STUDENT HANDBOOK

Applicable for students admitted into

M.Tech Programs from 2012-2013

K L University

u/s 3 of UGC Act, 1956

Koneru Lakshmaiah Education Foundation

INSIDE

S.NO	DETAILS	PAGE NO
I.	Contact Details	3
II.	About University	4
III.	Academic Regulation	25
IV.	Programs Offered	27
1.	Master of Technology in Biotechnology (BT)	42
2.	Master of Technology in Structural Engineering (SE)	57
3.	Master of Technology in Computer Science & Engineering (CS)	71
4.	Master of Technology in Computer Networks and Security (CNS)	90
5.	Master of Technology in Communication and Radar Systems (CRS)	111
6.	Master of Technology in Very Large Scale Integration (VLSI)	133
7.	Master of Technology in Embedded Systems (ES)	147
8.	Master of Technology in Power Electronics and Drives (PED)	175
9.	Master of Technology in Power Systems (PS)	196
10.	Master of Technology in Thermal Engineering (TE)	215

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Note: While every effort has been made to ensure that this book is accurate and up to date, it may include typographical or other errors. Changes are periodically made to this publication and will be incorporated in new editions.

ABOUT UNIVERSITY

VISION:

To be a globally renowned university.

MISSION :

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

OBJECTIVES :

Focus	Objective
Academics	1. To offer academic flexibility by means of Choice based credit systems and the like. 2. To identify and introduce new specializations and offer programs in emerging areas therein 3. To incorporate into the curriculum the Application orientation and use high standards of competence for academic delivery 4. To design and implement educational system adhering to outcome based International models. 5. To introduce and implement innovation in teaching and learning process to strengthen academic delivery 6. To offer academic programs at UG, PG, doctoral, Post-Doctoral which are industry focused, and incorporates Trans-discipline, inter-discipline aspects of the education system 7. To deliver higher education that includes technologies and meeting the global requirements
Research	8. To promote inter-disciplinary studies and create needful facilities that enhance inter-disciplinary research and innovation 9. To create an ambience that is conducive for undertaking sponsored research, internal funded research and offering consultancy services to wide spectrum of originations 10. To establish centers of excellence in frontier areas of research, and design innovation centers with industry collaboration 11. To create environment to innovate and incubate the products and services that addresses the societal requirements

	12. To integrate research into all academic programs 13. To maintain high standards in achieving research outcomes 14. To promote International conferences / Seminars / Workshops / in collaboration with professional bodies for creation of avenues for research exchange
Extramural and extension	15. To generate means and avenues for carrying out extramural research for Industry and Academia 16. To organize extension activities covering literacy promotion, health awareness and improve the living standards of community 17. To make the research outcomes useful and applicable for the societal needs
Infrastructure	18. To promote and maintain state of the art facilities for academic delivery, research and co & extra-curricular facilities and develop congenial and eco-friendly fully residential campus 19. To create and strengthen focused and modern infrastructure that address the national needs through generation of dedicated funds from Industry, Government and research organizations,
Equity / Access	20. To provide and promote the opportunities to higher education to socially deprived communities and remove disparities by promoting women, differently abled and socially deprived 21. To provide equal access to meritorious both in terms of admissions and financial support
ICT	22. To lay emphasis on effective usage of ICT, WEB –resources and train the faculty on the latest advancements thereof and develop effective e-content 23. To develop and maintain world class ICT infrastructure and lay emphasis on its effective usage, extend regular training to both faculty and students on its latest advancements there by ensure interactive academic delivery
Examinations and evaluations	24. To introduce reforms in the examination and evaluation system that brings out knowledge application skills and competencies of the students and ensure transparency

