2. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, Satellite Communications, Singapore : John Wiley and Sons Inc. 2003
3. Dennis Roddy, Satellite Communications. New York : McGraw-Hill, 2001

SEM III

Power Electronics

ELE 33 Microcontroller Based System Design and ARM Architecture

Unit 1:

Review of microcontroller solutions for control/measurement systems, their analog and digital features (8051, PIC, AVR, MSP430): architectural benefits, Key characteristics, Digital I/O, interrupts, timer/counters, RTC, analog comparator, ADC, PWM, UART, I2C, clock oscillators, low power operating modes, watchdog timer, ISP/IAP techniques.

Unit 2:

System Design: Minimum system with 89C51/PIC microcontrollers to monitor frequency,
Isolation Techniques: Realys, opto-couplers and their specifications, Interfacing of Relays and opto-couplers
Signal Transmission: V to I and I to V Conversion, V to F and F to V Conversion, Electrostatic

Unit 3:

Transducers and digital sensors for temperature, pressure and speed, signal conditioning, Instrumentation Amplifiers for RTD, thermocouple, bridge and LVDT, System design with 89C51 for measurement and control of temperature, pressure, speed using ON/OFF, Proportional and
PID modes, stability aspects of the system, s/w development.

Unit 4:

ARM Architecture: Introduction to ARM microprocessor and its features, Architecture,
Programming model, Processor Operating States, registers, Exceptions, ARM organization – 3-stage/5-stage pipelined ARM organization.

Reference Books:

1. Datasheets of 8051 (P89C51RD2), AVR (ATMEGA32), PIC (16F877),TI MSP430 microcontrollers.
2. The 8051 Microcontroller – K.J. Ayala, Penram International.
3. Microcontrollers: theory and applications By Ajay V Deshmukh, TMH.
4. Microprocessors application in Process control – S.I. Ahson, Tata McgrawHill.
5. Transducer Interfacing Handbook, D.H. Sheingold, Analog Devices Technical Handbook Norwood, USA.
6. ARM System-on-chip Architecture, Steve Furber, Addison Wesley.
7. ARM Architecture Reference Manual, David Seal, Addison-Wesley.

SEM III

Power Electronics

ELE-34 Industrial Automation

Unit 1. Process Models:-

Static model dynamic models, Step response methods- two parameter model, three parameter model & four parameter model. Models for oscillatory system, method of moments. Disturbance models- measuring noise characteristics.

Controller Principles :- Process Characteristics - process equation, process load, process lag, self regulation Control system parameters- Error, variable range, control parameter range, control lag, dead time, cycling.

Unit 2. Tuning of Controllers :-

Control modes: - Discontinuous- two position, multi position, floating control Continuos – proportional, integral, derivative & composite modes Control paradigms- Cascade control., Criteria for controller tuning-specified decay ratio, minimum integral of absolute error (IAE), minimum integral of time & absolute error. (ITAE) closed loop response methods: ultimate method damped oscillation method Process reaction curve & open loop tuning.

UNIT 3: - Programmable Controllers and SCADA

PLC Basics: Programmable Controllers – functional diagram, operation, programming.

PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

PLC Programming. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

PLC Registers

SCADA - Supervisory control and Data Acquisition systems implementation considerations, energy control centres, software requirements for implementing the above functions.

Unit 4. Digital Controller design:

Controller Design techniques, Bode diagram method, PID controller, Root Locus Method – Root locus Plot, Controller design, State Space Method – Controllability Observability , Full-state feedback Regulators Tracker, Regulator design by pole placement, Controlling Voltage, Controlling Current, Control of Induction Motor

Reference book :

1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.
3. Power Electronics Essentials and Applications, L. Umanand, Wiley.

SEM III

Computer Applications

ELE - 33 Soft Computing

Unit 1: Introduction

What is soft computing? Definitions, Goals, Components of soft computing, Importance, Applications of soft computing.

Unit 2: Fuzzy Logic

Fuzzy Set: Crisp and non-crisp set, Capturing uncertainty, Definition of Fuzzy Set, Graphical Interpretations, Fuzzy Operations, Fuzzy Reasoning, Fuzzy Inference, Fuzzy Relation, Compositional Rule of Inference.

