Department of Electronics & Communication Engineering

School of Engineering & Technology

Mizoram University

(A Central University)

Aizawl- 796 004, Mizoram

Course Structure & Syllabus
for
Bachelor of Technology (B.Tech.)
Programme in

Electronics and Communication Engineering

(2011)

MIZORAM UNIVERSITY

School of Engineering and Technology

Department of Electronics and Communication Engineering

B. Tech. Course Structure

BRANCH：Common for all B.Tech. Courses Year : I Semester :I

Sl. No	Code No	Title	L	T	P	Credit	Marks
1	AP-101	Physics-I	2	1	0	3	75
2	AC-101	Chemistry	2	1	0	3	75
3	AM-101	Mathematics-I	2	1	0	3	75
4	IT-101	Computer Concepts and Programming	3	1	0	4	100
5	ME-101	Engineering Mechanics	3	0	0	3	75
6	HU-101	English Communication Skills	1	1	0	2	50
7	AP-191	Physics Laboratory-I	0	0	3	2	50
8	AC-191	Chemistry Laboratory	0	0	3	2	50
9	IT-191	C Programming Laboratory	0	0	3	2	50
		Total	**13**	**5**	**9**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 13+5+9=27 hrs per week Total Credits = 24

BRANCH：Common for all B.Tech. Courses Year : I Semester :II

Sl. No	Code No	Title	L	T	P	Credit	Marks
1	AP-201	Physics-II	2	1	0	3	75
2	AM-201	Mathematics-II	3	1	0	4	100
3	EC-201	Basic Electronics	3	1	0	4	100
4	EE-201	Basic Electrical Engineering	3	1	0	4	100
5	ES-201	Environment & Ecology	2	1	0	3	75
6	ME-291	Engineering Graphics	0	0	3	2	50
7	AP-291	Physics Laboratory-II	0	0	3	2	50
8	WR-291	Workshop Practice	0	0	3	2	50
		Total	**13**	**5**	**9**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 13+5+9=27 hrs per week Total Credits = 24

BRANCH : ECE Year : II Semester :III

Sl No	Code No	Title	L	T	P	Credit	Marks
1	AM-302	Mathematics III	3	1	0	4	100
2	EC-301	Digital Electronics & Logic Design	3	1	0	4	100
3	EC-302	Electronics Devices & Circuits	3	0	0	3	75
4	EC-303	Network theory & Analysis	3	0	0	3	75
5	IT-302	Data Structure & Algorithm	3	1	0	4	100
6	IT-391	Data Structure & Algorithm Laboratory	0	0	3	2	50
7	EC-391	Digital Design Laboratory	0	0	3	2	50
8	EC-392	Electronics Devices & Circuits Laboratory	0	0	3	2	50
		Total	**15**	**3**	**9**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 15+3+9=27 hrs per week Total Credits = 24

BRANCH : ECE Year : II Semester :IV

Sl No	Code No	Title	L	T	P	Credit	Marks
1	AM-402	Numerical Analysis	3	1	0	4	100
2	EC-401	Microprocessors	3	1	0	4	100
3	EC-402	Analog Circuits & Systems	3	0	0	3	75
4	EC-403	Signals & Systems	3	0	0	3	75
5	EC-404	Analog Communication	3	0	0	3	75
6	EC-405	Electromagnetic Theory	3	0	0	3	75
7	EC-491	Microprocessor Laboratory	0	0	3	2	50
8	EC-492	Analog Circuits Laboratory	0	0	3	2	50
		Total	**18**	**2**	**6**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 18+2+6= 26 hrs per week Total Credits = 24

BRANCH : ECE Year : III Semester :V

Sl No	Code No	Title	L	T	P	Credit	Marks
1	EC-501	Linear Integrated Circuits	3	1	0	4	100
2	EC-502	Digital Signal Processing	3	1	0	4	100
3	EC-503	Electronic Measurement & Instrumentation	3	1	0	4	100
4	EC-504	Antenna Engineering	3	1	0	4	100
5	EC-505	Digital Communication	3	1	0	4	100
6	EC-591	Antenna Engineering Laboratory	0	0	3	2	50
7	EC-592	Communication Laboratory	0	0	3	2	50
		Total	**15**	**5**	**6**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 15+5+6= 26 hrs per week Total Credits = 24

BRANCH : ECE Year : III Semester :VI

Sl No	Code No	Title	L	T	P	Credit	Marks
1	EC-601	Microwave Engineering	3	1	0	4	100
2	EC-602	Microelectronics and IC Technology	3	1	0	4	100
3	EC-603	Wireless and Mobile Communication	3	1	0	4	100
4	EC-604	Control Engineering	3	1	0	4	100
5	EC-605	Computer Architecture & Organization	3	1	0	4	100
6	EC-691	Microwave Engineering Laboratory	0	0	3	2	50
7	EC-692	Industrial Training*	0	0	3	2	50
		Total	**15**	**5**	**6**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**
Total contact hours = 15+5+6= 26 hrs per week Total Credits = 24

***Industrial Training must be done during winter vacation (between 5th and 6th Semester) , training duration of minimum 30 days and maximum upto 45 days. Mark distribution (15- Presentation, 5- Viva Voce, 5- Report) same for both sessional (Internal) and examination**

BRANCH : ECE Year : IV Semester :VII

Sl No	Code No	Title	L	T	P	Credit	Marks
1	EC-701	Optical Fiber Communication	3	1	0	4	100
2	EC-702	VLSI Design	3	1	0	4	100
3	EC-703	Power Electronics	3	1	0	4	100
4	EC-7XX	Elective-I	3	1	0	4	100
5	EC-7XX	Elective-II	3	1	0	4	100
6	EC-791	VLSI Laboratory	0	0	3	2	50
7	EC-792	**Minor Project +**	0	0	3	2	50
		Total	**15**	**5**	**6**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**

Total contact hours = 15+5+6= 26 hrs per week Total Credits = 24

+ Mark distribution (17.5 – Presentation/Demonstration, 5- Viva Voce, 2.5- Report) same for both sessional (Internal) and examination

"XX => 04 to 15"

Electives (any two or more approved by the Department):

Code No.	Subjects
EC 04	Computer Networks
EC 05	Multimedia Communication
EC 06	Internet & Web Technology
EC 07	Mobile Computing
EC 08	Neural Networks
EC 09	Fuzzy Control Systems
EC 10	Remote Sensing
EC 11	Radar Engineering
EC 12	Biomedical Instrumentation
EC 13	Material Science
EC 14	Robotics
EC 15	Artificial Intelligence

BRANCH : ECE Year : IV Semester :VIII

Sl No	Code No	Title	L	T	P	Credit	Marks
1	BM-801	Principles & Practice of Management	3	1	0	4	100
2	EC-8XX	Elective- III	3	1	0	4	100
3	EC-8XX	Elective-IV	3	1	0	4	100
3	EC-891	Major Project*	0	0	18	12	300
		Total	**9**	**3**	**18**	**24**	**600**

L = Lecture, T= Tutorial, P = Practical **Total Marks = 600**

Total contact hours = 9 +3+18 = 30 hrs per week Total Credits = 24

***Project Allotment, literature survey etc. start from 7th Semester and it will be submitted in 8th Semester, Mark distribution (105- Presentation/Demonstration, 30- Viva Voce, 15- Report) same for both sessional and examination**

"XX => 01 to 12"

Electives (any two or more approved by the Department):

Code No.	Subjects
EC 01	Digital Design using HDL
EC 02	Embedded System Design
EC 03	Nano Devices
EC 04	Design Using CAD Tools
EC 05	Information Security Systems
EC 06	Cryptography
EC 07	Intelligent & Virtual Instrumentation
EC 08	Fundamental of MEMS
EC 09	Advanced Digital Signal Processing.
EC 10	Digital Image Processing
EC 11	Advanced Microprocessor and Microcontroller
EC 12	Opto-Electronics Devices

Total Credits (Course): 24+24+24+24+24+24+24+24 = 192

Total Marks (Course): 600+600+600+600+600+600+600+600=4800

Physics-I: AP 101

Credits: 3 (2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Use of vectors in Physics, Different coordinate systems – Cartesian, cylindrical and spherical polar coordinates, Vector fields and their potentials, gradient, divergence, curl and their physical significance, continuity equations, Gauss and Stokes theorems and their physical significance. 8L

UNIT II:
Newton's laws of motion, motion in a uniform field, components of velocity and acceleration in Cartesian system, Plane polar coordinate system, Uniformly rotating frame, centripetal acceleration, Coriolis force and its applications, Centre of mass and its equation of motion, conservation of energy, linear and angular momenta, Conservative and non-conservative forces. 10L

UNIT III:
The laws of thermodynamics: The Zeroth law, indicator diagram, first law of thermodynamics, Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Entropy, principle of increase of entropy, The thermodynamic scale of temperature; its identity with the perfect gas scale, third law of thermodynamics, Thermodynamics potentials, Maxwell's general relationships, Clausius-Clapeyron equation, Thermal conductivity and diffusivity, differential equation of rectilinear flow of heat (one dimension), Wiedemann-Franz law. 10L

UNIT IV:
Schrodinger equation: Schrodinger equation in time-dependent and time-independent form, Physical interpretation and probability interpretation of wave function, Equation of continuity, conservation of probability, expectation values of an operator-Ehrenfest theorem, Basic postulates of quantum mechanics, Schrodinger equation as eigen value equation, eigen value and eigen function, Free particle in one dimensional infinite potential well, calculation of its eigen values and normalized eigen functions, Calculation for transmission and reflection coefficient for particle in step potential. 10L

UNIT V:
Harmonic oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, Superposition of waves of the same frequency, Lissajous figures, group and phase velocities, Standing waves, Free and forced vibration, resonance and condition of resonance, sharpness of resonance, Ultrasonics: production, detection and application of ultrasonic waves in engineering and medicine. 7L

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Text Books:

- A Beiser, Concepts of Modern Physics, McGraw Hill
- R Feynman, R Leighton & M Sands, The Feynman Lectures in Physics, Vol. 1,2&3.
- M Speigel, Outline of Vector Analysis, Schaum Series.

Recommended Books:

- N C Rana and P S Joag, Introduction to Classical Mechanics, TMH.
- D Halliday, R Resnick and J Walker, Fundamentals of Physics, J. Wiley & Sons.
- Brijlal and Subrahmaniam, Heat and Thermodynamics, S Chand and Co.
- J L Powell and B Crasemann, Quantum Mechanics, Narosa Pub. House.
- D Halliday, R Resnick and J Walker, Fundamentals of Physics, John Wiley & Sons
- N Subrahmaniam and Brijlal, Textbook of Sound.
- D.S. Mathur: Elements of Properties of Matter, S. Chand & Co.
- P. K. Chakaraborty: Advanced Text Book on Heat, Modern Book Agency, Kolkata.
- D. S. Mathur: Fundamentals of Heat, S. Chand & Co. (latest edition)
- S. Garg, C.K. Ghosh, S. Gupta: Oscillations and Waves, PHI India Ltd

Chemistry: AC 101

Credits: 3 (2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Phase rule, and their thermodynamic derivations, the distribution law and solvent extraction. Ionic, molecular and covalent network in solids, Crystal types: AX and AX_2, Point defects in crystals, Band theory of solids. 7L

UNIT II:
Concept of rate, Rate constant, 1^{st}, 2^{nd}, and 3^{rd} order reactions, Determination of Rate law, Kinetics of catalytic, photochemical, and, fast reactions, Collision and absolute reaction rate theories, Adsorption of gases on solids, Langmuir and Freundlich isotherms, Homogeneous & heterogeneous catalysis, Industrial applications, Zeolites. 9L

UNIT III:
Electrochemical systems, galvanic cells, classification and thermodynamic treatment, Concentration cell and liquid junction potential, Potentiometry, Membrane equilibria, ion-selective electrodes, and pH-metry, Corrosion types, mechanism, and methods of prevention. 7L

UNIT IV:
Composition and properties of glass, refractoriness and cement, Molecular sieve, elementary ideas of electronic and photonic ceramics. Classification and properties of composite materials, Mechanism of reinforcement composites. Polymerization, classification, linking and engineering uses of polymers, thermoplastic and thermosetting resins, elastomers & synthetic fibers, ion-exchange resins, organic conducting and insulating materials. 11L

UNIT V:
Elementary idea of absorption & emission spectrometry, flame, and spectrophotometer analysis of engineering materials, Infra-Red (IR) and Nuclear Magnetic Resonance (NMR) Spectroscopy and spectra of simple compounds, Mass Spectrometry, X-ray methods (X-Ray Diffraction, Electronic Spectroscopy for Chemical Analysis). 11L

Text Books:

- G. M. Barrow, Physical Chemistry, 5^{th} Ed., TMH, New Delhi.
- V. Walters, J. de Paulo, and Peter Atkins, Explorations in Physical Chemistry, Oxford.
- Puri, Sharma, and Pathania, Principle of Physical Chemistry, 44^{th} Edition, Vishal Publishing House, New Delhi
- Hameka, Chemistry: Fundamentals and Applications, Academic Press.
- Davis, and Berner, Handbook of Industrial Chemistry (vol. 1 & 2), John-Wiley.

- D. A. Skoog, Principles of Instrumental Analysis, 5th Ed., Saunders College Publ.
- Parameshwara Murthy, Textbook of Engineering Chemistry, BS Publications.
- Walton, Polymers, Oxford University Press (Oxford Chemistry primers)

References:

- M. Bowker, The basis and Applications of Heterogeneous Catalysis, Oxford University Press (Oxford Chemistry Primers).
- S. Metcalfe, Chemical Reaction Engineering: First Course, Oxford (Oxford Chemistry Primers).
- West, Solid-state Chemistry and its applications, John-Wiley.
- Baerns, M., Basic Principles in Applied Catalysis, Springer-Verlag.
- Jones, and S. Wimperis, NMR: the Tool kit, Oxford University Press (Oxford Chemistry primers)
- A. K. Brisdon, Inorganic Spectroscopic methods, Oxford University Press (Oxford Chemistry primers)
- W. Clegg, Crystal Structure Determination, Oxford University Press (Oxford Chemistry primers)
- Robinson, Undergraduate Instrumental Analysis, John-Wiley.
- James C Gerdeen, et. al., Engineering Design with polymers and Composites, CRC Press.
- James G. Speight, Handbook of Coal Analysis, John-Wiley.

Mathematics-I: AM 101

Credits: 3(2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Successive differentiation, Leibnitz's theorem, polar curves, angle between radius vector and tangent, angle of intersection of two curves, derivatives of arcs (Cartesian and polar), curvature, radius of curvature and evolute. 8L

UNIT II:
Rolle's Theorem, mean value theorems, partial differentiation, Euler's theorem, total differential, differentiation of composite and implicit functions. 7L

UNIT III:
Convergence, divergence, comparison test, ratio test, Cauchy's root test, Cauchy's integral test, alternating series, Leibnitz's theorem, absolute and conditional convergence, Expansion of functions into Taylor's and Maclaurin's series. 6L

UNIT IV:
Binary operation, linear dependence and independence, basis, orthogonal basis, Vector Spaces and Subspaces, Simple examples, Matrices, elementary column and row operations, inverse, rank, system of linear equations, solution by Gauss elimination method. 12L

UNIT V:
Reduction formulae for $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \sin^m x \cos^n x\,dx$. Evaluation of $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$, $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\,dx$ where m and n are positive integers. Tracing of standard curves Folium of Descartes, Strophoid, Lemniscate of Bernoulli, Witch of Agnessi, Astroid, Cissoid of Diocles, Cardioid, Cycloid, Roses (three and four leaved), Length, area and volume of revolution involving simple curves. 12L

Text Books:
- B.S. Grewal, Higher Engineering Mathematics.
- Shanti Narayan, Differential Calculus.
- Shanti Narayan, Integral Calculus.
- Maity and Ghosh, Differential Calculus.

References:
- C.B. Thomas, Calculus and Analytical Geometry.
- N. Piskunov, Differential and Integral Calculus, Vol. I and Vol. II.