Ecology and Environment	25. To Build into curriculum, issues related to social awareness about ecology and environment towards achieving greener society
Linkages	26. To promote collaborations with international and national organizations for advancements of academics, research, Technology transfer and Intellectual property rights. 27. To Indigenize the global technological solutions and develop the products, and services that transforms the standard of living of rural India 28. Design new products and services that address commercially attractive needs and opportunities while leveraging the available resources in the form of un-employed and under-employed Individuals
Employability	29. To provide skills through curriculum and training that are essential in fostering entrepreneurial thoughts, employability prospects and at the same time provides necessary support for incubating the innovations and assisting them for prospective commercialization. 30. To provide necessary business infrastructure that allows attracting and sustaining the industry to commence their business establishments within the University Campus and aid in life long sustenance of employment. 31. To develop industrial cluster that helps the students to start their industry after incubating the products at the incubating centers which will create Jobs 32. To develop National depositories for meeting the goals of National skill development council 33. Train people to profile neighborhood and communities for the needs and commercial opportunities that will support financially sustainable new businesses
Governance	34. To institute measures for transparent administration that aid in improving efficiency, accountability and reliance 35. To comply with regulations of all the statutory bodies. 36. To install professional managers who are global visionaries, thought leaders, and thinkers into the management of the University so as to contribute to the ideals of the University system

Quality	37. To continuously upgrade the faculty in curriculum design, teaching pedagogy, usage of ICT and various processes pertaining to academics, research and University administration 38. To develop mechanism that attracts talented, qualified and experienced faculty from across the globe for pursuing their academic and research careers at the University. 39. To consider and implement norms, metrics, standards, procedures and benchmarks for assessing and improving the quality in every aspect of University system and achieve quality certifications by National and International bodies. 40. To establish Internal quality Assurance cell (IQAC) and install a quality systems that is integral part of all the University processes 41. To continuously upkeep overall quality of the University based on aspects of regular feedback from the stake holders 42. To improve the quality of faculty through faculty incentives, awards and recognitions
Value orientation	43. To mold the students to possess professional ethics, moral values and intrapersonal skills that shape them into effective leaders and who are having the thoughts of equality and unanimity towards all walks and sects of life. 44. To inculcate the self-consistency, self-reliance and self-learning qualities for shaping the students to lead their life on their own. 45. To sharpen the critical thinking and reasoning skills by making students tackle problems and ideas that are yet to be tackled through application of their intellectual discovery. 46. Developing the students towards human intellectual achievement and make them rich in cultural experience 47. Students to be encouraged and provided with necessary support enabling them to choose and pursue careers of their choice & interest that make them professionally satisfied.
National development	48. To expand the University in all its modes of delivery so as to contribute to the Nation's increase in Gross Enrolment Ratio 49. To align the academic programs and courses to match the requirements of the National goals

	50. To develop technology that helps sustainable socio economic development

History

The President of KoneruLakshmaiah Education foundation, Er.KoneruSatyanarayana, along with Late Sri.KoneruLakshmaiah, founded the K L College of Engineering in the Academic year 1980-81. With the mighty vision and restless efforts of Er.KoneruSatyanarayana K L College of Engineering carved a niche for itself through excellence in engineering education, discipline and record numbers of placements and was the leading college in the state of AP. K L College of Engineering achieved NBA Accreditation for all its B.Tech. programs in 2004 and later re-accredited in 2007. K L College of Engineering was transformed into an autonomous engineering college in the year 2006. In 2008 this college received a record grade of 3.76 on a 4 points scale with "A" Grade from NAAC; and in February 2009, the college, through its founding society "KoneruLakshmaiah Education Foundation" was recognized as Deemed to be University by the MHRD-Govt. of India, Under Section 3 of UGC Act 1956. This Deemed to be University is named as "K L University".

Location

Vijayawada is located on the banks of river Krishna in the state of Andhra Pradesh and has been historically a cultural, political and educational center. It is also a part of Andhra Pradesh Capital Region. The city is well connected by National Highway and Rail with Chennai (440 km), Hyderabad (275 km), Vizag (385 km) and is a central junction for trains running from North to South India. Daily flights operate from Hyderabad and Bangalore.

K L University is situated in a spacious 100-acre campus on the banks of Buckingham Canal of river Krishna, eight kilometers from Vijayawada city. Built within a rural setting of lush green fields, the institute is a virtual paradise of pristine nature and idyllic beauty. The campus has been aptly named "Green Fields" and the splendid avenue of trees and gardens bear testimony to the importance of ecology and environment. The campus ambience is most befitting for scholastic pursuits. The University has been situated on a built up area of around 15, 00,000 S. Ft.