Unit 3: Artificial Neural Network

Biological Model, Information flow in neural cell, Artificial Neuron, Functions, Equations, Elements, Single and Multilayer Perceptrons, ART, Training and Learning Methods, Associative Memory.

Unit 4: Genetic Algorithm

What is GA? Why GA? Mechanics of Biological evolutions, Artificial Evolutions and Search Optimization: Taxonomy of Evolutions and Search Optimization – Enumerative, Calculus-based and Guided random search techniques, Evolutionary Algorithms (EAs), Typical case studies of Soft computing.

Reference Books

1. S. N. Sivanandam, S. N. Deepa,"Principles of Soft Computing", Wiley, India (P) Ltd., Ist Indian Edition, 2008
2. S. Rajsekaran, G. A. Vijayalaxmi Pai," Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and applications", PHI, New Delhi
3. Rajkumar Roy, Mario Koppen "Soft Computing and Industry: Recent Applications", Springer.
4. F.O. Karray & C.D. Silva, Soft Computing and Intelligent Systems Design-theory, tools and applications, Pearson Education
5. J.S.R. Jang, C.T. Sun & E. Mizutani, Neuro-Fuzzy and Soft Computing-A computational approach to learning and machine intelligence, Pearson Education

SEM III

Computer Applications

ELE-34 Advances in Software Design

UNIT 1. Introduction to Software Engineering

Introduction, Socio-technical Systems, Dependability, Software Processes, Software Requirements, RE Processes, Systems Models, Critical Systems Specification, Formal Specification

UNIT 2. Design Engineering & Software Development Methodologies

Architectural Design, Distributed Systems Architecture, Application Architectures Object-oriented Design, Real-time Systems, User Interface Design. Software Development Methodologies - Iterative Software Development, Software Reuse, CBSE, Critical Systems Development Software Evolution

UNIT 3. Software Management & Development

Verification and Validation, Software Testing, Critical Systems Validation, Managing People, Software Cost Estimation, Quality Management, Process Improvement, Configuration Management

UNIT 4. Alternative Paradigms

Extreme Programming, Agile Software Engineering, Clean Room Software Engineering, Introduction to Formal Methods, soft systems Advanced Software Engineering Process Software Process Improvement, Software Economics, Software Quality, Software Metrics, Software Maintenance, Risk management, Requirement Engineering

Reference Books:

1. Software Engineering, Ian Sommerville, 8th Edition, Addison-Wesley,2006,ISBN-10: 0321313798, ISBN-13: 9780321313799

2. Software Engineering: A Practitioner's Approach, 6/e, Roger S Pressman, McGraw Hill, 2005, ISBN: 0072853182

SEM IV

Embedded System

ELE 43 ARM Programming and Embedded Communication Protocols

Unit 1)

The ARM instruction set: Introduction, exceptions, conditional execution, Branch and branch with link, software interrupt, data processing instructions, multiply instructions, data transfer instructions.

Architectural support for HLLs: Data types, Expressions, Conditional statements, loops.

Embedded Communication Protocols:

Unit 2)

Inter-Integrated Circuit (I2C) BUS: I2C bus specification, general characteristics, bus signals, Address mechanism, Applications – microcontroller interfacing examples for I2C EEPROM, RTC, ADC, and digital temperature sensors.

Unit 3)

Serial peripheral interface (SPI): Introduction, Specifications, master slave configuration, applications - microcontroller interfacing examples for SPI EEPROM, RTC, ADC and digital temperature sensors.

Unit 4) Recent embedded protocols:

Controller Area Network (CAN): Specifications, basic concepts, Frame types, bus signals, Error handling, Addressing.

IButton devices, 1-wire protocol.

Reference books:

1. David Seal, ARM Architecture reference manual, Addison-Wesley Professional; 2nd edition, 2001. SBN-10: 0201737191
2. Steve Furber, ARM System-on-chip Architecture, Addison Wesley. (2nd Edition) 2000 ISBN-10: 0201675196
3. The I^2C-bus specification, http://www.semiconductors.philips.com/i2c, Philips semiconductor, 2000.
4. PIC/AVR datasheets for I^2C, SPI functions.
5. Overview and use of the SPI PICmicro Serial Peripheral Interface, Microchip Inc. http://www.microchip.com.
6. Robert Bosch GmbH, CAN Specification, 1997.