Computer Concepts and Programming : IT 101

Credits: 4 (3L, 1T)
Total Hrs: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Computer Basics-characteristics of a computer system, I/O Devices, functional units.Operating System-definition, application of OS.Sofwares-types and uses.Problem Solving Technique, concepts of algorithms, flowcharts 7L

UNIT II:
Introduction to C language - background, compilation. Tokens, character sets, constants, variables, identifiers, keywords, data types, user-defined data type. Operators and expressions, Input and output in C programs.Decision making and branching, looping. 15L

UNIT III:
Arrays – Declaration, initialization on one dimensional array, two dimensional arrays, multidimensional arrays, dynamic arrays. Character arrays and string. 8L

UNIT IV:
Functions – concepts, elements of user defined function, passing values, scope, visibility and lifetime of variables
Pointers – Concepts, pointers and arrays, pointers and character strings, array of pointers, pointers and function (pointers as function arguments, functions returning pointers). 15L

UNIT V:
Structure-concepts, operations on individual members, array of structures, structures and function, union, size of structure. File operation(opening a file, closing file, input output operations, modes). Error handling during I/O operations, random access to files, command line arguments 15L

Text Books:

- E.Balaguruswamy, “Programming in ANSI C”, TMC
- Yashavant P. Kanetkar, “Let Us C”, BPB Publications
- Byron S. Gottfried "Programming with C, (Schaum's Outlines Series)Mc Graw Hill

References:

- Brian W. Kernighan and Dennis Ritchie: “The C ProgrammingLanguage”, 2nd Edition, PHI, 1998.
- R. Sethi, “Programming Language”, Addison Wisely
- V. Rajaraman “Computer Progmamming in C”, PHI

Engineering Mechanics: ME 101

Credits: 3 (3L)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Types of forces-concurrent, coplanar, distributed, spatial, resultant of a force about an axis, concept of equilibrium, Moment and couple, Principles of Transmissibility, Lamis and Varignon's theorem, Moment of inertia of areas and masses, Simple applications to machines, mechanical efficiency. 10L

UNIT II:
Concepts of stress and strains-Internal and external forces, Stress-normal, shearing and bearing, Deformations, Strain-Normal, shearing and bearing, Stress-strain diagram, Elastic and plastic behavior, elastic constants and their mutual relations, Thermal stresses, Deflections of beams, Shearing force and bending moments. 10L

UNIT III:
Rectilinear and curvilinear motion of particles, General plane motions, equations of motions in non-inertial frames of reference, D'Alembert's principle, Basic Principle of work and energy, Mechanical vibrations, Principle of impulses and momentum, application to plane motion of particles and rigid bodies. 9L

UNIT IV:
Introduction, first law for closed and open systems, flow processes and control volume, Limitations of first law of thermodynamics, Power producing and power absorbing devices, second law of thermodynamics, Corollaries of second law. 8L

UNIT V:
Properties of Fluid, Classifications, ideal fluid, Newtonian and non-Newtonian fluids, Inviscid fluid, Newton's law of viscosity, Basic concept of Fluid Statics, Dynamics and Kinetics, Flow through open channel. 8L

Text Books:

- Cengel, Thermodynamics.
- Som & Biswas, Fluid Mechanics and Machinery.

References:

- Rao Y.V.C., Engineering Thermodynamics, Universities Press
- Garde, Engineering Fluid Mechanics, Scitech.

English Communication Skills: HU 101

Credits: 2(1L, 1T)
Total Hours: 30
Full Marks: 50 (Internal: 20 Marks, End Semester Examination: 30 Marks)
Internal mark {14 (Term test) + 4 (assignment/Presentation) + 2 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1(Mark) (Compulsory) + Any four (4) from Q.2-8 x 6(Marks)} = 30.

UNIT-I :
Principles and Process of communication (coherent communication, barriers, removal of bottleneck; verbal & non-verbal network of communication). 6L

UNIT-II:
Grammar: Parts of Speech (Sentence and its structures- subject verd-object formation of speech & writing, assertive, negative, interrogative and idioms, active, passive voice etc). 6L

UNIT-III:
Tense form, agreement /concord 4L

UNIT-IV:
Phonetics, Stress pattern in English, Speech mechanism & Spoken exercises; Group discussion & Public speaking, presentation. 7L

UNIT-V:
Basics of Business letters, drafting: Addressing & concluding.
Report Writing: Types and specimens using hard & software. 7L

Text Books:

- Leena Sen "Communication Skills", PHI
- Urmila Rai, S.M. Rai "Managerial Communication", Himalaya Publishing house
- Das, B.K. Samantray, K. et all. An Introduction to Professional English and Soft Skills; New Delhi: CUP, 2009
- Bansal, R.K.& Harrison, J. B. Spoken English [for India], Orient Longman.

References:

- O'Connor, J.D. Better English Pronunciation (Cambridge English Language Learning) 1981, CUP.
- Patnaik, P. Group Discussion and Interview Skills, New Delhi: CUP, 2011.
- Seeley, John. Oxford Guide to Effective Writing and Speaking, Delhi: OUP, 2000.
- E-Resources: Website- **EnglishClub.com** -for Business correspondence**.**
- PowerPoint Presentation – for Professional Communication.
- Murphy, Raymond. English Grammar In Use[3rd edn] CUP,2010.

Laboratory-I: AP 191

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Errors and approximations – with data from Vernier Callipers and Screw Gauge
2. Determine the acceleration due to gravity by bar pendulum
3. Determination of Young's Modulus by cantilever bending method
4. Determination of Thermal Conductivity of bad conductor by Lee's Disc
5. Verify laws of vibrations of strings by using ac sonometer
6. Determine the coefficient of linear expansion of a rod by optical lever method
7. Determination of velocity of ultrasonic sound in liquid using Ultrasonic wave interferometer
8. Determination of co-efficient of viscosity by Poiseulle's capillary flow method.
9. Determination of thickness of a wire by using air-wedge
10. Determine the refractive index of a liquid/solid by using a traveling microscope.

Chemistry Laboratory: AC 191

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Estimation of hardness of water using EDTA titration.
2. Critical micellar concentration of commercial detergents from surface tension measurements using stalagmometer.
3. Conductometric titration of strong acid with strong base.
4. Potentiometric titration of Fe^{2+} using potassium dichromate.
5. Evaluation of pKa of weak acid using pH meter.
6. Determination of surface tension and viscosity of liquid
7. Kinetics; Determination of rate constant for acid catalysed hydrolysis of Ester.
8. Determination of percentage composition of sugar solutions using viscometer.
9. Determination of partition coefficient of acetic acid between n-butanol and water.
10. Spectrophometric determination of copper.
11. Conductometric titration of weak acid with strong base.

C Programming Laboratory: IT 191

Credits: 2(3P)
Total Hours: 45

Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

Group A

1. Program to find whether the given number is prime or not.
2. Program to find the factorial of a given integer
3. Program to find the sum of individual digits of a positive integer.
4. Program to find the GCD (greatest common divisor) of two given integers.
5. Program to display first N terms of Fibonacci series.
6. Program to replace lowercase letters by uppercase letters and vice versa in a sentence
7. Program to check whether a string is palindrome or not
8. Program to sort 10 names in alphabetical order
9. Write a function(using a pointer parameter) that reverse the elements of a given array
10. Program to display contents of a file

Group B

11. Program to find output all the roots of a given quadratic equation, for non-zero coefficients.
12. Program, which takes two integer operands and one operator from the user, performs theoperation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
13. Program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
14. Program to find both the largest and smallest number in a list of integers.
15. Program to calculate the following Sum:
    Sum=$1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$
16. Program to read matrix A (M X N) and find the following using function
    i) sum of elements of M rows
    ii) sum of elements of N columns
    iii) sum of all elements of the matrix
17. Program to multiply two matrices
18. Program which copies one file to another file.
19. Program to count the number of characters, tabs, spces, number of lines in a file
20. Create a structure to specify data on students given below:
    Roll No. , Name, Class, marks obtained on three subjects

- Enter N students information and display the percentage of each student (assumeF.M is 100 each).
- Print the data of a student whose roll number is given by the user

(During Practical examination students have to attempt one program from each group)

Physics-II: AP 201

Credits: 3(2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Wave optics: Huygen's principle, Young double slit experiment, colour of thin films, Newton's rings, diffraction, single slit diffraction, diffraction grating. Polarization of light. 8 L

UNIT II:
Lattice, unit cell and translation vector, classification of crystals, Bravais lattice, Bloch theorem, Kronig-Penney and the origin of band gap in solids, classification of solids, different types of magnetic materials, hysteresis, various polarization mechanics in dielectrics and their frequency and temperature dependence, internal field and Clausius-Mosotti equation–concept of complex permittivity, loss tangent, dielectric loss, dielectric breakdown, High resistivity alloys, superconductors-properties and applications. 12L

UNIT III:
Semiconductors–intrinsic and extrinsic semiconductors, elemental and compound semiconductors and their properties, density of states, Fermi-Dirac statistics, calculation of Fermi energy and its importance, concept of hole, origin of band gap in solids (qualitative treatment only), effective mass of electron, Carrier concentration in intrinsic semiconductors – carrier concentration in n-type and p-type semi conductors. 12L

UNIT IV:
Spontaneous and Stimulated emission of radiation, Population inversion, Einstein's A & B co-efficient (basic idea), Optical resonator and condition necessary for active Laser action, Ruby Laser, He-Ne Laser. 7 L

UNIT V:
Optical Fibers–Core and cladding, total internal reflection, calculation of numerical aperture and acceptance angle, losses in optical fibers, types of optical fibers. 6L

Text Books:

- C L Arora, Refresher Course in BSc Physics , S Chand and Co.
- R Feynman, R Leighton and M Sands, The Feynman Lectures in Physics, Volumes 1,2 & 3.
- R Murugeshan and Kiruthiga Sivaprasath, Modern Physics, S Chand and Co.
- D J Griffiths, Introduction to Electromagnetics.

Reference Books:

- M L Gupta, Radio and Electronics Engineering, Dhanpat Rai & Sons
- C Kittel, Introduction to Solid State Physics, Wiley & Sons

- J P Srivastava, Elements of Solid State Physics, Prentice Hall of India.
- Sze S M, Introduction to Semiconductor Physics.
- David A Bell, Introduction to Semiconductor Physics.
- Ghatak A and Tyagarajan N, Introduction to Fiber Optics, Cambridge University Press.
- Gerd Keiser, Optical Fiber Communications, MGH.
- P J Collins and M Hird, Introduction to Liquid Crystals, Taylor and Francis
- M D Ventra, S Evoy and RJ R Heflin Jr, Introduction to Nanoscale Science and Technology, Springer.

Mathematics-II: AM 201

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Order, degree, Solutions of equations - homogeneous and non homogeneous equations, exact equations, linear equations, Bernoulli's equations. 10L

UNIT II:
Homogeneous equations, linear equations with constant coefficients, non homogeneous equations, method of variations of parameters and inverse differential operators, solution of Cauchy's homogeneous linear equations, Solution of simple simultaneous equations. 10L

UNIT III:
Laplace Transforms of elementary functions, transforms of derivatives and derivatives of transforms, Inverse transforms, transforms of periodic, functions, unit step function, shifting theorems, and solutions of differential equations using Laplace transforms. 15L

UNIT IV:
Direction cosines, planes, straight lines, spheres, right circular cone and right circular cylinder. 8L

UNIT V:
Extreme values of a function of two variables, Lagranges's method of undetermined multipliers, simple problems, multiple integrals: evaluation by change of order of integration, changing of variables. Jacobians, Applications to areas and volumes, Beta and Gamma functions: elementary properties, simple problems. 17L

Text Books:

- E.D. Rainville and P. E. Bedient, A short course in differential equation.
- Erwin Kreyszig, Advanced Engineering Mathematics.
- Shanti Narayan, Differential Calculus.
- Shanti Narayan, Analytical solid Geometry

References:

- C.B. Thomas, Calculus and Analytical Geometry.
- N. Piskunov, Differential and Integral Calculus, Vol. I and Vol. II

Basic Electronics: EC 201

Credits: 4 (3L, 1T)
Total hrs: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Crystalline materials, Fermi energy, Conductors, Semiconductors and Insulators: electrical properties, band diagrams, Intrinsic and extrinsic semiconductor, P-type and N-type, drift and diffusion carriers, The Hall Effect. 10L

UNIT II:
P-N junction, Forward and reverse bias, V-I Characteristics, Simple diode circuits, Zener and avalanche breakdown, load line, linear piecewise model, rectifiers: half wave, full wave, its PIV, DC voltage and current, ripple factor, efficiency Clipper and Clamper circuits. 10L

UNIT III:
Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, Ebers-Moll model of transistor, transistor characteristics, Biasing and Bias stability: derivation of stability factor. Different operating modes, Equivalent Circuit for h-parameters; Transistors as amplifier: Calculation of gain (Current and Voltage), input and output impedance, frequency response for CE amplifier with and without source impedance (qualitative). 15L

UNIT IV:
Introduction to IC Technology, Properties of Op-amp, specification of IC-741, concept of virtual earth, Op-Amp transfer characteristics, Application of operational amplifier: inverting and non-inverting amplifier, summing, difference, constant gain multiplier, voltage follower, comparator, integrator, differentiator. Silicon Controlled Rectifier (SCR): constructional features, physical operation, characteristics, applications, Uni-Junction Transistors (UJT): Physical operation, Characteristics and simple applications, Concept of TRIAC, DIAC, Insulated Gate Bipolar Transistor (IGBT) and GTO. 15L

UNIT V:
CRO Operation, Construction features of cathode ray tube, concept of dual beam CRO, application of CRO for different electrical measurements: amplitude frequency and phase of sine wave, Lissajous figure. 10 L

Text Books:

- Malvino, Electronic Principle
- Mottershed, Electronics Devices & Circuits
- B.G.Streetman & S. Banerjee, Electronics Devices & Circuits
- Millman & Halkias, Integrated Electronics

References:

- Millman & Grabal, Microelectronics
- Schilling & Belove, Electronics Circuits
- Salivahanan, Electronics Devices & Circuits

Basic Electrical Engineering: EE 201

Credits: 4 (3L, 1T)
Total hrs: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Coulomb's law, Gauss's theorem (proof), capacitance calculation for plates, concentric spheres and co-axial cylinders, dielectrics, stored energy, electrostatic precipitator, electrostatic photocopying (Xerox), Ohm's law, Kirchhoff's laws, mesh current and node voltage methods.
12L

UNIT II:
Magnetism as a Relativistic effect, Biot-Savart law, Ampere's circuital law, magnetic field due to long straight conductors, coils and solenoids; magnetic forces: Lorentz /Ampere force, force production in simple systems (as in PMMC), B-H characteristics of ferromagnetic materials, Magnetic circuits, Faraday's law. 12L

UNIT III:
D.C. Machines, Construction, Characteristics of D. C. generators and D.C. motors (qualitative and only for shunt & series machines), starting (by 3-point starter) and speed control of D.C. machines (armature voltage and field current control), D.C. transients in R-L, R-C and R-L-C circuits. 12L

UNIT IV:
A.C. generation, waveforms, average and RMS values, peak-factor, R-L, R-C and R-L-C circuits, Three phase power supplies, Delta and star connection, line and phase quantities, solution of 3-phase circuits for balanced voltage and balanced loads, phasor diagrams, 3 phase, 4 wire circuits, power measurement by two wattmeter method, General structure of electrical power systems.
12L

UNIT V:
Single phase Transformers**:** Core and shell type construction, EMF equation, no load and on load operation, open and short circuit tests, 3-Phase Induction Motors: Construction, Production of rotating field, principle of operation ratings. Torque –speed characteristics (qualitative only).
12 L

Text Books:

- Nagrath I J, Basic Electrical Engineering, Tata McGraw Hill Pub. Co.
- Kamaleshaiah and Naidu, Introduction to Electrical Engineering, Tata McGraw Hill Pub. Co.

References:

- Edward Hughes (revised by Ian McKenzie Smith), Electrical Technology, Seventh Ed., English Language Book Society Publication with Longman.
- Vincent Del Torro, Electrical Engineering Technology, Second Edition, Prentice Hall of India Pvt. Ltd.
- Rizzoni, Principles and Applications Of Electrical Engineering, TMH.

Environment & Ecology: ES 201

Credits: 3(2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Concept of environment, ecology. Introductory to population & community ecology. Life forms and biological spectrum, population interaction, man, society and environment, need for environmental awareness. 5 L

UNIT II:
Concept, types and components of an ecosystem, understanding of food chain, food web , trophic levels, ecological pyramids and energy flow in an ecosystem, a brief account of aquatic (lentic & lotic) and terrestrial (forests, grassland, desert) ecosystems and major biomes of world. 10 L

UNIT III:
Definition and types of environmental pollution (air, water and soil), Climate change, Global warming, greenhouse gases, acid rain, ozone layer depletion, A brief account of eutrophication, biomagnification, radioactive pollution and hazardous effects of radiation environment and human health. 8 L

UNIT IV:
Concept of environmental impact assessment (EIA), application of information technology and remote sensing in environment management , disaster management floods ,earthquakes, cyclone and landslides. 10 L

UNIT V:
Concept of biodiversity (genetic, species & ecosystem), mega diversity hot spots, anthropogenic activities in relation to deterioration of environment, concept of genetic, species and loss of biodiversity. Convention of Biodiversity (1992), agenda 21 and sustainable development. 12 L

Text Books:

- Masters. G.M. Introduction to Environmental Engineering and Sciences PHI
- Nebel, B.J. Environmental Sciences PHI

References:

- Cunningham, W.P, M.A. Cunningham and B.W. Sargo. Environmental Sciences: a Global Concern. 8th edition. MGH, New York.
- Frankie, R.G and D.N. Frankie. Man ad the changing Environment. Holt Renechart and Winston, New York.
- Odum E.P. Fundamentals of Ecology. 3rd edition. W.B. Saunders Company, USA.
- Sharma, P. D. Ecology and Environment. Rastogi Publication, Meerut, India.