ACCREDITATIONS:

- Declared as Deemed to be University u/s 3 of UGC Act 1956.
- Accredited by National Assessment and Accreditation Council (NAAC) of UGC as 'A' Grade with 3.16 CGPA on 4 point scale.
- Approved by All India Council for Technical Education (AICTE), New Delhi.
- ISO 9001 - 2008 Certified Institution.

FACILITIES :

Central Library: E-Resources

The Central Library is the largest, and holds materials to serve the whole University community. It has materials relevant to the Engineering, Science & Humanities courses offered by the University.

The library system contains more than one lakh and fifty thousand books and periodicals on all subjects related to the teaching and research interests of the University staff and students. The library has over 15,000 electronic journal titles, academic databases and 5000 eBooks. Access is available on campus on student computers and remotely.

A new library building will be opened shortly on par with international standard with modern IT facilities.

Every department of the college maintains their library to cater the needs of students and faculty. All foreign and Indian journals are made available in the department library for the convenience of faculty and students.

The libraries render following library services.

- Circulation of library documentary.
- Inter-library loan services.
- Photo copying services.
- Reference service.
- CD-ROM search services.
- Inter Net services.
- OPAC
- WEB OPAC
- Audio visual
- Online lectures

The Data Center

A State-of-the-Art Data center with advanced servers provides highly interactive learning environment with full-fledged hardware and software training facilities.

Hardware:

The configuration of high end stream of servers that provides various services is

Super Computer

HPC Infrastructure (Super Computer):

- 5.3 TERA Flops (CPU + GPU)
- HP SL 230 4* SL230s Gen8, (2 * 2.6 GHz, 32GB RAM, 2x500GB HD, 10G IB HCA) providing -1.3TF
- HP SL 250 2* SL250s Gen8, (2 * 2.6 GHz, 32GB RAM, 2x500GB HD, 10G IB HCA + 2 NVIDIA K20 GPU providing -4TF. Master Node:
- HP DL 380P 1* DL380p Gen8 (2* 2.6Ghz, 64GB RAM, 2x2TB HD, 10G IB HCA).
- Compute Switch (48 Port Low latency switch)QLogic IB QDR 36 Port Switch.
- Intel® Composer XE for Linux.

The data centers consists of BYOD Servers& Backup Server, **Sun Servers, Dell and HP Blade Servers**, **Apple Server Xserve:**

SPECIAL LABORATORIES

The institute is equipped with various Industry Collaborated Labs

S. No	Discipline	Name of the Lab	Research Group Associated
1.	Computer Science and Engineering	CISCO	Computer Networks and security
2.	Computer Science and Engineering	IBM	Software Engineering
			Knowledge Engineering
3.	Computer Science and Engineering	Microsoft	Embedded Systems
			Software Engineering
			Knowledge Engineering
4.	Computer Science and Engineering	Adobe	Web technologies

			Image processing
5.	Computer Science and Engineering	Oracle	Knowledge Engineering
6.	Electronics Communication Engineering	NI Lab View	Communications Systems

Physical Education- Sports Facilities:

KL University encourages students to explore their latent talents by providing good games and sports facilities. The institute is equipped with the following.

- Athletic track
- Hockey Field
- Badminton Courts -4
- Tenni-koit Courts -2
- Cricket Field with Net practice - 3
- Volleyball Courts -4
- Tennis Courts - 2
- Handball Court
- Netball Courts - 2
- Throw ball courts - 2
- Beach Volleyball Court
- Football Field
- Basketball Courts – 2
- Kabaddi Courts – 2
- Table Tennis - 6
- Chess
- Caroms
- Kho Kho Court
- Soft Ball
- Archery

The University had State-of- the - Art Indoor stadium of 30000 sq.ft with:

- 4 wooden Shuttle Courts/ Basketball Court
- Yoga and Meditation Center
- Dramatics

- 8 Table Tennis Tables
- Hobby Center
- Gymnasium for Girls
- Gymnasium for Boys
- Multipurpose room with Chess, Carroms etc.
- Power lifting/Weight Lifting

Accommodation- Hostels

- KL University has separate hostels for boys and girls with well furnished rooms and modern amenities. The overall atmosphere is very conducive for the students to concentrate on studies.
- A state- of – the- art kitchen and spacious dining area has been provided for both the hostels.
- Generators have been provided as power back up.
- Emphasis has been laid on hygiene and cleanliness for healthy living. A customized menu caters to the student needs and it keeps changing according to their tastes.
- Teaching staff will have to address academic and personal problems of the students.
- Round-the-clock security, communication, dispensary facilities are also available.