SEM IV

Embedded System

ELE 44 System Design using EDA Tools

1. FPGA Architecture

Introduction to Programmable logic, Basic Components of FPGA (LUT, CLB, Switch Matrix, IOB), Basic FPGA Architecture - Spartan 3e/6,Basics of Configuration (Configuration Process , Modes , Configuration Pins & Startup Sequence), Daisy chaining

2. FPGA Design Flow

Xilinx tool Flow – webpack, Reading Reports, Implementing IP cores – Core Generator, Pin Planning - Plan Ahead, Static timing Analysis, Global timing Constraints, Debugging - Chipscope Pro,

3. Optimal FPGA Design:

Synchronous Design Techniques, HDL Coding Techniques, FPGA Design Techniques, Synthesis Techniques & Implementation Options, Achieving Timing Closure, Identify the differences between behavioral and structural coding styles Distinguish coding for synthesis versus coding for simulation Use scalar and composite data types to represent information Use concurrent and sequential control structure to regulate information flow Implement common VHDL constructs (Finite State Machines [FSMs], RAM/ROM data structures)

4. Hardware Software co-design Methodology

Xilinx EDK flow, Soft-core and Hard-core , softcore- Microblaze Architecture, Hardware System design using Base system builder- Xilinx EDK,Software Design using Xilinx software developer kit,Hardware debugging – Hardware in loop using EDK Debugging , Software using realtime kernel.

Reference Books:

1. FPGA based System design by Wayne Wolf
2. Digital Systems Design With FPGAs And CPLDs By Ian Grout, Elsevier(2008)
3. Unleash the System On Chip Using FPGAs and Handel C By Rajanish K. Kamat, Santosh A. Shinde, Vinod G Shelake, Springer (2010)

SEM IV

Communication

ELE-43 Fiber Optics Communications

Unit 1:

Introduction: Historical developments, Optical fiber communication system, Principle of optical communication, Advantages of optical fiber communication, Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Cylindrical fiber.

Structure and types of optical cable: Structure of optical fibers, Single and multimode fibers, Step index and graded index optical fiber.

Unit 2:

Transmission characteristics of optical fibers: Mid-infrared and Far-infrared transmission, Inter-modal and Intra-modal dispersion, Overall fiber dispersion, Polarization.

Losses in optical fibers: Attenuation, Material absorption losses, Linear scattering losses, Non-linear scattering losses and Fiber bends loss and Joint loss.

Preparation methods of optical fibers: Liquid phase (melting) and Vapour phase deposition techniques.

Unit 3:

Optical fiber connection: Joints, Fiber alignment, Splices, Connectors, Couplers.

Optical sources: Absorption and emission of radiation, Einstein's relation, Population inversion, Optical emission from semiconductors, Semiconductor LASER, LED power and efficiency characteristics. Optical transmitter and receiver.

Unit 4:

Optical detectors: Optical detection principles, Absorption and emission, Quantum efficiency, Responsivity, Long wavelength cutoff, p-n photodiode, p-i-n photo diode, photo transistors.

Optical fiber measurements: Fiber attenuation measurements, Dispersion measurements, Refractive index profile measurements, Cut-off wavelength measurements, Numerical aperture measurements.

Reference books:

1. John M. Senior: Optical fiber communications, Principles and Practice, PHI.
2. Charles K Kao: Optical fiber systems, Technology design and applications, Mc- Graw Hill Int. Ed.
3. Gerd Keiser: Optical fiber communications, Mc-Graw Hill International Edition.
4. J. Gower: Optical fiber communication, PHI.
5. Franz and Jain: Optical communications: components and systems; Narosa Publishing House.