Engineering Graphics: ME 291

Credits: 2(3P)
Total Hrs: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution: 15- practical, 5- viva-voce, 5- report/record book/Chart)

UNIT I:
Purpose of Engineering Drawing & graphics, Drawing Instruments & materials, Lines & their conventions, dimension, scales, sense of proportioning. 9H

UNIT II:
Lattering, projections of points & lines, Orthographic projections (cylinder, cone, cube, pyramid), isomeric projections. 9H

UNIT III:
Projections of plane figures (obtaining true shape of plane figures by projection), Angle of Projections, free hand sketching, orthographic views, pictorial views, auxiliary views. 13H

UNIT IV: Projections of Solids, Lines, planes, intersection & development of surface. 7H

UNIT V:
Nomography-basic concepts & uses, AutoCAD commands & simple drawings using AutoCAD 7H

Text Books:

- K. L. Narayana & P Kannaiah, Engineering Graphics, TMH.
- V. Luxminarayana & Vaish wanar, Engineering Graphics, Jain Brothers, New Delhi.

References:

- N. D. Bhatt, Elementary Engg Graphics, Charatar Book Stall, Anand.
- A. M. Chandra & Satish Chandra, Engineering Graphics, Norosa.

Physics Laboratory-II: AP 291

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Determination of the dielectric permittivity of non-polar solids using LCR meter
2. Determination of the dielectric permittivity of liquids using a dipole meter
3. Determination of band gap of semiconductors
4. Determination of particle size by using He-Ne Laser
5. Determination of Laser parameters
6. Determination of fiber-optical properties – acceptance angle, power-loss
7. Determination of Hall-Coefficient of semiconductors
8. Hysterisis tracing of the B-H Loop
9. Use CRO for the study of A.C. supply waveform and compare the frequencies.
10. Determination of wavelength of light by Newton's ring method.

Workshop Practice: WR 291

Credits: 2(3P)
Total Hrs: 45
Full Marks: 100 (Sessional: 50 Marks, End Semester Examination: 50 Marks)
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical/Job, 5- viva-voce, 5- report/record book)

I. Theory (*about various components involved in Workshop Practice)*
(a) Carpentry: Timber, definition, Engineering applications, seasoning and preservation, plywood and ply-boards.
(b) Metal Joining Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene glass welding process, equipment and techniques, types of flames and their applications. Manual metal arc welding technique and equipment, AC and DC welding, electrodes, constituents and functions of electrode coating. Welding positions. Types of weld joint. Common welding defects such as cracks, undercutting, slag inclusion, porosity.
(c) Metal Cutting: Introduction to machining and common machining operations. Cutting tool materials. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. Quick return mechanism of shaper. Difference between drilling and boring. Files-material and classification.

II. Experiments : *At least eight (8) experiments need to be conducted*
List of Jobs to be made in the Workshop
(a) Carpentry:
1. T-Lap & L-joints
2. Bridle joint
(b) Metal Joining: Welding Practice.
1. Gas welding practice on mild steel flat
2. Lap joint by Gas welding
3. MMA welding practice by students
4. Square butt joint by MMA Welding
5. Lap joint by MMA Welding
6. Demonstration of brazing
7. Tin smithy for making mechanical joints and soldering of joints

(c) Metal Cutting:
1. Job on lathe with one step turning and chamfering operations
2. Job on shaper and milling machine for finishing two sides of a job
3. Drilling two holes of size 5 and 12 mm diameter on job used / to be used for shaping
4. Grinding a corner of above job on bench grinder
5. Finishing of two sides of a square piece by filing.

Text Books:

- Chapman & Arnold, Workshop Technology, Very Low Priced Edition.
- Begeman & Amstead, Manufacturing Process, John Wiley.

References:

- B S Raghubansi, Workshop Technology, Dhanpat rai & sons.
- Hajra, Chaudhuri, Elements of Workshop technology, Media Promoters & Publishers.
- Khanna , O.P., Workshop Technology, Dhanpat Rai Publications.
- S. Crawford, Basic Engineering Processes, Hodder & Stoughton.
- T. Jeyapoovan, Workshop Practics, Vikas Publication.

Mathematics-III : AM 302

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Finite sample space, conditional probability and independency, Baye's theorem, one dimensional random variable, mean, variance and expectation, Chebyschev's inequality, Two and higher dimensional random variables, covariance, correlation coefficients, least squares principle of curve fitting.
Distributions: Binomial, Poisson, Uniform, Normal, Gamma, Chi square and exponential, simple problems. 16L

UNIT II:
Fourier series of odd and even functions and functions with arbitrary period, Half range extensions, Fourier sine and cosine transforms, and Fourier integrals. Parseval's identity, Convolution theorem, solution of boundary value problems by Fourier transforms, Z-transforms, solution of difference equations using Z-transforms. 12L

UNIT III:
Introduction to complex numbers, functions, continuity, differentiability, analyticity -Cauchy Riemann equations and properties of ana1ytic functions, Line integrals in complex plane and basic properties of Cauchy's integral theorem and Cauchy's integral formula -derivatives of analytic functions. 10L

UNIT IV:
Taylor, Maclaurin and Laurent's series, residue theorem, evaluation of standard real integrals using contour integrals. 10L

UNIT V:
Gradient, divergence and curl, their physical meaning and identities, line, surface and volume integra1s -simple applications, Curvilinear coordinates. 12L

Text books:

- P. L. Mayer, Int. to Probability and Statistical Applications, American Publishing Co., Ed. 2.
- R. V. Churchill and J. W. Brown, Complex variables and applications.
- B.S. Grewal, Higher Engineering Mathematics.
- Murray R. Spigel, Vector Analysis, Schaum Outline Series.
- Erwin Kreyszig, Advanced Engineering Mathematics.

References:

- Murray R. Spigel, Complex variable, Schaum Outline Series
- Ross, Introduction to probability & statistics for engineers & scientists, Wiley Int.
- K. S. Trivedi, Probability and Statistics, Prentice-Hall.

Digital Electronics and Logic Design: EC 301

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Binary representation, Codes and their conversions, BCD, Octal, Hexadecimal, ASCII, Gray code, Excess-3 code, Binary arithmetic. 10L

UNIT II:
Boolean algebra, logic gates and circuits, Minimization of logic expressions by algebraic method, K-map method, VEM methods and Quine Mc Clauskey method. 10L

UNIT III:
Adder, subtractor, encoder, decoder, comparator, multiplexer, de-multiplexer, parity generator, Priority Encoder, ALU, BCD to 7 segment code converter. Flip Flops, various types of Registers and counters and their design, Ring Counter, State table and state transition diagram, sequential circuits design methodology. 20L

UNIT IV:
Weighted resistor and R-2R ladder type D/A converter, Parallel-comparator type, Successive approximation type, Dual slope, Counting A/D converters. 10L

UNIT V:
DTL, TTL, ECL, MOS and CMOS, their operation, specifications, Advantages and Disadvantages, RAM, ROM, PROM, EROM. 10L

Text Books:

- Jain, Modern Digital Electronics, 2/e ,TMH
- Leach & Malvino, Digital Principles & Application, 5/e, TMH
- Morris Mano, Digital Logic Design, PHI.

References:

- H.Taub & D.Shilling, Digital Integrated Electronics, Mc Graw Hill.
- Givone, Digital Principles & Design, TMH
- Virendra Kumar, Digital Technology, New Age.
- S.Aligahanan, S.Aribazhagan, Digital Circuit & Design, Bikas Publishing House.

Electronic Devices & Circuits: EC 302

Credits: 3(2L, 1T)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Introduction to Properties of metal semiconductor junctions, photovoltaic effect-solar cells, Zener and Tunnel diodes, Varactor diodes, Semi conductor sensors and detectors, LED's, High voltage and high power transistors. 10L

UNIT II:
JFET's operation, static characteristics, JFET biasing, amplification, IJFET. MOSFET operation, Characteristics, types, enhancement, depletion mode, Introduction to CMOS. 8 L

UNIT III:
MOS: MOS fundamentals, MOS capacitor, surface space charge region, accumulation, depletion and inversion, Flatband and threshold voltages, MOS capacitor on n-sub, electrostatic characteristic of MOS, Device physics of MOS, drain current and channel charge, gradual channel approximation, strong and moderate Inversion, Body bias effects. 10L

UNIT IV:
Concept, properties, positive and negative feed back, loop gain, open loop gain, feed back factors, topologies of feed back amplifier, effect of feed back on gain, output impedance, input impedance, sensitivities (qualitative), BW, Stability, effect of positive feed back: instability and oscillation. 10L

UNIT V:
Condition for oscillation, Barkhausen criteria, general form of oscillator, configuration, loop gain, Wien- bridge oscillators, introduction to phase shift oscillators and crystal oscillators. 7L

Text Books:
- Millman & Halkias, Integrated Electronics, TMH
- Millman & Grabel, MGH Micro-Electronics
- Neamen, Semiconductor Physics &devices TMH
- Chattopadhyay, Rakshit, Saha & Purkait, 2nd Edn -Foundation of Electronics

References:
- Prof. Manis Mukherjee, Foundation Of Electronics Devices And Circuits, EPH.
- Kasap, Principles of Electronic Materials &devices TMH
- Malvino, Principle of Electronics, TMH
-

Network Theory & Analysis :EC-303

Credits: 3(2L, 1T)
Total Hours: 45

Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT-I
Network Theorems (DC and AC) - Mesh analysis, Thevenin, Norton, Superposition and Maximum power transfer theorems. 5 L

UNIT-II
Networks – One port, Two port, Balanced, unbalanced, Active, Passive, T, PI, Lattice, Ladder networks. Characteristic impedance of T and PI networks. Star-Delta transformation 5 L

UNIT III:
Different types of systems & networks: continuous & Discrete, Fixed and Time varying, Linear and Non-linear, Lumped and distributed. 5 L

UNIT IV:
First –order systems, Introduction, Natural response of First order system, Initial conditions, complete response of First- order systems, zero state and zero input responses of Firstorder system. Second order system, Natural response, Overdamped, Underdamped and critically damped case. Geometry of plane, unit-step and unit impulse response, linear system with sinusoidal inputs, impedance and admittance, power. 15 L

UNIT V:
Network theorems and applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis, Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix & node pair potentials. 15 L

Books:

- M.E. Van Valkenburg," Network Analysis", Prentice Hall of India
- Donald E. Scott : "An Introduction to Circuit analysis: A System Approach" McGraw Hill Book Company.
- D.Roy Choudhary,"Networks and Systems" Wiley Eastern Ltd.

References

- A.Chakrabarti,'Circuit Theory" Dhanpat Rai and Co.
- W.H. Hayt and Jack E-Kemmerly, Engineering Circuit analysis" Tata McGraw Hill.

Data Structure & Algorithm: IT 302

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Abstract Data Types (ADT); List ADT – array-based implementation, linked list implementation, cursor-based linked lists, doubly-linked lists; applications of lists – Stack ADT, Queue ADT , circular queue implementation; Applications of stacks and queues. 12L

UNIT II:
Need for non-linear structures; Tree ADT – tree traversal techniques – Pre-Order, In-Order and Post-Order; Representation of trees – Array, Linked-list, leftmost child, right sibling representations; Binary Tree – Huffmann Coding, Expression trees, Prefix, Infix and Postfix notations; binary search tree ADT, Applications of trees. 12L

UNIT III:
Definitions – Directed and Undirected Graphs; Graph traversals – Depth First Search, Breadth First Dearch; Shortest Path Algorithms; Minimum Spanning Tree; Connectivity, Biconnectivity; Applications of graphs. 12L

UNIT IV:
Internal sorting methods; Simple Sorting Schemes – Bubble, Insertion, Selection; Quicksort; Heapsort; Binsort; Analysis of sorting algorithms – Best case, worst case, average case.. 12L

UNIT V:
Searching in Linear, Tree and Graph – Analysis & Complexities, Program Case Study: Prim's and Kruskal's algorithms implementation. 12L

Text Book:

- Aho, J.E. Hopcroft, and J.D.Ullman, " Data Structures and Algorithm", Pearson Education, 1983

References :

- Yashavant Kanetkar, Data Structures through C, BPB Publications.
- R. F. Gilberg, B. A. Forouzan, "Data Structures: A Pseudocode approach with C", Second Edition, Thomson India Edition, 2005.
- Sara Baase and A. Van Gelder, "Computer Algorithms", Third Edition, Pearson Education, 2000.
- M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, 2002.

Data Structure and Algorithm Laboratory: IT 391

Credits: 2(3P)
Total Hours: 45

Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of practicals to be done in the DSA Lab. Programming may be done using C/ C++. (The teacher in-charge may select suitable list based on the convenience)

1. Finding simple interest for a given Principal, Time and rate of Interest.
2. Finding sum, average, maximum and maximum in an integer array.
3. Searching and insertion of element in integer array.
4. Implementation of different sorting techniques in integer array.
5. Program to calculate series e.g., $\sum_{i=1}^{n} \frac{i^2 + i}{i!}$, **Error! Bookmark not defined.** $\sum_{n=0}^{N} (n^2 + 2n - 10)$ etc
6. Construction of Graph using 2-D array for directed and undirected, weighted and unweighted graphs.
7. Implementation of minimum spanning tree in a given graph.
8. Construction of binary tree using linked list ADT.
9. Implementation of Depth First Search in binary tree.
10. Implementation of Breadth First Search in binary tree.
11. Preorder Tree Traversal technique.
12. Inorder Tree Traversal technique.
13. Postorder Tree Traversal technique.
14. Conversion of infix to postfix expression.
15. Evaluation of postfix expression.
16. Finding shortest path in a given graph.

Digital Design Laboratory: EC 391

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Design & Realization of basic gates using Universal logic gates
2. Design & Realization a circuit from 4-bit BCD code to Excess-3 code & vice-versa
3. Design & Realization a circuit from BCD code to Gray code & vice-versa
4. Design & Realization of a simple Decoder Circuit
5. Design & Realization Multiplexer and De-Multiplexer circuits
6. Design & Realization of BCD to 7- Segment Decoder
7. Design & Realization of Half Adder & Full Adder circuits using Universal logic gates
8. Design & Realization of Half Subtractor & Full Subtractor circuits using Universal logic gates
9. Design & Realization of 4-bit parity generator & comparator circuits
10. Design & Realization of RS & JK flip-flops using Universal logic gates
11. Design & Realization of D & T flip-flops using Universal logic gates
12. Design & Realization of Asynchronous & Synchronous Up/Down counter
13. Design & Realization of Ring counter & Johnson's counter
14. Design & Realization of a Shift Register circuit

Electronics Devices and Circuits Laboratory: EC 392

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Familiarization with components such as Resistors, Capacitors, Diodes, Transistors, FET's, Op-Amps, DC Power supply, Multimeter, CRO etc.
2. Study on V-I characteristics of Junction Diode.
3. Study on V-I characteristics of Zener Diode.
4. Study on Half Wave and Full Wave rectifiers.
5. Study of CB, CE characteristics of BJT.
6. Study of fixed base bias BJT circuit and determination of operating point.
7. Study of collector to base bias BJT circuit and determination of operating point.
8. Study of Emitter resistance bias BJT circuit and determination of operating point.
9. Study of self bias circuit bias BJT circuit and determination of operating point.
10. Study of VI characteristics of Field Effect Transistors.
11. Study of feedback circuit.
12. Study of Wien bridge oscillator.
13. Study of RC phase shift Oscillator Circuit.
14. Study of LC oscillator circuit.

Numerical Analysis: AM 402

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Solution of algebraic and transcendental equations using method of ordinary iteration, Regula Falsi and Newton Rapson's method, Simple examples, Interpolation and applications, finite difference, Divided differences, Newton -Gregory and Lagrange's interpolation formulae, Numerical differentiation. 12L

UNIT II:
Trapezoidal rule, Simpson's one third and three eighth rule, numerical evaluation of Fourier coefficient, diff. equations with constant coefficient & their solution. 10L

UNIT III:
Numerical solution of initial value problems in ordinary differential equations by Taylor series method, Picard's method, Euler's method, Modified Euler's method, Runge Kutta second and fourth order method, Millne's Predictor and Corrector method. 12L

UNIT IV:
Jacobi, Gauss-Seidal and relaxation methods, Solution of tridiagonal systems, Eigen values and eigenvectors of matrices and elementary properties, computation of largest Eigen value by power method. 12L

UNIT V:
Finite difference methods, Derivation from Taylor's polynomial, Accuracy and order, Parabolic, Elliptic and Hyperbolic equations. Dirichlet, Neumann and Mixed problems. Heat equation: Explicit method, Implicit method, Crank-Nicolson schemes, Stability and convergence analysis, Introduction to FEM. 14 L

Text Books:

- S. S. Sastry, Introductory Methods of Numerical Analysis, Ed. 2, PHI.
- B.S. Grewal, Higher Engineering Mathematics.
- Joe D. Hoffman, Numerical methods for Engineers and Scientists, McGrow Hill.
- G. D. Smith, Numerical solutions to Partial Differential Equations, Brunel University, Clarendon Press, Oxford, 1985.
- K.W. Morton and D.F. Mayers, Numerical Solution of Partial Differential Equations, An Introduction. Cambridge University Press, 2005.