The Girls Hostel

The girl's hostel is within the campus with a capacity of 1192 in 500 rooms. Different rooms accommodating 2 per room, 3 per room with attached toilets as well as A.C. rooms are available. Suite rooms with modern furniture and separate study room are also available.

The Boys Hostel

It is a short walk from the university with a capacity of 2040 in 780 rooms. Different rooms accommodating 2 per room, 3 per room with attached toilets as well as A.C. rooms are available.

Facilities in the Hostels

Protected drinking water, state of the art kitchen, dining hall, newspapers, telephones, toilets and bathrooms are well maintained. Every student in the hostel is provided with a cot, study table, chair and a rack. Fan and light are also provided in each room.

- Gas & Steam based hygienic food preparation
- Palatable regional, national and international cuisines
- Cleanliness and Safety

- STD/ISD Facilities
- Medical Kits and First Aid Boxes
- Soft drinks, snacks, Fruits etc.
- Laundry
- Stationary shop

➢ Hostel Rules & Regulations

- Students are hereby informed that while staying in the hostel, it is essential to be responsible in maintaining dignity by upholding discipline. They must be obedient to the hostel warden/floor in – charges.
- Valuable items like jewelry etc., should not be kept with students while staying in the hostel. It is student's own responsibility to safeguard her/his Laptops, Money by locking suitcases and bags. If any loss is found, management will not take any responsibility.
- Student has to intimate to the hostel authorities before you giving police complaint against losses.
- Students are not allowed to indulge in smoking, consumption of Alcohol, Narcotic drugs etc., and defaulters will be strictly viewed upon.
- Students are directed that after locking their rooms they have to hand over the keys to security and can collect them on returning back to the hostel.
- Students must switch off Fans, Lights, Geysers, A/C's etc., before leaving their rooms.
- Visitors are not allowed inside the hostel at any time, however they are allowed into the visitor's hall with the prior permission of the warden. Only family members listed by the parents are allowed to contact the student. Visiting hours are up to 7.30 pm only and after 7.30 pm visitors are required to leave premises.
- Hostel students are not allowed to come into the hostel after 3.00 pm in case morning shift students and 6.00pm for day shift students. Those students who are utilizing computer lab, library etc., after the times specified have to submit the permission slip to the security while entering into the hostel.
- During public holiday outings, those who seek permission to leave the hostel will have to obtain a written permission from warden. Permission will be given only to those students who get permission from parents to leave the hostel during holidays/outings. Moving out of

campus without permission are strictly prohibited.

- Strict study hours from 7.30 to10.30 pm shall be maintained in the hostel. The hostellers must be in their allotted rooms during study hours.
- The general complaints of any kind should be noted in the complaint register, which is available at the hostel office. Registered complaints only will be entertained.
- Any health problem should be brought to the notice of Warden/Floor In – charge for necessary treatment.

Transportation:

- The institution runs 70 buses covering all the important points in Vijayawada City, Mangalagiri, Guntur & Tenali towns with a total seating capacity of 4000 students in two shifts.
- Transport is available 24 hrs in case of any emergency in the institute / hostels.
- Transportation is available for conducting industrial tours and visits etc.
- Regular transport facility available up to 10 PM.

Health Centre

A full-fledged health center with all the facilities is established to cater to the needs of the students, staff, Faculty and to the general public in the adopted villages. It consists of three doctors (Homoeopathy, Ayurvedic& Allopathy).

Cafeteria

- KL University has a spacious canteen with latest equipment and hygienic environment which provides quality food and prompts service and caters to needs of all the students and the staff.
- A central cafeteria of 1500 Sq.m. is available in the campus. Mini cafes and fast-food centers are available in various blocks.
- The canteen is open from 6:30 a.m. to 8:30 p.m. There is a wide variety of North-Indian and South-Indian cuisine and the students enjoy the pleasure of eating during the breaks. Cool aqua water for drinking is available.