SEM IV

Communication

ELE-44 Cellular Mobile Communications

Unit 1: Introduction to Cellular mobile systems, Elements of Cellular radio system Design, specifications of analog systems, Cell coverage for signal and traffic

Unit 2: Cell-site antennas and mobile antennas, Co-channel interference reduction, Types of non co-channel interference, Frequency management and channel assignment

Unit 3: Handoffs and dropped calls, operational techniques and Technologies, switching and traffic

Unit 4: Introduction to digital systems, Digital cellular systems, Intelligent cell construction and Applications, Features of handset, SMS, Security

Reference Books

1. William C.Y. Lee, *Mobile Cellular Telecommunications : Analog and Digital Systems*, Singapore : McGraw-Hill, 1995
2. William C.Y. Lee, Mobile Communication Engineering, McGraw-Hill

SEM IV

Power Electronics

ELE 43 Power Electronics Circuit Analysis & System Design

Unit I: Power Electronics Circuit Analysis

I) AC – DC Converter II) DC to DC Converter III) DC to AC Converter

Unit II: Triggering Circuit Design

Design & trippering circuits for AC to DC Converter, DC to DC converter & DC to AC Converter. Magnetic concepts, design & line frequency and high frequency inductor and transformer. Design & Pulse transformer, General notes on magnetism.

Unit III: Design of AC to DC and AC to AC Converter

Half converter, Full Converter, Bridge Converter and AC to AC Converter with discrete firing circuits and microcontroller based firing circuits.

Unit IV: Design of DC to DC and DC to AC Converter

Design Thyristor, MOSFET and IGBT based chopper with conventional and microcontroller based control circuit. Design and thyristor based inverter and UPS with conventional control circuits and microcontroller based circuits.

Reference Books :

1. M.D.Singh, K B Khanchandani, Power Electronics, New Delhi : McGraw-Hill
2. M.A. Pai, Power Circuits and Electromechanics, Narosa
3. M.S. Jamil Asghar, Power Electronics, New Delhi : PHI
4. Muhammad H. Rashid, Power Electronics circuits, devices, and applications, Pearson Education
5. Vedam Subrahmanyam, Power Electronics, NEW AGE Publication
6. L Umanand, Power Electronics: Essential and applications, Wiley
7. P. S. Dhogal, Basic Electrical Engineering with Numerical Problems, New Delhi : McGraw-Hill

SEM IV

Power Electronics

ELE 44 - ADVANCED DRIVES AND CONTROLS

Unit 1: Basic of Electrical machines:-

D.C. motors, Types of D.C. motors, torque speed characteristics. Induction motors, Types of Induction motors. Synchronous machines and stepper motors.

Unit 2: D.C. Motor Control:-

Separately excited DC motors with rectified single phase supply- single phase semi converter and single phase full converter for continuous and discontinuous modes of operation. Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation. Closed loop control of phase controlled DC motor Drives: - Open loop Transfer function of DC Motor drive- Closed loop Transfer function of DC Motor drive –Phase-Locked loop control.

Chopper controlled DC motor drives, Closed loop control of chopper fed DC motor Drives :-

Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller

Unit 3: AC motor Control:

Voltage Source Inverter Fed Induction motor drives : - Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with slip regulation-Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive. Current Source Inverter Fed Induction motor drives : -

Current-Fed Inverter control-Independent current and frequency control-Speed and flux control in Current-Fed Inverter drive-Volts/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

Slip power recovery schemes: - Slip-power recovery Drives-Static Kramer drive-Phasor diagram-Torque expression-Speed control of a Kramer drive-Static scherbius drive**.** Vector control of **Induction Motor: -** Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation.

Unit 4: Stepper motors:-

Classification, types, modes of excitations, Drive requirements, Unipolar voltage ,drive for various reluctance, motor bipolar voltage drive for permanent magnet and hybrid step motors. Drives for specific applications: - Drive considerations for textile mills, steel rolling mills, cranes and hoist drives, cement mills, sugar mills, paper mills, coal mills, centrifugal pumps.