References:

- Erwin Kreyszig, Advanced Engineering Mathematics.

Microprocessors: EC 401

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Evolution of microprocessors, important features, Applications. Register section, Arithmetic and Logic Unit, Interface section, Timing and Control section. 10L

UNIT II:
MPU Block Diagram, Pin Description, Generating Control Signals, Demultiplexing, Address / Data Bus, Bus Buffering, 8085 Instruction and Timing process. 10 L

UNIT III:
Data Transfer, Arithmetic and Logic-operation, Branching, Stack and subroutines, Input and Output, Problems using Instruction set. The Address Map, Address Decoding Techniques, Memory Interfacing, Design of I/O Ports using MSI and PPI, Keyboard and Display Interfacing, DAC and ADC Interfacing Technique. 15L

UNIT IV:
Introduction Synchronous & Asynchronous transfer, Interrupt Driven data transfer, DMA Transfer. 8085 interrupts, multiple interrupts, Enabling & Masking Interrupts, Device Polling. 10 L

UNIT V:
8086 and architecture, segmented memory has cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation, and interrupt processing, Addressing modes and their features, Introduction to Programming. Brief overview of some other microprocessors (eg. 6800 Microprocessor). 15 L

Text Books:

- Ramesh S. Gaonkar, Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd.
- B.Ram, Fundamental of Microprocessor and Microcomputers, Dhanpat Rai andSons

References:

- Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications.
- Adam Osborne and J. Kane, An introduction to micro computers Vol. 2 – some real Microprocessor, Galgotia Book Source, New Delhi
- Ray and Bhurchandi, Advanced Microprocessors, TMH
- Intel Corp. Micro Controller Handbook – Intel Publications.
- Douglas V. Hall, Microprocessors and Interfacing, MGH International Ed.
- Alan R. Miller, Assembly Language Programming the IBM PC, Subex Inc.

Analog Circuits & Systems: EC 402

Credits: 3(3L)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Introduction, Classification of amplifiers, generalized amplifier analysis and models, Cascade amplifiers, Difference amplifier. General considerations, R-C and transformer-coupled coupled amplifier, Darlington pair, Super-alpha configuration, Direct coupled amplifiers, Noise in electronic circuits. 10L

UNIT II:
Audio power amplifier requirements, Class A power amplifier, Push-pull amplifiers, IC power amplifiers. 5L

UNIT III:
Differential amplifier, Basic operational amplifier circuits, Signal conditioning circuits, Active Filters, Op-amp applications, Errors in Op-amplifiers, Slew rate, Frequency compensation, IC op-amps. 10L

UNIT IV:
Multivibrators: Astable, monostable and bistable circuits, detailed analysis and design with discrete components. Uses of multivibrators, Designs with ICs (NE-555 timer, op-amp) and logic gates. 10 L

UNIT V:
Regulated power supply: Working principles of regulated power supply, simple zener shunt regulator, transistor series regulators, simple and fold back current limiting, line and load regulation, three terminal regulator ICs, LM78XX, LM79XX, IC-723, LM317, LM337 adjustable power supply design, basic principles of buck and boost switching regulators. 10L

Text Books:

- Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
- Franco, Design with Operational Amplifiers & Analog Integrated Circuits, 3/e,TMH
- Gayakwad R.A, OpAmps and Linear IC's, PHI
- Coughlin and Drisscol, Operational Amplifier and Linear IC – Pearson Education.
- Sudhakar, Circuits & Networks:Analysis & Synthesis, TMGH

References:

- Malvino, Electronic Principles , 6/e ,TMH

- Millman & Taub, Pulse, Digital & switching waveforms- TMH
- Horowitz & Hill, The Art of Electronics; Cambridge University Press.
- Hayes & Horowitz, Student Manual for The Analog Elect.; Cambridge Univ. Press.
- Boyle'stead & Nashelsky, Electronic Devices & Circuit theory, PHI.
- Millman & Halkias, Basic Electronic Principles; TMH.
- Tobey & Grame, Operational Amplifier: Design and Applications, MGH
- Tushar Jadhab, Linear Integrated Circuits, Everest Publishing House

Signals and Systems: EC 403

Credits: 3 (3L)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Introduction: signals and systems, examples of signals and systems; signal types: energy and power signals, continuous and discrete time signals, analog and digital signals, deterministic and random signals; signal properties: Symmetry, periodicity, and absolute integrability. 8 L

UNIT II:
Systems and system properties: linearity, shift-invariance, causality, stability, realizability; Continuous time and discrete time linear shift-invariant (LSI) systems: the impulse response and step response; response to arbitrary inputs: convolution, interconnections; characterization of causality and stability of linear shift-invariant systems. 10 L

UNIT III:
Signal representation: signal space and orthogonal bases of signals, Fourier series representation; Fourier Transform and properties, Parseval's Theorem, time-bandwidth product; Phase and group delays; Hilbert transform, pre- envelope. Spectral Analysis: Energy, power, Parseval's theorem, Energy, Power Spectral density functions (PSDF), the autocorrelation function, Cross correlation function, relationship between PSD function and the auto correlation function. 10 L

UNIT IV:
Complex Frequency, Laplace Transforms, Shifting theorems, initial value theorem, final value theorem, effects of differentiation and integration in time domain. System transfer function, poles and zeroes, impulse response convolution, transient and steady state analysis (R-L-C circuit), solution of linear differential equations. 7 L

UNIT V:
Discrete signals, z-transform and Inverse z-transforms, relation between s–plane and z–plane. Shifting theorem. Initial value theorem and final value theorem, Transfer function of delay unit, realization of z-domain transfer function, unit sample response convolution. Solution of difference equations. 10 L

Text Books:

- A.V.Opponheim, A.S.Willsky and Nawab, Signals and Systems, 2/e, PHI.
- Robert A. Grabel and Richard A.Roberts, Signals and Linear System, John Willey and Sons.

Reference Books:

- R.F. Ziemer,W.H. Tranter and D.R. Fannin, Signals and Systems – Continuous and Discrete, 4/e, PHI.
- I. J.Nagrath, S.N. Saran, R.Ranjan and S. Kumar, Signals and Systems, TMH,
- Roberts, Signal and Systems: Analysis using Transformed Method and MATLAB, TMH.

Analog Communication: EC 404

Credits: 3 (3L)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Analog Communication System, Chronology of developments, Prospects and trends, Modulation: Types and Reasons, Elements of Analog communication system Transmitters, transmission channels and receivers, Merits and demerits. 8L

UNIT II:
AM Introduction, Time domain expression and modulation index, frequency domain (spectral) representations, transmission bandwidth for AM, AM for a single tone message, phasor diagram of an AM signal, illustration of the carrier and side band components, Transmission requirements for AM, normalized power and side band power, DSB modulation, time and frequency domain expressions, Transmission requirements for DSB , bandwidth and transmission power for DSB, Methods of generating AM and DSB, square law modulators, balanced modulators, ring modulators, SSB, generation of SSB using a side band filter, indirect generation of SSB, Representation off SSB signals, Transmission requirements for SSB, transmission bandwidth and power, side band filter examples, VSB, Demodulation of AM signals, square law and envelope detectors, The superheterodyne receiver for standard AM radio. 15 L

UNIT III:
Instantaneous frequency instantaneous phase, time domain representation for FM and PM, Phasor diagram, FM and PM signals for a single tone message, the modulation index, Spectral representation of FM and PM for a single tone message, Bessel's functions, Generation of FM using Armstrong method and VCO, commercial FM requirements, The limiter discriminator, and Demodulation of FM using PLL, Commercial FM radio and stereo FM radio. 8 L

UNIT IV:
Pulse Analog Modulation, Practical Sampling, Introduction to different type of multiplexing, Frequency Division & Time Division Multiplexing. 8L

UNIT V:
Noise in Continuous wave Modulation: Noise in AM System, Noise in FM System 6L

Text Books:
- Taub & Schilling, Principle of Communication System, Tata McGraw Hill.
- B.P.Lathi, Modern Digital & Analog Comm. System, Oxford University press.
- Taub & Schilling, Principles of Communication Systems, 2nd ed., MGH.
- P. Chakrabarti, Analog Communication Systems, Dhanpat Rai & Co.

References:
- Dungan, Electronics Communication System, Vikas.
- Zeimer & Tarnter, Principles of Communication, Jaico.
- Singh, Communication Systems: Analog & Digital, TMH.

Electromagnetic Theory: EC 405

Credits: 3 (3L)
Total Hours: 45
Full Marks: 75 (Internal: 30 Marks, End Semester Examination: 45 Marks)
Internal mark: {21 (Term test) + 6 (Assignment/Presentation) + 3 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 1.5(Mark) (Compulsory) + Any four (4) from Q.2-8 x 9(Marks)} = 45.

UNIT I:
Review of time varying EM fields, and field theory, Vector relation in rectangular,cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient. Divergence and curl, Green's and Stroke theorems. 5 L

UNIT II:
Electric field intensity and flux density. Electric field due to various charge configurations. The potential functions and displacement vector. Gauss's Law.Posisson's and Laplace's equation and their solution. Time varying electric and magnetic fields. Conduction and displacement currents. Relationship between circuits and fields theory. 10 L

UNIT III:
Electrical properties of matter (brief discussion). Dielectrics, polarization and permittivity. Frequency response of dielectric materials. Magnetic, magnetization and permeability. Linear, homogenous, isotropic and non-dispersive media. AC variations in materials-complex permittivity, complex permeability. 10 L

UNIT IV:
Maxwell's equations: integral and differential forms. Time harmonic form, boundary conditions, power and energy. Electromagnetic waves- solution for free space conditions, uniform plane wave and its propagation. Wave equation for a conducting medium. Sinusoidal time variation. Wave polarizations- Linear, circular, Elliptical polarization poincare sphere, direction cosines. 10L

UNIT V:
Reflection by a perfect conductor- normal/oblique incidence, reflection by a perfect dielectric-normal/ oblique incidence, Reflection by a perfect insulator- oblique incidence, reflection at the surface of conductive medium, surface impedance. Guided waves between parallel planes. TE, TM, TEM waves and their characteristics. 10 L

Text Books:
- E. Jordan and K. Balmin , Electromagnetic waves and radiating systems, 2th edition, , Prentice Hall of India, New Delhi, 2001.
- M.N.O. Sadiku, Elements of Electromagnetics 4th Edition –, Oxford.
- W H Hayt, J A Buck, Engineering Electromagnetics 7th Edition –Tata McGraw Hill

References

- C.A. Balanis, Advanced Engineering Electromagnetics, John Willy and Sons, New York.
- J.D.Kraus, Electromagnetics, 4th edition, Tata McGraw Hill, New Delhi.
- N.N. Rao, Elements of Engineering Electromagnetics, 6th Edition- PHI
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Microprocessor Laboratory: EC 491

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Familiarization with 8085 register level architecture and trainer kit components. Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

2. Familiarization with 8085 simulator on PC and also Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.

3. Programming using kit/simulator for table look up, Copying a block of memory, shifting a block of memory**.**

4. Programming using kit/simulator for Packing and unpacking of BCD numbers, Addition of BCD numbers and Binary to ASCII conversion.

5. Programming using kit/simulator for String Matching and Multiplication using Booth's Algorithm.

6. Interfacing with ADC.

7. Interfacing with Speed control of mini DC motor using DAC.

8. Interfacing with Keyboard.

9. Interfacing with Multi-digit Display with multiplexing.

10. Interfacing with Stepper motor.

11. Interfacing any 8-bit Latch with trainer kit as a peripheral mapped output port with absolute address decoding.

12. Program using subroutine calls and IN/OUT instructions using 8255 PPI the trainer kit.

Analog Circuits Laboratory: EC 492

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. To determine the characteristics curve of BJT.
2. Study of Different Biasing Circuits to determine Q-point.
3. Design of a 2-stage R-C coupled amplifier and measure its Gain and Bandwidth
4. Design the Bistable Multivibrator using NE 555.
5. Design of Timer Circuits (Monostable and Astable Multivibrator Configuration) using NE 555.
6. Design of Class A Power amplifier.
8. Design of Push Pull Amplifier.
9. Study of Op-Amp and its application (Non inverting, inverting, adder, substractor etc.)
10. Construction of V-I & I-V Converter using Op-Amps.
11. Study of Shunt Zener Voltage regulator
12. Study of transistor series voltage regulators.
13. Study of simple and fold back current limiting voltage regulator.
14. Study of Voltage Regulator using regulator IC's.

Linear Integrated Circuits: EC 501

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
The basic operational amplifier and its schematic symbol, Block diagram representation of op-amp, Power supply requirements of an op-amp, Evolution of op-amp, Specification of a typical op-amp (μA-741C), DC and AC gain analysis of μA 741C , Some popular op-amp ICs. 10 L

UNIT II:
Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, error voltage, variation of OPAMP parameter with temperature and supply voltage. Supply voltage rejection ration (SVRR), CMRR-Measurement of OP-AMP parameters, Null offset methods, Slew rate, causes of slew rates and its effects in application. 15 L

UNIT III:
Open loop gain of OP-AMP, the Negative feedback configurations - inverting and non inverting amplifiers, voltage followers and high input impedance configuration, differential amplifiers, closed loop frequency response and circuit stability, inverting and non-inverting summing, scaling and averaging amplifiers, voltage to current and current to voltage converters, integrators and differentiators, logarithmic and antilogarithmic amplifiers, difference amplifier and instrumentation amplifiers. 15 L

UNIT IV:
Advantages of active filters, classification of filters, response characteristics of butter worth, first order and second order butter worth filters- low pass and high pass types, Band pass and band reject filters. All pass filters (Phase shifters), Universal filters. 10 L

UNIT V:
Basic comparator and its characteristics, zero crossing detector, voltage limiters, clippers and clampers, small signal half wave and full wave rectifiers, absolute value detectors, analog multipliers and square rooter, sample and hold circuit. square wave, triangular wave and saw tooth wave generators, voltage controlled oscillator, 10 L

Text Books:

- Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
- Franco, Design with Operational Amplifiers & Analog Integrated Circuits , 3/e,TMH
- Gayakwad R.A, OpAmps and Linear IC's, PHI
- Coughlin and Drisscol, Operational Amplifier and Linear IC – Pearson Education.
- Millman and Halkias, Integrated Electronics: Analog and Digital circuits and system Tata McGraw Hill

References:

- Malvino, Electronic Principles , 6/e ,TMH
- Millman & Taub, Pulse, Digital & switching waveforms- TMH
- Horowitz & Hill, The Art of Electronics; Cambridge University Press.
- Hayes & Horowitz, Student Manual for The Analog Elect.; Cambridge Univ. Press.
- Boyle'stead & Nashelsky, Electronic Devices & Circuit theory, PHI.
- Millman & Halkias, Basic Electronic Principles; TMH.
- Tushar Jadhab, Linear Integrated Circuits, Everest Publishing House

Digital Signal Processing: EC 502

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Discrete Fourier Transform: Introduction, Definition of DFT, Properties of DFT: Linearity, Circular shift of a sequence, Symmetry properties, Circular convolution, Linear Convolution using DFT. Computation of DFT: Introduction, FFT algorithms: Decimation in time and Decimation in frequency, in place computations. 10 L

UNIT II:
Analog filters Design: The filter design problem, Approximation problem in network theory, maximally flat low pass filter approximation, Chebyshev filter approximation, Frequency transformation. 10 L

UNIT III:
Digital Filter Design-I: IIR Filter design: Design of IIR filters from analog filters. Impulse invariance, Design based on numerical solution of differential equations, bilinear transformations, applications of above techniques to the design of Butterworth, and Chebyshev filters. 15 L

UNIT IV:
Digital Filter Design-II: FIR Filter design: Properties of FIR digital filters, Gibbs phenomenon, different types of window functions: Rectangular, Hamming, Hanning, Barlett, Blackman and Kaiser windows, design of FIR filters using above windows. 15 L

UNIT V:
Implementation of Discrete-Time Systems: block diagram representation, equivalent structures, basic FIR digital structures: direct forms, cascade form, basic IIR digital structures: direct forms, cascade and parallel realizations. 10 L

Text Books:

- S K Mitra, Digital Signal Processing, 3/e, TMH.
- John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing, 3/e, PHI.
- P. Ramesh Babu, Digital Signal Processing, 2/e, Scitech, 13th Reprint, 2004.

Reference Books:

- A V Oppenheim and R.W Schafer, Discrete-Time Signal Processing, 3/e, Pearson.
- L R Rabinar and Gold, Theory and applications of Digital Signal Processing, PHI.
- S. Salivahanan, A. Vallavaraj and C. Gnanapriya, Digital Signal Processing, TMH, 19th reprint.

Electronics Measurement & Instrumentation: EC 503

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Techniques for Analog and Digital Measurements Units and standards of physical quantities, Documentation standards, Basic Instrumentation schemes – Static & Dynamic, Accuracy, Precision, Fidelity, speed of response, Linearization of techniques. 15 L

UNIT II:
Definition, Brief description of Classifications of errors, Statistical Analysis, Introduction to Reliability. 5L

UNIT III:
Data Acquisition Systems, Actuator, Analog Multiplier, R M S and Average value detectors, Wave and Spectrum Analyzers, Q-meters, Measurement of high frequencies RF and VHF. 20L

UNIT IV:
Working of voltmeter, ammeter and ohmmeter, Digital multimeter, Signal generator and Function generator. 10 L

UNIT V:

Definition of transducer, classification, Elements of Transducer, LVDT, strain gauge, resistive, capacitive, inductive, magnetic, optical, piezoelectric, pneumatic. 10 L

Text Books:

- Helric & Cooper, Modern Electronic Instr. & Measuring Instruments, WP.
- Dhir S.M, Applied Electronics & Instrumentation, TMH
- Shawney A.K, A course in Electrical & Electronic Measurements, Dhanpat Rai & Sons.

References:

- P.H.Mansfield, Electrical Transducers and Industrial Measurements.
- H.K.P. Neubert, Instrument Transducers, 2/e, Oxford University Press.
- A. K. Ghosh, Introduction to Measurements and Instrumentation, 2/e, PHI.
- H.S. Kalsi, Electronic Instrumentation, 7/e, TMH.

Antenna Engineering: EC 504

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Antenna fundamentals, Basic antenna parameters, radiation patterns, beamwidth, Beam effeiency, gain, directivity, aperture concepts, field zones, wave polarization. 10 L

UNIT II:
Point sources, Source with Hemispheric, Unidirectional Cosine, Bidirectional Cosine, sine (Doughnut), sine square, unidirectional Cosine Power patterns, array of two isotropic point sources, Non-isotropic similar and dissimilar point sources. Principle of pattern multiplications, Linear Array of n isotropic point sources, Null Directions for n isotropic point sources. 15 L

UNIT III :
Short Electric Dipole, Radiation resistance and fields of Short Electric Dipole, and thin linear antennas, Radiation resistance and fields of thin linear antennas, Concepts of loop antenna, short magnetic dipole equivalence to a loop, different types of loop Small, circular, square loops. 15 L

UNIT IV:
Introduction to Helical, Slot, Horn Antennas, spiral and log periodic and Microstrip antennas. 10 L

UNIT V:
Antenna Measurements: Pattern, Phase, Directivity, gain, Terminal Impedance measurements and Ploarization measurements etc. 10L

Text Books:

- J.D Kraus, Antennas, McGraw Hill, 3rd ed.
- C.A Balanis, Antenna theory: Analysis and design, , John Wiley and Sons, New York,1982

References:

- Jordan E.C. & Balmain K.G, Electromagnetic Waves & Radiating systems, PHI.
- Kennedy G, Electronic Comm. Systems, 4th ed., MGH Book Co.
- J.D Kraus, Electromagnetic with Applications, McGraw Hill, 5th Ed
- R.S Elliot, Antenna Theory and Design, , John Wiley and Sons.
- R.Garg, P.Bhartia,I.Bhal,A.Ittipiboon., Micrstrip antenna Design Handbook, Artech House, London 2001.

Digital Communication: EC 505

Credits: 4 (3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}

End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Digital Communication System, Chronology of developments, Prospects and trends, Elements of Digital communication system Transmitters, transmission channels and receivers, Merits and demerits. 10L

UNIT II:
Analog-to-Digital Conversation: Sampling, Quantizing, Quantization error, Encoding, Non-uniform quantization, A-Law Compandor, PCM, DPCM, DM, ADM. 10L

UNIT III:
Transmission Line Codes, Differential encoding, PSD of digital signals (viz. UP, P, BP, SP, HDB3, DB), Inter Symbol Interference: Nyquist's Laws, Spectrum shaping, Optimum pulse shape, Full cosine roll-off, Duo binary. 10L

UNIT IV:
BPSK, DPSK, BFSK, MARY-PSK & -FSK, QPSK, MSK principles, QASK, Error calculation, Synchronous, Envelope/Non-coherent schemes, Performance evaluation (BER, SNR, BW) for various schemes. 15L

UNIT V:
Bit error probability, Decoding errors, Error threshold, Regenerative Repeaters, Error performance, Parity check, Hamming distance, ARQ and FEC systems, Flow control, Cyclic redundancy check, Cyclic codes & Convolutional codes, Viterbi Algorithm, basics of Turbo Encoder & Decoder. 15L

Text Books:

- Taub & Schilling, Principle of Communication System, Tata McGraw Hill.
- B.P.Lathi, Modern Digital & Analog Comm. System, Oxford University press.
- Simon Haykin, Communication System, John Wiley & Sons,
- L.W. Couch II, Modern Communication System, Prentice Hall India.
- Taub & Schilling, Principles of Communication Systems, 2nd ed., MGH.
- Carlson, Communication System, 4/e ,TMH

References:

- J.G. Proakis, Digital Communications, McGraw Hill.
- J.Das, S.K.Mullick, P.K.Chatterjee, Principle of Digital Comm., Wiley Eastern Ltd.
- Roden, Analog & Digital Communication Systems, 5e, SPD
- Dungan,Electronics Communication System, Vikas
- Zeimer & Tarnter, Principles of Communication, Jaico.
- Rekha, Digital Communications, Scitech
- Singh, Communication Systems: Analog & Digital, TMH
- L.W.Couch Ii, Digital and Analog Communication Systems, 2nd Edition, Macmillan Publishing Co., New York.

Antenna Engineering Laboratory: EC 591

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Study of Radiation pattern and Measurement of Gain & Bandwidth of a simple dipole antenna.
2. Study of Radiation pattern and Measurement of Gain & Bandwidth of a folded dipole antenna.(Single elements)
3. Study of Radiation pattern and Measurement of Gain & Bandwidth of a helical antenna.
4. Study of Radiation pattern and Measurement of Gain & Bandwidth of a Yagi Uda antenna.
5. Study of Radiation pattern and Measurement of Gain & Bandwidth of a log periodic antenna.
6. Study of Radiation pattern and Measurement of Gain & Bandwidth of a Horn antenna.
7. Study of reciprocity theorem.
8. Measurement of currents at different parts of antenna by current censor.
9. Study of Radiation pattern and Measurement of Gain & Bandwidth of a folded dipole antenna (3- elements)
10. Study of Radiation pattern and Measurement of Gain & Bandwidth of a folded dipole antenna (5- elements).
11. Study of Radiation pattern and Measurement of Gain & Bandwidth of a simple dipole antenna (3- elements)
12. Study of Radiation pattern and Measurement of Gain & Bandwidth of a simple dipole antenna (5- elements)

Communication Laboratory: EC 592

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Realization of Amplitude Modulation (AM) & Demodulation techniques.
2. Realization of DSB-SC Modulation & Demodulation technique.
3. Realization of SSB-SC Modulation & Demodulation technique.
4. Realization of Frequency Modulation (FM) & Demodulation techniques.
5. Realization of Phase Modulation (PM) & Demodulation techniques.
6. Realization of PAM and Demodulation techniques.
7. Realization of PCM transmitter and receiver Circuit.
8. Realization of Delta Modulator & Demodulator Circuit.
9. Realization of Time Division Multiplexing (TDM) & De-multiplexing.
10. Realization of ASK modulator and demodulator technique, connected by either physical or simulated channel.
11. Realization of PSK modulator and demodulator technique, connected by either physical or simulated channel
12. Realization of FSK modulator and demodulator technique, connected by either physical or simulated channel

Microwave Engineering: EC 601

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction: Microwave frequencies, systems and measurements. Electron motionin EM field. Microwave Transmission lines(Brief discussion)-Transmission line Equations and Solutions, Reflection and transmission Co-efficient, Standing waves and SWR,Line impedance and Admittance, Impedance matching using Smith chart. 15 L

UNIT II:
Microwave wave guides-Detailed study of Rectangular and Circular Wave guides.TE,TM propagation, Microwave components-rectangular, Circular and Semi Circular cavity resonators., S parameters. Wave guide Tees, E-plane, H-Plane, E-H Plane, Directional Couplers, Circulators and Isolators, Hybrid couplers. 15 L

UNIT III:
Microwave Sources-Klystrons, Reflex klystrons, Slow wave structures, TWTs, BWO, Magnetrons, Gyrotron. 13 L

UNIT IV:
Microwave solid state devices-Transistors, Tunnel Diodes, FETs, Gunn LSA diodes. Avalanche transit time devices- IMPATT, TRAPATT, and BARITT Diodes. Parametric devices. Introduction to MMIC. 12 L

UNIT V:
Microwave measurements VSWR, power, frequency. Industrial Applications of microwave. 5 L

Textbooks:

- David M Pozar, Microwave Engineering, John Willy & Sons, Inc.
- Peter A. Rizzi, Microwave Engineering – Passive Circuits, Prentice Hall of India

References:

- M L Sisodia, Microwave Active Devices:Vacuum and Solid State, New Age Int. Pub.
- S Y. Liao, Microwave Devices and Circuits, Pearson Education/PHI.
- M.N.O Sadiqu, Elements of Electromagnetism, Oxford
- K. C. Gupta, Microwaves, New Age Int. Publication

Microelectronics and IC Technology: EC 602

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Basic Considerations in Microelectronics, Discrete circuits vis-à-vis Microelectronics, Classification of different types of IC's, General outline of hybrid integrated circuits based on thin and thick film technology, Semiconductor monolithic circuits based on bipolar, MOS and CMOS technology, Advantages and disadvantages of different types of integrated circuits, Structure-based classification of integrated circuits-SSI, MSI, LSI, VLSI and ULSI. 15L

UNIT II:
Crystal Growth, Wafer preparation, Methods of PN junction formation (melt growth junctions, alloying, solid state diffusion, ion implantation). Introduction to epitaxial growth: LPE, VPE, MBE; Growth and deposition of dielectric layers: Thermal oxidation, CVD, plasma CVD, sputtering. 15L

UNIT III:
Planar technology, masking, lithography and etching, pattern definition, metal deposition technique. Design considerations in respect of the isolation between components; Polarity dependence, high temperature dependence, poor tolerance of the components, Poor dissipation capability, cost, Yield and Reliability: Failure mechanisms and yield loss. 12L

UNIT IV:
Basic considerations and design approach using bipolar and MOS technology, Realization of passive components, restrictive components and building blocks, Realization of different active structures. MOS integration; Different steps, MOS gates, CMOS inverter process, Silicon on Sapphire device, non volatile memory devices. 12L

UNIT V:
Introduction to Bi-CMOS inverter, VLSI interconnects. 6L

Text Books:

- S.M.Sze, VLSI Technology, TMH
- Cambel, Microelectronics Science & Engg. Fabrication, Oxford University Press.
- S.K. Gandhi, VLSI Fabrication Principles, John Wiley & Sons

References:

- Demicheli, Synthesis & Optimization of Digital Circuits, TMH
- E. S. Young, Microelectronics Devices, McGraw Hill International, New York

Wireless and Mobile Communication : EC 603

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT-I
Wireless local area network (LAN), applications, requirements, technology – Infrared (IR) wireless LAN, diffuse, quasi-diffuse and point-to-point IR wireless LAN, Narrowband Microwave LAN, Bluetooth: architecture and application, Wireless local loop (WLL): configuration, advantages and its propagation characteristics. 12L

UNIT-II
Spread Spectrum Communication: definition, types, process gain, pseudo-random sequences, direct sequence spread spectrum (DSSS), frequency hopping spread spectrum (FHSS), Limitations of conventional mobile system, mobile cellular communication: introduction, concept of frequency reuse, cluster size, cellular system architecture: mobile station, base station, Mobile Switching centre, description of mobile radio environment, introduction to radio wave propagation, concepts of free space propagation model, comparison of first generation(1G) second generation (2G) and third generation (3G) wireless cellular networks. 15L

UNIT-III
Global System for Mobile (GSM): services and features, system architecture, GSM radio interface, protocols, GSM channel types, location updating and call setup, handover, General packet radio service (GPRS). Introduction to Code Division Multiple Access (CDMA), digital cellular standard, comparison between GSM and CDMA. 15L

UNIT-IV
Brief history and overview of satellite communications, Orbital mechanics, Transponder model, Satellite link design: basic transmission theory, system noise temperature and G/T ration for earth stations, design of uplink and downlink. 10L

UNIT-V
Satellite Mobile Communication**,** GEO, MEO, LEO system, routing, localization and handover, direct broadcast satellite receiving system ,Global positioning system: basic principles of position fixing with GPS, GPS application. 8L

Text Book:

- Jochen Schiller,Mobile Commnications,Pearson Education.
- William C.Y.Lee, Mobile cellular telecommunications: analog & digital systems, MGH
- Kamilo Feher,Wireless Digital Communications,PHI.
- Stallings,Wireless Communication & Networks, Pearson Education.
- Pratt,Bostian,Allnutt,Satellite Communiation,Wiley.

Reference Book:

- Theodore S. Rappaport, Wireless communications: principles and practice, Pearson.
- Aggarwal, Introduction to Wireless & Mobile Systems,Vikas
- D. C. Agarwal, Satellite communication, Khanna publishers
- Santamaria et al, Wireless LAN systems, Artech House
- Talukder & Roopa Yavagal, Mobile Computing.
- Black U D, Data Communication and Distributed Networks, PHI
- Comer, Computer Networks and Internets, PH Int.
- Tanenbaum, Computer Networks, PHI.

Control Engineering: EC 604

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Elementary control concepts. Open loop and close loop control system. Transfer function, and impulse response, modeling of electrical and mechanical (translational and rotational) systems, and signal flow graphs. 10 L

UNIT II:
Transient response analysis of I and II order system.: Type of systems and its effect on error function. stability, steady state error. LTI (Linear Time Invariant) control system. 10 L

UNIT III:
Stability concept: Routh Hurwitz criterion of stability Root locus techniques: Root Loci and complementary root loci rules for root locus plots. 10 L

UNIT IV:
Frequency Response Analysis: Nyquist plot and Bode plot. Gain and phase margins, compensation. Compensators and controllers, lead lag and lead lag compensators, proportional, PI(Proportional Integral) and PID (Proportional Integral Derivative) control system. 15L

UNIT V:
Digital control systems, effect of sampling rate on stability transient response and steady State error State Space representation, stability analysis, state transition matrix, eigen values. 15 L

Text Books:

- Nagaratha and Gopal: Control Systems Engineering.
- K.Ogata, “Modern Control Engg.” 2nd ed., PHI, 1995.
- B.C. Kuo, “Digital Control Systems”, 2nd ed., Saundey Publication, New York, 1992.

References

- B.C.Kuo, “Automatic Control Systems”, 7th ed., PHI, 1995
- J.C.D. Azzo and C.H. Houpis, “Linear Control System Analysis and Design”, McGraw Hill1988.

Computer Architecture & Organization: EC-605

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Functional Units, Introduction to Logic Gates, Boolean algebra, Map Simplification, Combinational Circuits, Half-adder, Full-adder. Integrated Circuits, Decoders, Multiplexers, Registers. Memory Unit-RAM, ROM, Types of ROMs. Basic Computer Organization and design: Instruction Codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycle, Memory-Reference Instructions, Concept of Interrupt. 15L

UNIT II:
Machine Language, Assembly Language, Assembler, Program Loops, Subroutines. Control Unit: Micro-operations, Microinstruction Format , Control of the processor, Hardwired Implementation. 15L

UNIT III:
Introduction, Number Systems, Complements, Fixed Point Representation, Floating Point Number Representation, Addition, Subtraction, Multiplication and Division of Numbers in different types of Representation. 10L

UNIT IV:
General Register Organization, Stack Organization, Instruction Formats. Addressing Modes, RISC. Input/ Output: Peripheral Devices. Necessity of Interfacing.Asynchronours function of I/0 and I/O bus, Modes of I/O Transfer. 10L

UNIT V:
Introduction, Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory, Virtual, Memory,Memory Management Hardware.M.J.Flynn's Classification of Computer Systems, Parallel Processing, Pipelining, Arithmetic Pipelining. 10L

Text Books:

- Mano, M.M., Computer System Architecture, Prentice Hall of India, 1983.
- Hayes, Computer Architecture and Organization, McGraw Hill International Edition.
- William Stallings, Computer Organization & Architecture, PHI

References:

- Langholz, G., Grancioni, J., and Kandel, A.L., Elements of Computer Organization, Prentice Hall International, 1988.
- Assembler, Manual for the Chosen Machine.
- Gear, C. W., Computer Organization and Programming, McGraw Hill, 1975.
- Tanenbaum, A.S., Structured Computer Organization, Prentice Hall of India.
- Dr.Madhulika Jain, VineetaPillai&Satish Jain, Computer Organization and Architecrure.