Reference Books:

1. Electronic drives- Concept & Applications –Vedam Subrahmanyam(THM)
2. Power Semiconductor drives-S.B.Dewan, G.R.Sleman, A.Strauphan (Wiley Int.Publ.-John Wiley Sons.)
3. Power Electronics – By P.C.Sen.
4. Power Electronics –C.W.Lander(MHI Publication
5. Power Electronics and Motor Control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press
6. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications

SEM IV

Computer Applications

ELE 43 Computer Algorithms

Unit 1.

Notation, functions and related theorems, The logarithmic function, Sets, permutations and combinations, Probability , Algorithms: Eciency, analysis and order, Efficient algorithms, Analysis of algorithms, Order, Solving recurrence relations, Induction, characteristic equations, and substitution methods, Extending results

UNIT 2 . Divide-and-Conquer

Definition, Applications: Binary search, merge sort, quicksort, More applications: Matrix Multiplication, Arithmetic with large numbers, Determining thresholds

UNIT 3. Dynamic programming- Definition, binomial coefficient

Applications: Shortest path, optimization problems, matrix multiplication

More applications: Binary search trees, traveling salesperson problem

UNIT 4. The greedy approach: Definition, Applications: Minimum spanning tree, shortest path, scheduling Greedy vs. dynamic programming;, Backtracking: Definition, Applications: the n-queens, sum-of-subsets, graph coloring, More applications: Hamiltonian circuit, 0-1 knapsack. **Computational Complexity:** Introduction, notation, and definitions, Sorting: Comparison of algorithms, lower bounds, sorting by distribution, Searching: comparison and interpolation techniques, searching in trees, hashing, The selection problem; Intractability : Definition, Three general problems, NP theory, Handling NP -Hard problems

Reference books:

1. Foundations of Algorithms Using C++ Pseudocode, Third Edition , by Richard Neapolitan and Kumarss Naimipour

SEM IV

Computer Applications

ELE 44 Advanced Computer Networking

UNIT 1

Introduction: Internet Architecture, End-to-End principle and Internet design, Emerging Data Link and Physical Layer Technologies **Applications:** HTTP, FTP, DNS, SMTP, Overlay Networks and Peer-to-Peer (P2P) , Systems, P2P File Sharing

UNIT 2

Transport: Transport Services, TCP and UDP, **IP Routing:** IP Addressing, Overview of Internet Protocols (e.g. IP, ICMP), Distance Vector, Link-State (OSPF), BGP, Multicast routing. **Link Layer and Local Area Networks** The Data Link Layer: Introduction, Services, Error Detection and Correction Techniques, Multiple Access Protocols and LANs, LAN Addresses and AR, Ethernet, Hubs, Bridges, and Switches, IEEE 802.11 LANs, PPP: The Point-to-Point Protocol, Asynchronous Transfer Mode (ATM), X.25 and Frame Relay.

UNIT 3

Congestion Control: Open-loop (Policing and Shaping), Closed-loop (TCP congestion control algorithms Reno, Tahoe, Vegas); Network Assisted – ECN; Active Queue Management (RED). **IP QoS:** QoS Schedulers (WFQ, DRR, PQ), IP QoS Architectures, IntServ and RSVP, DiffServ, Router Design for IP QoS, Policy-based QoS Management. **Traffic Engineering:** Principles of IP Traffic Engineering, MPLS.

Unit 4

Multimedia Networking: Multimedia Applications, Protocols for Multimedia Support, RTP, RTCP, RTSP, **Network Management:** Network management framework, SNMP, ASN **Network Security:** Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Management of Public Keys, Communication Security, IPSec, Firewalls, VPNs, Authentication Protocols. **Network Simulation and Analysis:** Simulation Modeling, System Performance Evaluation, Traffic Analysis and Optimization, Network Simulators

Reference Books :

1. Computer Networking, A Top-Down Approach Featuring the Internet, James F. Kurose and Keith W. Ross, Pearson Education Inc.
2. DATA COMMUNICATIONS AND NETWORKING, Behrouz A. Forouzan, McGraw-Hill.

3. Internetworking with TCP/IP - Volume I, II, III, Author - Douglas E. Comer, Prentice Hall of India.
4. TCP/IP Protocol Suite, Behrouz A Forouzan, McGraw Hill.
5. Computer Networks, Andrew S. Tanenbaum, PHI.