Microwave Engineering Laboratory: EC 691

Credits: 2(3P)
Total Hours: 45

Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Familiarization of Microwave Test Bench and microwave components.
2. Study of VI characteristics of Gunn Diode.
3. Study of Klystron characteristics
4. Measurement of unknown frequency by direct frequency meter.
5. Measurement of unknown frequency by indirect frequency meter
6. Study of E plane Tee.
7. Study of H-plane Tee.
8. Study of Magic (E-H) Plane Tee.
9. Study of Circulator
10. Study of Directional Coupler
11. Study of Phase shifter
12. Measurement of reflection coefficient and SWR using slotted line.
13. Measurement of radiation pattern of Horn antenna.
14. Measurement of dielectric constant using Waveguide Test Bench (WTB).

Optical Fiber Communication: EC 701

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction to optical fiber communication and systems, principles and operation, Advantages and Disadvantages of fiber communication. Optical Fibers–Core and cladding, total internal reflection, calculation of numerical aperture and acceptance angle, losses in optical fibers, types of optical fibers, applications–wave guides and sensors. LED's and Semiconductor Laser's Principle of operation; It's Characteristics and Structures; Coupling to fibers; Drive circuitry; Direct and external modulation; Multiplexing. 20 L

UNIT II:
Photodetectors Principles and it's Characteristics, Pre-amplifiers, Noise sources, Signal to Noise ratio, Power penalty, Link analysis and design, Receiving sensitivity, Eye diagram. Principles, Advantages and Disadvantages, Schemes, Devices. 15L

UNIT III:
Duplexing, Tee networks, Bus, Star and Ring Topology, Couplers, Switches, Filters and other devices, Link in electronic networks - FDDI, Ethernet etc., Light wave Networks - MAN, WAN, Fiber in the Local Loop. 15L

UNIT IV:
WDM: Principle of operation, Devices, Schemes, Examples, Other high data rate handling schemes, Elements of Solitons. 5L

UNIT V:
Holography, Pattern recognition, Spatial Light Modulators and their use, Elements of Optical Computation. 5L

Text Books:

- John. Senior, Optical fiber communications: principles and practice, PHI.
- Walker, Optical Engineering Fundamentals, PHI.
- Gerd Keiser, Optical fiber communications, McGraw Hill, 3rd edition

References:

- Mynbaev & Scheiner, Fiber optic communication technology, Pearson.
- R. P. Khare, Fiber optic and optoelectronics, Oxford University press.
- John Gowar, Optical Communication Systems, PHI.
- Selverajan, Kar & Srinivas, Optical fiber comm.: principle & system, TMH.

VLSI Design: EC 702

Credits: 4(3L, 1 T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Review of MOSFET characteristics, scaling and small-geometry effects, MOSFET capacitances, MOS current source, current mirror circuits, MOS voltage source. 6 L

UNIT II:
MOS inverters, CMOS inverter, state characteristics, switching characteristics, power dissipation issues. CMOS logic gates: NAND, NOR, XOR, CMOS logic design of half and full adders. CMOS transmission gates, pseudo-nMOS, domino logic gates. Sequential MOS Logic Circuits: The SR latch circuit, clocked latch and flip-flop, CMOS D-latch and edge-triggered circuits, Schmitt trigger circuit, Comparator, Dynamic Logic Circuits: Pass transistor logic. 16 L

UNIT III:
Switches: Ideal Voltage Controlled Switches, Bipolar Transistor as a Switch, MOS Transistor as a Switch, Common Source Amplifier, Differential Amplifier, Two stage CMOS operational amplifier (OPAMP) design, Cascade OPAMP, Compensation techniques. 16 L

UNIT IV:
Design Methodologies: Full Custom, Standard Cells and Gate Arrays, basics of PAL & PLA, Programmable Logic Devices (PLD), CPLD and FPGA. 6L

UNIT V:
SPICE: Element lines, Control lines, Command lines, Types of analysis, Models and model parameters.
Layout: Layout design rules, Layout of inverters, NAND, NOR gates using LASI.
VHDL Syntax: Basic concepts in VHDL and VHDL grammar, Structural specification, VHDL description of Inverter, NAND gate, Full adder. 16L

Text Books:
- J.M. Rabaey, Digital Integrated Circuits, PHI
- Waste and Eshraghian, VLSI Design.
- Geiger, Allen & Strader, VLSI Design Tech. for Analog & Digital Circuits, MGH.
- Pucknel, VLSI Design.
- J. Bhaskar, VHDL.

References:
- P.E. Allen and D.R. Holberg, CMOS Analog VLSI Design, OUP.
- Ken Martin, Digital Integrated Circuit Design, OUP
- S.M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits, TMH
- Baker, Li and Boyce, CMOS Circuit Design, Layout and Simulation, PHI
- M.Ismail and T. Fietz, Analog VLSI Signal and Information Processing.

Power Electronics: EC 703

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Power Diodes: Rectifiers, Single phase and three phase; Effect of Inductive elements; Controlled rectifiers (SCR, Triac); Triggering Devices (UJT, Diac); Three phase converters; Effect of ac side inductance; Power FETs; VMOS; High power devices on SiC and other materials. Thyristers. 20L

UNIT II:
Thyristor Gating circuits; Gate pulse amplifier; dv/dt triggering; snubber circuit; Commutation circuit; Jones chopper. 7L

UNIT III:
DC-DC switch mode converters; Buck Boost, Buck-boost converter; Continuous and discontinuous mode operations; Full-bridge DC-DC converter; PWM bipolar and unipolar switching; Switch-mode DC-DC inverter; Three phase inverter using thyristors; Resonant converters; Switch-mode power supplies and their control; UPS; Flyback converter; Forward converter; Half-bridge converter; Full-bridge converter. 20L

UNIT IV:
Speed control of DC motor; Two quadrant and four quadrant and chopper; Dual converter; Control of induction motor; Regenerative braking. 7L

UNIT V:
Cycloconverter: Cycloconverter variable frequency speed control system; Cycloconverter circuits. 6L

Text Books:
- Krein, Elements of Power Electronics, OUP
- Mohan, Undeland & Robbins, Power Electronics(Converters, App. & Design), JW
- Jacob, Power Electronics, Vikas
- M H Rashid, Power Electronics (Circuits, Devices & Applications), Pearson.

References:
- M D Singh & K B Khanchandani, Power Electronics, TMH
- B.K. Bose, Modern Power Electronics, Jaico
- P C Sen, Modern Power Electronics, Wheeler Publishing
- Dr. P.C. Sen, Power Electronics, S.Chand
- S N Biswas, Industrial Electronics, Dhanpat Rai & Co.
- S K Bhattacharya & S Chatterjee, Industrial Electronics & Control, TMH

VLSI Laboratory: EC 791

Credits: 2(3P)
Total Hours: 45
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

1. Design basic Logic Gates Using VHDL / Verilog HDL. Implement the Design with FPGA

2. Design Universal Logic Gates Using VHDL / Verilog HDL. Implement the Design with FPGA

3. Design XOR and XNOR gates Using VHDL / Verilog HDL. Implement the Design with FPGA

4. Design the Half Adder and Full Adder circuit Using VHDL / Verilog HDL. Implement the Design with FPGA.

5. Design the Half Subtractor and Full Subtractor circuit Using VHDL / Verilog HDL. Implement the Design with FPGA.

6. Design 16:1 MUX using VHDL / Verilog HDL and download the above in FPGA and Test the circuit.

7. Design the D Flip-Flop & T Flip-Flop circuit Using VHDL / Verilog HDL. Implement the Design with FPGA.

8. Design a 4-bit counter using VHDL / Verilog HDL, simulate and observe the wave form and down load the above in FPGA and test the circuit.

9. Design and Simulate CMOS NAND & NOR gate using SPICE

10. Design & Simulate CMOS Half Adder & Full Adder Circuits Using SPICE and obtain the transfer characteristics.

11. Design & Simulate XOR & XNOR Circuits Using SPICE and obtain the transfer characteristics.

12. Design layout of a two input CMOS NAND & NOR gate using LASI.

13. Design layout of a two input CMOS XNOR gate using LASI.

14. Design layout of a simple CMOS amplifier using LASI.

Credits: 4(3L, 1T)
Total Hours: 60

Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction: Uses of computer network, Network hardware, network software. Reference models: OSI, TCP/IP, comparison of OSI and TCP reference model.
Concept of data communication, Transmission media, Introduction to Wireless transmission, The telephone system(PSTN, structure of telephone system, switching techniques) 10L

UNIT II:
The Data Link Layer:Design issues – services provided to the network layer, framing, error control, flow control. Error detection and correction-error correcting codes, error detecting codes.Sliding window protocols – one bit sliding window protocol, a protocol using Go Back n, a protocol using Selective Repeat. 10L

UNIT III:
The MAC sublayer: Channel allocation, multiple access protocols(ALOHA, carrier, Carrier Sense Multiple Access Protocols, Collision-free protocols, Limited-Contension Protocols), Satellite Networks(Polling, ALOHA, FDM, TDM, CDMA). 10L

UNIT IV:
The network layer: Design issue, routing algorithms (The Optimallity Principle, SPR, flooding, flow, Distance Vector Routing, Link State Routing, Broadcast Routing, Multicast Routing) , Congestion control algorithms(The leaky bucket algorithm, token bucket algorithm, flow specification) Congestion control in virtual circuits, load shedding , jitter control, congestion control for multicasting, Internetworking, the network layer in the Internet. 20L

UNIT V:
Transport layer: Transport layer services, elements of transport protocols, internet transport protocol-TCP-service model, protocol, segment header, connection management, transmission policy, congestion control, timer management. UDP. 10L

Text Books:
- Tenenbaum, Computer Networks
- Ferozaan, Computer Networks Fundamentals

References:
- Black, Computer Networks.
- Schwartz, Communication Networks.
- Stevens, UNIX Network Programming.
- Douglas, TCP/IP and Internetworking.

Multimedia Communication: EC 705

Credits: 4(3L, 1T)
Total Hours: 60

Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction of Multimedia, multimedia tools, Audio & Video Response of Human Organs, Fundamentals of multimedia, Digital Audio: Audio synthesis, FM synthesis, Digital signal processing. 12L

UNIT II:
Digital video: Fundamentals of picture frame and interlacing, RGB Color representation, VGA and SVGA standards, display devices-CRT, LCD, Plasma Panel display, Comparison, Mixing video and graphics, Digital Video Camera, Zooming. 12L

UNIT III:
Digital Video Compression: Compression Models, Lossy Compression, Lossless Compression, JPEG and Motion JPEG, MPEG 1, MPEG 2, MPEG 4, Compression Standards. 12L

UNIT IV:
CD Technology: CD production, CD formats, Recording and playback techniques, Comparison, CD standards, DVD technology, DVD writing technology, Difference with CD. 12L

UNIT V:
Multimedia transmission: Issues, Properties of Multimedia data, Transmission time, quality maintenance, Noise reduction, transmission techniques: ISDN, ISDB, OFDM, COFDM. 12L

Text Books:
- Multimedia Techniques.
- Ganzalez & Woods, Digital Image Processing, Pearson Education.

References:
- Multimedia Techniques and Applications.
- Rogers & Adams, The mathematical element of Computer Graphics, MGH.

Internet & Web Technologies: EC 706

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Data Communication Networking: LAN, WAN, Circuit switching, Packet switching, Datagram and Virtual Circuit Switching, Frame relay, ATM, Protocols and Protocol Architecture: OSI Model, Introduction to three layers Model, TCP/IP Protocol architecture, TCP/IP versus OSI, UDP. 12L

UNIT II:
Internetworking: Principles of internetworking, Connection-mode operation, Bridge approach. Internet Protocol (IP): IP addressing, Sub-net addressing, Internet Control Message Protocol (ICMP), Routing protocols, Border Gateway protocol, Open Shortest Path First (OSPF) protocol, VOIP, Internet Telephony, Ipv6 (IPNG), ICMP v6. 12L

UNIT III:
Electronic Mail: Simple Mail Transfer Protocol (SMTP), RFC 822, Multipurpose Internet Mail Extension (MIME), Uniform Resource Locators (URL), Universal Resource Identifiers (URI), File transfer protocol (ftp), Hypertext transfer protocol (http). 12L

UNIT IV:
World Wide Web (WWW): The client side, the server side, Common Gateway Interface (CGI), writing a web page in HTML, JAVA, Search engine, Window, View port, Zooming, Panning, Clipping, Transformation in 3-D, Projection-perspective and parallel projections, computing vanishing points. 12L

UNIT V:
Three Dimensional Viewing and Representation: Hidden surface removal, Back face removal, Z-buffer algorithm, Painter's Algorithm, Shading, Gouraud and Phog shading, Fractals, Self-similar fractals, Animations. 12L

Text Books:

- Douglas, TCP/IP and Internetworking.
- Tenenbaum, Computer Networks
- Ferozaan, Computer Networks Fundamentals

References:

- Black, Computer Networks.
- Schwartz, Communication Networks.

Mobile Computing: EC 707

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Basics of Mobile Technology, Brief history of Mobile Computing, Terrestrial cellular telephony: cellular concept, cell cluster, frequency reuse, mobile station (MS), base station (BS), Mobile switching center (MSC), Different cellular standards, digital cellular systems, TDMA and CDMA systems, global system for mobile communication (GSM) standard, GSM network, control function, call setup, call handling, mobility management. 12L

UNIT II:
Cellular digital packet data (CDPD) system: IP based mobile system, general packet radio service (GPRS). Switching and Traffic: intelligent cell concepts, intelligent network communication, and wireless local loop Antennas for cellular systems: multi-path and fading in signals, co-channel suppression, and GMSK modulation. 12L

UNIT III:
Satellite mobile communication: Orbital mechanics: GEO, MEO, LEO system, personal communication system (PCS), satellite PCS, Third generation Mobile system. 12L

UNIT IV:
Spread spectrum communication: definition, types, process gain, pseudo-random sequences, direct generation of spread spectrum signals (SSS), frequency hop SSS, hybrid SSS, Analysis of spread spectrum systems, near and far problem, acquisition and tracking of SSS. 12L

UNIT V:
Satellite links: direct broadcast satellite receiving system, earth station design, VSAT, analog and digital transmission of voice and TV signals, bandwidth compression, principles of FDMA, TDMA, CDMA, SPADE, DMAS, Global positioning system: basic principles of position fixing with GPS, errors in position fixing, DGPS, WAAS, GPS application. 12L

Text Books:

- Talukder & Roopa Yavagal, Mobile Computing.
- Black U D, Data Communication and Distributed Networks, PHI

References:

- Comer, Computer Networks and Internets, PH Int.
- Tanenbaum, Computer Networks, PHI.

Neural Networks: EC 708

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Fundamentals of Artificial Neural Network (ANN), Biological prototype, Neural Network Concepts, Definitions – Activation, Functions single layer and multiplayer networks, Training ANN's, perceptrons, Exclusive OR problem, Linear seperability, storage efficiency, perceptron learning - perceptron training algorithms, Hebbian learning rule - Delta rule, Kohonen learning law problem with the perceptron training algorithm. 15L

UNIT II:
The back propagation Neural network, Architecture of the back propagation, Network Training algorithm, network configurations, Back propagation error surfaces, Back propagation learning laws, Network paralysis _ Local minima, temporal instability. 10L

UNIT III:
Counter propagation, Networks Architecture of the counter propagation network, Kohonen layer, Training the Kohonen layer preprocessing the input vectors initializing, the weight vectors Statistical properties, Training the Grossberg layer- Feed forward counter propagation, Neural Networks Applications. 15L

UNIT IV:
Statistical methods simulated annealing, Bloltzman Training, Cauchy training – artificial specific heat methods, Application to general non-linear optimization problems, back propagation and Cauchy training. 10L

UNIT V:
Hopfield net stability, Associative memory, statistical Hopfield networks, Applications ART NETWORKS GENETIC ALGORITHMS, Bidirectional Associative memories-retrieving stored information, Encoding the association, continuous BAMS. 10L

Text Books:

- Linus Fe, Neural Network in Computer Intelligence , McGrawHill
- Philip D.Wasserman, Neural Computing(Theory and Practice)

References:

- Robert Hecht-Nilson, Neuro Computing.
- James A.Anderson, An Introduction to Neural Networks.
- Jack M. Zureda, Introduction to Artificial Neural Systems

Fuzzy Control Systems: EC 709

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
History of Fuzzy Computing, Fuzzy Sets, From Crisp Sets to Fuzzy, Fuzziness, Membership function, Basic properties of Fuzzy Sets, Basic Operations on Fuzzy Sets, Fuzzy arithmetic, Properties of Fuzzy relations, Representation of Fuzzy Relations, Operations on Fuzzy Relations. 15L

UNIT II:
Concept of Fuzzy Logic, Fuzzy logic versus conventional logic, Membership function, Fuzzy logic and probability, Alpha-cut and its application. 10 L

UNIT III:
Fuzzy Control, Necessity of Fuzzy control linguistic variables and base variables, Fuzzification of variables, Fuzzy rule-base, Inference machine, Defuzzification methods. Example of a temperature control system. 15 L

UNIT IV:
Applications of Fuzzy Sets, Fuzzy sets and Soft Computing, Accuracy Management with Fuzzy, Fuzzy Models. 7L

UNIT V:
Basics of Coding theory, Coding for reliable digital transmission and storage, Types of codes, Types of errors encountered, Error Control Strategies, Encoding of cyclic codes, Syndrome computation and error detection, Decoding, and Cyclic Hamming Codes. 13L

Text Books:
- Klir & Yuan, Fuzzy Sets and Fuzzy Logic
- Delf, Introduction to Cryptography, Springer.

References:
- Klir & Folger, Fyzzy Sets, Uncertainity and Information.
- Buchman, Introduction to Cryptography, Springer.

Remote Sensing : EC 710

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Transmission of Solar Radiation through Atmosphere: Solar radiation spectrum, Radio infrared & optical windows of earth's atmosphere, Spectrum of solar radiation, Emissions from disturbed sun. Reflection, Absorption and Emission from Earth and Atmosphere: Variation of earth's reflectivity, wavelength and geographical location, Seasonal variation of reflectivity, Solar radiation reflected from earth. Thermal radiation from the earth, Thermal radiation from the atmospheric constituents, Thermal emission from cloud, rain, snow and fog, Radio noise and interference at satellite heights. 15L

UNIT II:
Sensors and Cameras: Optical and infrared detectors and filters, Optical and infrared cameras, Microwave and Millimetre wave radiometers, Scanning systems, Mechanical and Electronic Systems; Scatter meter, Altimeter. 10L

UNIT III:
Remote Sensing Satellites: Orbits of remote sensing satellites, Remote sensing satellites – LANDSAT, Indian Remote Sensing (IRS) Satellites, INSAT, NOAA Series, NASA's Upper Atmosphere Research Satellites (UARS), TRMM satellite. 10L

UNIT IV:
Remote Sensing of Atmosphere and Sea State: Passive and active remote sensing, Side Looking Airborne Radar (SLAR)), Synthetic Aperture Radar (SAR), Along Track Scanning Radiometer (ATSR), Laboratory measurements of remote sensing parameters, Tropical rainfall measurements, Microwave sensing of sea surface. 10L

UNIT V:
Interpretation of Sensing Data: Photo-interpretation, image processing and pattern recognition, Spectral interpretation of remote sensing imagery, Interpretation of thermal maps, Colour coding and enhancement, Image interpretation. Brief overview of GIS.
15 L

Text Books:

- Forsyth, Computer Vision- A modern Approach, Prentice Hall.
- Mann, Scott, Wireless Application protocol.

References:

- Singhal, Wireless Application protocol: Writing application for Mobile Internet.
- Ganzalez, Digital Image processing.

Radar Engineering: EC 711

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Rader fundamentals, Range equation, Different types of radar and its working principle. 6L

UNIT II:
Radar transmitters - High power transmitting devices, Receivers - Special design considerations, low noise receivers, Antennas, mechanical and electronic scanning of beam, Indicators and Display, Solid-State Radar - present trend. 10L

UNIT III:
Detection probability for a pulse Doppler radar, Factors affecting angular resolution, Effect of Propagational Factors on the Performance of Radar Systems: Atmospheric attenuation and refraction of radar waves, Attenuation, Back scatter and Doppler effects, Confusion of radar systems by Chaff. 16L

UNIT IV:
Wavelength and polarization dependence of complex targets, Control of radar cross section (RCS), RCS reduction, Body shaping, Radar absorbing materials (RAM), Resonant and broad band RAM, Impedance loading, Enhancement of RCS by multiple scattered, dielectric lenses, Retrodirective arrays and impedance loading. 10L

UNIT V:
General considerations, Requirements in angle tracking, Angle tracking system organization, Rate and position errors of tracking loop, Tracking loop mechanization, Range and velocity tracking, Signal Processing and Waveform Design: Matched filter processing, Radar ambiguity function for sophisticated waveforms, Choice of waveforms in different environmental conditions, Optimum waveform for detection in clutter, Desirability of range-Doppler ambiguity, Special techniques for optical signal processing, digital signal processing, Radar measurement accuracy. Applications of radar. 18L

Text Books:

- Peyton Z.Peebles Jr., Radar principles , John Wiley 2004Radar Systems.
- Babu R, Digital Signal Processing , Scitech.

References:

- Tri T. Ha, Digital Satellite Communication, McGraw Hill.
- William Lee, Mobile Cellular Telecommunication, MGH

Biomedical Instrumentation: EC 712

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction to bio potential origin, Electric activity of excitable cells, resting potential, action potential, Nerst equation, propagation of action potential, Surface map of bio- potential concept. 5L

UNIT II:
Electrode theory, Working principle & application of different bio-potential electrodes & biochemical transducers (Microelectrodes, surface electrodes, needle electrodes, Reference electrode, pH electrode, blood gas electrode, Ion electrode). 10L

UNIT III:
Sources of action potentials, Methodology & principle of measurement, Electroencephalograms & Electromyograms & their inferences. Brief description of cardiovascular system, Electrocardiography-Sources of cardiac bio-potentials, Methodology & principle of measurement, Electrocardiograms & their inferences, Vector cardiography- concept, Principles of direct & indirect measurement of blood pressure, Principles of measurement of blood flow/cardiac rate, PH & blood gas analyzer. 20 L

UNIT IV:
Working principles of medical X-ray, CT scan, CAT scan, Ultrasound scanning, MRI, Medical application of LASER including safety aspects, Fiber optic application in imaging internal organs, Effect of mm wave and microwave on human body, Electrical safety. 15L

UNIT V:
Respiratory mechanism, parameters of respiratory system, Principle of measurement of various parameters, impedance pneumograph, spirometer. Pacemakers, Defibrillators, ventilators, respirators, heamodialysis machine, cobalt therapy (Radio therapy). 10L

Text books:

- Carr & Brown, Intro. to Biomedical Equipment Tech., Pearson Education.
- Cromwell, Weibwell & Pfeiffer, Biomedical Instr. & Measurements, PHI.
- Khandpur, Hand book of Biomedical Instrumentation, TMH

References:

- John Webster, Medical Instrumentation, Application & Design, John Willey
- Venkata Ram, Biomedical Electronics & Instrumentation, Galgotia Pub. Ltd.
- Marvin D & Weirs Chilton, Biomedical Instrumentation, Book Co, London.

Material Science: EC 713

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Crystal structures and crystal planes, Crystal binding, Crystal defects, Polycrystalline materials, Grain boundaries, Defects, Amorphous materials, Solutions and Phase Diagrams. 10L

UNIT II:
Dielectric Constant, Clausius-Mossotti relation, Dielectric behavior at high frequency, Non-linear Susceptibility, Piezoelectricity: Origin, Piezoelectric materials, Surface Acoustic Waves, Ferro electricity: Spontaneous polarization, Different ferroelectric materials, Dielectric Resonator Materials, Diamond like Carbon, Photorefractive Materials, Materials for Optical Storage, Various Electronic and Optoelectronic applications. 15L

UNIT III:
Theory of Para, Ferro, ferri and anti-ferromagnetism, Magnetic domains, Ferrites, Magnetic materials in Electronics, Communication and Computers. Classification - Elemental, Compound, Alloy, Amorphous, Oxide and Organic Semiconductors, Applications. 15L

UNIT IV:
Different types, Applications, Ferroelectric Liquid Crystals and their use. Phenomena; Principles; Tunneling in junctions; Application in microwaves, power transmission and in computers; Mag Lev, High-Tc Superconductors(HTS). 10 L

UNIT V:
Bridgman, Zone melting and other techniques; Epi-taxial growth: VPE, LPE, MBE, MOCVD. Various electrical and optical methods of characterization. 10L

Text Books:

- Irene Eugene, Electronic Material Science.
- C. Kittel, Introduction to Solid State Physics
- Ali OmarIntroduction to Solid State Physics
- Rajendran and Marikanni, Semi conductor physics and opto electronics.

References:

- Streetman and Banerjee, Electronic Devices and Circuits.

Robotics: EC 714

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction to cognitive science and perception, problem representation through heuristics, problem reduction, basic heuristic search procedures; Knowledge representation and knowledge engineering. 12L

UNIT II:
Dimensions of Object, Color differentiation, Gray level images, color Images, Length estimations, Automated visual inspection, Object recognition & matching. 12L

UNIT III:
Stereo geometry & correspondence, Motion analysis, Optical flow, Robot arm, Robot sensing, Speech Recognition. 12L

UNIT IV:
Imaging, recognition captured imagery, stereoscopy of images, Application of computer vision**,** Bio-medical imaging**,** Document processing, OCR. 12L

UNIT V:
Inference engines and expert systems; Programming languages for AI; Feedback control and robot manipulation, robot learning. 12L

Text Books:

- Rich & Knight, Artificial Intelligence.
- Gonzalez, Digital Image Processing.

References:

- Jain, Machine Vision, MGH.
- Forsyth, Computer Vision- A modern Approach, Prentice Hall.

Artificial Intelligence: EC 715

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Artificial Intelligence (AI) Basics, AI Techniques, AI Problems, Problem space, production systems, Heuristics Search techniques-Hill climbing, BFS, DFS, Problem Reduction, Water-Jug Problem, Hill Climbing Problem, AND-OR Graph, Heuristic Function, Estimate of Heuristic Function, A*, AO* algorithm. 15L

UNIT II:
Statements, Connectives, Well-formed formulas, Conjunctive Normal form, disjunctive normal form, Inference rules: simplification, modus ponens, modus tollens, Predicate logic, prepositional logic, universal and existential quantifiers, conceptual dependency graph. 10L

UNIT III:
Monotonic reasoning, Non-monotonic reasoning, examples, properties, uses, Common-sense reasoning and its properties, Bayesian Networks, Dempster-Shafer Theory. 10L

UNIT IV:
Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge acquisition, Example-MYCIN, Properties of MYCIN. 10L

UNIT V:
Game Playing, techniques, Mini-max search procedure, Natural Language and its links with AI, Speech Synthesis and its recognition, Syntactic and semantic analysis with AI, Bio-medical application of AI in context of Fuzzy Sets, Image Processing with AI (only relational study). 15L

Text Books:

- Rick Knight, Artificial Intelligence, TMG.
- Peterson, Artificial Intelligence.

References:

- Vidyasagar, Intelligent Robotics Systems, TMG.
- Simon, The sciences of the Artificial Systems, MIT Press.

BM-801 : Principles & Practice of Management

Credits: 4 (3L 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I :

Management: Concept, Nature, Importance; Management Vs. Administration, Management Skills, Levels of Management, Characteristics of Quality Managers. History of management Thoughts, Theories & Approaches to Management. Business Ethics and Social Responsibility: Concept, Shift to Ethics, Tools of Ethics. 10 L

UNIT II:
Planning: Nature, Scope, Objectives and Significance of Planning, Types of Planning, Process of Planning, Barriers to Effective Planning, Planning Premises and Forecasting, Decision Making.
Organizing: Concept, Organization Theories, forms of Organizational Structure.
Combining Jobs: Departmentation, Span of Control, Delegation of Authority, Authority & Responsibility, Organizational Design.

15L

UNIT III:
Staffing: Concept, System Approach, manpower Planning, Job Design, Recruitment & Selection, Training & Development, Performance Appraisal
Directing: Concept, Direction and Supervision
Motivation: Concept, Motivation and performance, Theories of Motivation, Approaches for improving Motivation, Pay and Job Performance, Quality of Work Life, Morale Building.

15L

UNIT IV:
Leadership: The Core of Leadership: Influence, Functions of Leaders, Leadership Style
Communication: Communication Process, Importance of Communication, Communication Channels , Barriers to Communication.

10L

UNIT V:
Controlling; Concept, Types of Control, Pre requisite of Control. The Quality Concept Factors affecting Quality, Developing a Quality Control System, Total Quality Control.
Change and Development: Model for managing Change, Forces for Change, Need for Change, Alternative Change Techniques.

10L

Text Book:

- Prasad, L.M. Principles & Practices of Management
- Gupta, C.B. “Modern Business Organization”. Mayer Paper Books, New Delhi

Reference:

- Stoner, Freeman & Gilbert Jr-Management (Prentice Hall of India, 6th Edition)
- Koontz- Principles of Management (Tata Mc Graw Hill, 1St Edition 2008)
- Robbins & Coulter- Management (Prentice Hall of India, 8th Edition)
- Robbins S.P. and Decenzo David A. Fundamentals of Management: Essential Concept and Application (Pearson Education , 5th Edition)
- Hillier Frederick S. and Hiller Mark S. Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets (Tata Mc Graw Hill , 2nd Edition 2008)
- Weihirch Heinz and Koontz Harold- Management: A Global and Entrepreneurial Perspective (Mc Graw Hill, 12th Edition 2008)

Digital Design using HDL: EC 801

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, Combitional circuit Design approaches, Sequential Circuit design approaches. 10L

UNIT II:
Brief overview of VHDL Design at different levels with special emphasis on Gate level design (Gate Array), Design of Sequential, Combinational and Memory devices, Logic level design and synthesis - Optimization methods, Programming Concepts, architectures, Process & Examples. 15L

UNIT III:
Brief overview of Verilog HDL Design at different levels with special emphasis on Gate level design (Gate Array), Design of Sequential, Combinational and Memory devices, Logic level design and synthesis - Optimization methods, Programming Concepts, architectures, Process & Examples. 15L

UNIT IV:
Concepts of Gate Array Design-scope of bringing Analog and Digital design together, concepts like Standard Cell, Silicon Compiler etc., Gate Array Technology-Technology conversion, Combination Technology e.g. BIMOS (Bipolar + MOS technology), Silicon on Insulator (SOI), GaAs on Si. 10 L

Unit V:
Programmable aspects of Gate Arrays, CAD for Gate Arrays-Circuit and Logic Simulation, Testing, Fault Analysis, Test Generation, Placement and Routing, CMOS and BIPOLAR Macros, Information about XLINIX and ACTEL Gate Arrays. 10L

Text Books:
- J. Bhaskar, VHDL.
- J. Bhaskar, Verilog HDL.
- Waste and Eshraghian, VLSI Design.
- Geiger, Allen & Strader, VLSI Design Tech. for Analog & Digital Ckts., MGH.
- Pucknel, VLSI Design.

References:
- M. Sarrafzadeh and C.K. Wong, An Introduction to VLSI Physical Design, MGH.
- Sait &Youssef, VLSI Physical Design Automation: Theory and Practice, World Scientific Publication Company.
- S.M.Sze, VLSI Design.
- A. B. Kahng and G. Robins, Kluwer, On Optimal Interconnections for VLSI, Academic Publishers, Boston, MA, 1995.

Embedded System Design: EC 802

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction to Real Time Embedded Systems: Embedded Systems Components, Memory, Digital Signal Processors, General Purpose Processors, Embedded Processors and Memory- Interfacing. 12 L

UNIT II:
Embedded Systems I/O: Interfacing bus, Protocols, Timers, Interrupts, DMA,USB and IrDA, AD and DA Converters, Analog Interfacing. 10 L

UNIT III:
Design of Embedded Processors: Field Programmable Gate Arrays and Applications, Introduction to Hardware Description Languages. 10 L

UNIT IV:
Embedded Communications: Serial, Parallel, Network, Wireless Communication. 8 L

UNIT V:
Embedded System Software and Software Engineering issues: Introduction to Real-Time Systems, Real-Time Task Scheduling, Concepts in Real-Time Operating Systems, Commercial Real-Time Operating Systems, Introduction to Software Engineering, Requirements Analysis and Specification, Modeling Timing Constraints, Software Design. 20 L

Text Books:

- Real Time Systems, Rajib Mall, PHI, New Delhi
- Embedded SystemsArchitechture- A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard, Newnes, Elsevier.
- Embedded Systems-Architecture, Programming and Design, Raj Kamal , TMH

References:

- Prasad, Embedded Systems/Real time Systems.
- An Embedded System Primer, Simon, PHI
- Vahid Frank, Givargis, Tony, Embedded System Design.
- Heath Steve, Embedded System Design

Nano Devices: EC 803

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Nanotechnology and nanomaterials; Brief history, Comparison of dimensions of small scale materials, Applications in Electronics, Chemical, mechanical and other branches of science and engineering. 10L

UNIT II:
Basic FET structure, Operation, Drain current-drain voltage characteristics, Effect of gate voltage and drain voltage on mobility, Short channel effect, Hot electron effect, Gate tunneling, DIBL and GIDL, Sub-threshold; Scaling, Quantum effects, Power dissipation issues, Simulation tools. 10L

UNIT III:
Quantized motion of electrons in narrow potential wells: basic concepts and length scales, Quantum Wells, Wires and Dots, E-k diagrams and density-of-states function, Modulation doping, Transport in low dimensional systems: mobility enhancement, conductance quantization, resonant tunneling; Quantum Hall effect. 15L

UNIT IV:
High electron mobility transistors, resonant tunneling diodes and transistors, Applications in high frequency electronics, Single Electron Transistors: operation and applications. SOI devices. 15 L

UNIT V:
Absorption and recombination in Wells, Wires and Dots, Excitons, Effect of electric field, Intersubb, absorption and emission. Introduction to Carbon Nanotubes. Basic structure, chirality, Metallic and Semiconducting Nanotubes, Transport and mobility, CNT FETs, Other applications. 10L

Text Books:

- Klimov Vector, Semiconductor & Metal Nano crystal.
- Lonescu & Banerjee, Emerging Nano Electronics: Life with after CMOS.
- Waser Rainer, Nanoelectronics and IT.

References:

- Polushkin V, Nuclear Electronics.

Design using CAD Tools: EC 804

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}

End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Overview of VLSI structured design approach - from circuit topology to wafer fabrication through stages of layout pattern using various CAD tools; Full and semi custom design approaches; Data and control flow in systematic structures. 13L

UNIT II:
Overview of VHDL & VERILOG 4L

UNIT III:
Information about SUPREM and other CAD tools. Process, Device and Circuit Simulation : Process Simulation - Ion Implantation, Diffusion, Oxidation, Epitaxy, Lithography, Etching, Metallization. 13 L

UNIT IV:
Device Simulation - Modeling of Bipolar and MOS Transistor; Information about BIPOL and MINIMOS CAD tools; Circuit Simulation - Linearization methods, Frequency domain analyses, Non-linear DC circuit analyses, Transient analyses of dynamic networks, Optimization and Sensitivity analyses, Automatic Design. 20L

UNIT V:
Brief overview of PSPICE, ORCAD and other CAD tools. 10L

Text Books:

- J. Bhaskar, VHDL.
- J. Bhaskar, Verilog HDL.
- Waste and Eshraghian, VLSI Design.
- Geiger, Allen & Strader, VLSI Design Tech. for Analog & Digital Circuits,MGH.
- Pucknel, VLSI Design.

References:

- M. Sarrafzadeh and C.K. Wong, An Introduction to VLSI Physical Design, MGH.
- Sait &Youssef, VLSI Physical Design Automation: Theory and Practice, World Scientific Publication Company.
- S.M.Sze, VLSI Design.
- A. B. Kahng and G. Robins, Kluwer, On Optimal Interconnections for VLSI, Academic Publishers, Boston, MA, 1995.

Information Security Systems: EC 805

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction Security problem in Information Storages & computing Elementary Cryptography Introduction Substitution ciphers Transpositions Encryption Algorithms DES AES Public key encryption Uses of encryption. 10L

UNIT II:
Program security Secure programs Non-malicious program errors Viruses and other malicious code Targeted malicious code Controls against program threats, System Security: Intruders, Viruses and Related Threats, Firewall Design Principles. 10L

UNIT III:
Protection in general purpose operating systems Protected objects and Methods of protection Memory and address protection Control of access to general objects File protection mechanisms User authentication Designing Trusted operating systems Security policies Models of security Trusted operating system design Assurance in trusted operating systems. 15L

UNIT IV:
Data base security Introduction Security requirements Reliability and Integrity Sensitive data Inference multilevel databases Proposals for multilevel security. 10L

UNIT V:
Introduction: Attacks, Services and Mechanism, Model for Inter-network Security, Cryptography: Notion of Plain Text, Encryption, Key, Cipher Text, Decryption and cryptanalysis; Public Key Encryption, digital Signatures and Authentication. Threats in networks Network security controls Firewalls Intrusion detection systems. : Overview IP security Architecture. 15L

Text Books:

- Charles. P. Pfleeger & Shari Lawrence Pfleeger ,Security in Computing , 3/e Pearson Education.
- William Stallings, Network Security Essentials, Applications and Standards Pearson Education.

References:

- William Stallings, Cryptography and Network Security Principles and practice. 2/e, Pearson Education.
- Michael. E. Whitman and Herbert J. Mattord Principles of Information Security.
- W. Stallings, Networks Security Essentials: Application & Standards, Pearson Education, 2000.

Cryptography: EC 806

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Cryptography and cryptanalysis, Aspects of security, Crypt-analytic attacks. Classical CIPHER SYSTEMS. Introduction, Transposition Ciphers, Substitution Ciphers, The Hagelin machine, Statistics and cryptanalysis, The Information Theoretical Approach, The general scheme, The information measure and absolute security, The unicity distance, Error probability and security, Practical security. 17L

UNIT II:
The DES algorithm, Characteristics of the DES, Alternative descriptions, Analysis of the DES, The modes of the DES, Future of the DES, IDEA (International Data Encryption Algorithm). Shift Registers. Stream and Block enciphering, The theory of finite state machines, shift Registers, Random properties of shift registers sequences, The generating function, Crypto analysis of LFSRs, Non-linear shift registers. Public Key Systems. 18L

UNIT III:
Introduction, The RSA system, The Knapsack system, Cracking the Knapsack system, public key systems based on elliptic curves. 5 L

UNIT IV:
Protocols, Message integrity with the aid of Hash functions, Entity authentication with symmetrical algorithm, Message authentication with a message authentication code (MAC), Message authentication with digital signatures, Zero – knowledge techniques. 10L

UNIT V:
Key Management and Network Security. General aspects of key management, Key distribution for asymmetrical systems, Key distribution for symmetrical algorithms, Network security, Fair cryptosystems. 10L

Text Books:

- Jan C. A. & Van Der Lubbe, Basic method of cryptography, Cambridge University press.
- Ranjan Bose, Information theory Coding and Cryptography.

References:

- S.Kasana, Complex Variables Theory And Applications, PHI.

Intelligent & Virtual Instrumentation: EC 807

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Historical perspective and traditional bench-top instruments - General functional description of a digital instrument, Block diagram of a Virtual Instrument, Physical quantities and analog interfaces- Hardware and Software – User Interfaces, Advantages of Virtual Instruments over conventional instruments, Architecture of a Virtual Instruments and its relation to the operating system. 15L

UNIT II:
Definition, Pattern recognition, Criteria of success, Production Systems, Control Strategies, Heuristic Search, Problem Characteristics, Production System Characteristics, Forward and backward reasoning, Matching Indexing, Heuristic Functions, Search algorithms. 10L

UNIT III:
LabVIEW – graphical user interfaces, Controls and Indicators, 'G' programming, data types, data flow programming, Editing Debugging and Running a Virtual Instrument, Graphical programming palettes and tools, Front panel objects, Function and Libraries. 10L

UNIT IV:
FOR Loops, WHILE loops, Shift Registers, CASE structure, formula nodes, Sequence structures, Arrays and Clusters, Array operations, Bundle, Unbundle, Bundle/Unbundle by name, graphs and charts, string and file I/O, High level and Low level file I/Os – attribute nodes local and global variables. 10L

UNIT V:
Basics of DAQ Hardware and Software, Concepts of Data Acquisition and terminology – Installing Hardware, Installing drivers, Configuring the Hardware, addressing the hardware in LabVIEW, Digital and Analog I/O function, Buffered I/O, Real time Data Acquisition. Computer based instruments, Image acquisition, Motion Control. 15L

Text Books:

- Garry M. Johnson, LabVIEW Graphical Programming, Tata McGraw-Hill, Edition, 1996.
- Lisa.K.Wills, LabVIEW for Everyone, Prentice Hall of India, 1996.

References:

- Labview Basics I and II Manual, National Instruments, 2003
- Barry Paton, Sensor, Transducers and Lab VIEW, Prentice Hall, 2000.

Fundamental of MEMS: EC 808

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction To Fabrication Techniques: Basic fabrication techniques (lithography, thin film deposition and doping) MEMS fabrication techniques-Nano fabrication techniques (E-Beam nano-imprint fabrication, Epitaxy and strain engineering. Scanning probe techniques). 12 L

UNIT II:
Machining and Transport Property: Introduction to Micromachining and MEMS – Essential technical background for lithography-based micromachining - Photolithography, vacuum systems, etching methods, deposition methods. 12L

UNIT III:
MEMS Device Physics and Design: Critical understanding of various transduction principles -Design, production, and characterization of MEMS devices - Sensing (piezoelectric, capacitive, magnetic, etc.) - Actuation (electrostatic, electromagnetic, thermal, piezoelectric, SMA, etc.) 15 L

UNIT IV:
Layout and design rules Experimental Mechanics for Microelectromechanical Systems (MEMS) - Methods, techniques. 9L

UNIT V:
Applications: Sensors, Actuators, and Signal Processing - Principles and performance of micro transducers - Design of experiments - Sensor and actuator spatial/temporal resolution, error analysis, uncertainty - propagation, and data acquisition - Applications of micro transducers for distributed real-time control of systems. Introduction to RF MEMS. 12 L

Text Books:

- J. A. Pelesko and D. H. Bernstein, Modeling MEMS and NEMS, CRC, 2002,.
- N. Cleland, Foundations of Nanomechanics: From Solid-State Theory to Device Applications. Advanced Texts in Physics. Berlin: Springer, 2003.

References:

- V. Kaajakari, Practical MEMS, Las Vegas, Nevada: Small Gear, 2009.
- Liu, Foundations of MEMS. Illinois ECE Series, Upper Saddle River, New Jersey: Pearson/Prentice Hall, 2006.

Advanced Digital Signal Processing: EC 809

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I :
Review: Discrete-Time Signals and Systems, Sampling, Z-transform, DFT, Filter design techniques- FIR, IIR. 5L

UNIT II:
Discrete Hilbert transforms: Real and Imaginary Part, sufficiency of the FT for causal Sequences, Sufficiency Theorems for Finite length Sequences, Relationship between Magnitude and Phase, HT Relation for complex sequences. 8 L

UNIT III:
Cepstrum analysis and Homomorphic Deconvolution : Definition of complex cepstrum Homomorphic Deconvolution, Properties of complex Logarithm, Alternative expression for complex cepstrum, The complex cepstrum of exponential sequences, Realization of the Characteristic system, Examples of Homomorphic Filtering, Application to speech processing. 15 L

UNIT IV:
Multirate DSP: The basic sample rate Alteration device Filters in sampler rate Alteration System, Multistage Design of Decimator and interpolator.The polyphase Decomposition, Arbitrary rate sampler rate converter, Digital filter banks, Nyquist filters, two channel quadrature mirror filter bank, L channel QMF banks, Cosine modulated L- channel filter banks, Multilevel filter bank, STFT, Wavelet transform, DCT. 15L

UNIT V:
Adaptive filters: Introduction, Examples of Adaptive filtering, The minimum mean Square Error Criterion, The windrow LMS algorithm, Recursive Least Square Algorithm, Forward and Backward Lattice method, Gradient adaptive Lattice method.Application Oriented introduction to DSP: DTMF Detection, Subband coding , Digital audio sampling rate conversion, Speech and Image Processing. 17 L

Text Books:

- Emmanual C. Ifeachor et. Al., Digital Signal Processing : A Practical approach, Pearson Education, 2nd edition
- Digital Signal Processing, Algorithms and Applications 3rd edition, Proakis and Manolakis,Prentice Hall of India, New Delhi, 1999.
- Simon Haykin, Adaptive Filters, , PHI.

References:

- Digital Signal Processing, A Computer based Approach, 2nd edition, S.K.Mitra, Tata McGraw Hill, New Delhi, 2001.
- L.R. Rabiner and B.Gold, Theory and Application of Digital Signal Processing., PHI,

Digital Image Processing: EC 810

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Enhancement, restoration, Image analysis and reconstruction, image data compression, two dimensional systems, linear systems and shift invariance, Fourier transform, Z-transform, Block matrices and Kronecker products, Random signals. 12L

UNIT II:
Introduction, light, luminance, brightness and contrast, MTF of the visual system, visibility, function, monochrome vision models, color matching and reproduction, color vision Model, Image sampling and quantization, two dimensional sampling theory, reconstruction of images from its samples, Nyquist rate, aliasing, sampling theorem, Practical limits in sampling reconstruction, Image & visual quantization. 16L

UNIT III:
Two dimensional orthogonal and unitary transforms, properties of unitary transforms, one dimensional DFT, cosine, sine Harmrd and Haar transforms. 10L

UNIT IV:
Point operations, contrast stretching, clipping and thresholding, digital negative intensity level slicing, bit extraction, Histogram modeling, histogram equalization, modification, spatial operations, smoothing techniques, Magnificent and interpolation, Transform Operations, Color image enhancement. 14L

UNIT V:
Spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection. 8L

Text Books:

- Jain Anil K, Fundamentals of Digital Image Processing , Prentice Hall
- Gonzalez Rafel C & Wintz Paul, Digital Image Processing , Addison Wesley
- Pratt William K, Digital Image Processing, John Wiley and Sons

References:

Rosenfield Azriel & K. Avinash, Digital Image Processing , Academic Press.

Advanced Microprocessor and Microcontroller: EC 811

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I :
Evolution of 16 bit 32 bit microprocessors from the 8 bit 8085. Introduction to Intel 8086/8088 microprocessor architecture. Concepts of pipelining, parallel and coprocessing. Concept of segmentation and computation of physical addresses. The maximum and minimum mode of operation of 8086 processor. 14 L

UNIT II:
Architecture, Addressing Modes, Data Movement, Arithmetic and Logic operations, Program control, hardware specifications, memory and basic I/O interfaces, Interrupts, Direct memory access and DMA controlled I/O, Bus Interface, Arithmetic Co-processor, MMX and SIMD technologies of x86 family. 14 L

UNIT III:
The Protected mode operation via selectors and descriptors of 16 bit 80286 and its up gradation for 32 bit of 80386 and 80486 processors. The Pentium, Pentium Pro, P-II and P-III micro-processors. 8 L

UNIT IV:
Overview of the new 64 bit architecture and Multi core operations along with the multi-threading technologies; Other high end microprocessors, Motorola, AMD, Power PC, etc. 8 L

UNIT V:
The 8051 microcontroller: Evolution of microcontrollers, overview of the 8051family. Assembly language programming: Arithmetic, logical, jump, loop, call instructions. Input/Output port programming: pin descriptions of the 8051, I/O programming; bit manipulation. Addressing modes: Immediate and register addressing modes; memory accessing.Timer/Counter programming. Port Structure, External Memory Access, Timers, Interrupts, Program Branching Instructions, Serial Communication and interfacing. 16L

Text Books:

- Barry B Bray ,Intel Microprocessors (8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium-II, Pentium-III, and Pentium 4) Architecture, Programming and Interfacing, 7th Edition, , PHI, New Delhi 2006
- A.P. Mathur, Introduction to Microprocessors, 3rd Ed., Tata McGraw Hill, New Delhi.
- The 8051 Microcontroller and Embedded Systems, M. A. Mazidi, and J.G. Mazidi, Pearson Education
- Microcontroller Projects in C for 8051, D. Ibrahim, Newnes

References:

- Microprocessor Architecture Programming Applications with the 8085/8080A – R.S. Gaonkar, 3rd Ed., PHI.
- Kenneth L.Short Microprocessors and Programmed Logic, 2nd Ed, Prentice Hall of India, New Delhi, 1988.

Opto-Electronic Devices: EC 812

Credits: 4(3L, 1T)
Total Hours: 60
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
Internal mark {28 (Term test) + 8 (assignment/Presentation) + 4 (Attendance)}
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

UNIT I:
Introduction, radiative and non-radiative recombination processes, Einstein's relations for spontaneous and stimulated emissions and absorption, direct and indirect band-gap semiconductors, ternary and quaternary materials, heterojunctions, coherence properties of light, light as an electromagnetic radiation. 15 L

UNIT II:
Electroluminescent process, Injection efficiency, recombination efficiency, LED materials, LED construction, device configuration and efficiency, LED structures: planar, dome shaped, hetero junction, surface emitting, edge emitting LED; device performance, drive circuitry, spectral response. 15L

UNIT III:
Photoconductors, Photodiodes: p-n, p-i-n, hetero junction photodiodes, avalanche photodiodes, comparison of different photodiodes, photo transistor, liquid crystal displays, solar cells. 10 L

UNIT IV:
Operation, population inversion, gain, lasing threshold condition, semiconductor laser structures: Buried hetero structure laser, distributed feedback laser, quantum well laser; gas lasers, mode locking, Q switching, tunable semi-conductor lasers. 10L

UNIT V:
Optical fiber as waveguide, principle of ray propagation (ray theory), material and structure, meridional and skew rays, numerical aperture, step index and graded index fibers, electromagnetic wave propagation in step and graded index fibers, single mode and multimode fibers, normalized frequency, mode volume, mode field diameter, cut-off wavelength. Introduction to optical integrated devices 10 L

Text books:

- Keiser, Optical fiber communication, Tata McGraw Hill.
- J. Wilson & J.F.B Hawkes, Optoelectronics – an introduction, Prentice Hall of India.
- Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India

References:

- Jasprit Singh, Optoelectronics – an introduction to materials and devices, MGH.
- John M. Senior, Optical fiber communication, Prentice Hall of India
- Prince S, Optical & Optoelectronic Devices, Scitech