Placements*:*

K L University has meticulously planned to make all its outgoing students employed. The University had installed the infrastructure, employed well experienced faculty, designed and delivered programs t**h**at help enhancing the communication and soft skills which are required for

making the students employable. An excellent system is in place that considers all the issues that make a student employable. The University has been successful for the last 7 years, in employing all the students who have registered and eligible for placement through its offices located across the country. About 50 trained personnel work extensively to make the students ready for recruitment by the Industry.

Counselling & Career Guidance

A special Counseling Cell consisting of professional student counselors, psychologists, senior professors counsels/helps the students in preparing themselves to cope with studies, perform well in the tests & various competitions. This Cell provides its services to the students in getting the solutions for their personal problems and also provides career guidance with the help of Industrial Relations and Placements (IRP) department.

A group of 20 students are allotted to a senior faculty member who counsels them regularly and acts as their mentor.

Social Service Wing

KL University has a social service wing which is used to channelizing the social service activities of the faculty, the staff and the students. It has adopted 5 nearby villages and conducts activities like medical camps, literacy camps and educates the villagers regarding hygiene and health care on a regular basis.

NSS Wing of Institute

Regularly organizes Blood donation camps, Blood grouping camps, Fund collection and distribution to poor children and old age homes, distribution of old clothes and free medicines to slum dwellers, tree plantations, AIDS awareness program, teaching basic computer skills to a target group of 500 people in villages.

Hobby Clubs

Wholly and solely managed by the students, the clubs have in the past contributed much to the cultural life of the campus and to the cultural evolution of the students, A number of student bodies and clubs operate in the campus like music society, dance club, drama society, literary and debating club, English press club, drawing club, painting club, mime club, computer club etc. Students manage entire activities and budget of the organization for the entire semester in advance. Around 4000 students are the active members of the Hobby Clubs.

Life Skills and Inner Engineering

KL University feels that it is its responsibility to mould the students as good human beings contributing to the country and to the society by producing responsible citizens. Along with the regular programs every student admitted into KLU undergoes a one week special life skills /orientation program. Through this program, KLU is producing the students with the clarity of thoughts and charity at hearts. Strict regularity, implicit obedience, courtesy in speech and conduct, cleanliness in dress and person is expected of each KLU student. Life skills and inner engineering teach a student his/her obligations towards GOD, himself /herself his/her country and fellow human beings. Every student is encouraged to practise his/her own religious faith and be tolerant and respectful towards other religions.

Technical Festival

KLU organizes various programs for the all round development of the students. The technical festival and project exhibition is being organized in the odd semester (October) every year to elicit the innovative ideas and technical skills of the students.

Cultural Festival

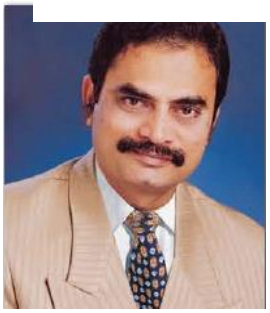
The cultural festival in the even semester (February) of every year is the best platform for the students for exhibiting their talents and creativity. Through these festivals KLU is imparting organizational skills, leadership skills, competitive spirit, and team behavior skills to our students. Along with the knowledge, KLU festivals are providing recreation to the student community.

INNOVATION, INCUBATION AND ENTREPRENEURSHIP CENTER

KLU being a pioneering institute supporting Academics and Research in Engineering, Science and Technology is endowed with all the infrastructure and highly experienced faculty, has an Innovation, Incubation and Entrepreneurship Centre (IIE) that comprises of:

- Innovation centre which aims to inculcate a spirit of innovation.
- Incubation centre which aims to incubate the innovations through prototype product development.
- Entrepreneurship Development Centre (EDC) which aims at fostering entrepreneurial skills among the students.

UNIVERSITY ADMINISTRATION



KoneruSatyanarayana,

President

Sri KoneruSatyanarayana, BE, FIE, FIETE, MIEEE graduated in Electronics and Communication Engineering in the year 1977. Along with Sri KoneruLakshmaiah, he is the co-founder of the Institute which was established in the year 1980. He is an educationist of eminence and also an industrialist of great repute. He runs a number of industries in and around Vijayawada.

Dr. M Ramamoorty

Chancellor

Dr. Ramamoorty assumed charge as Chancellor, K L University with effect from 30th March 2015 after successful career as a Professor in IIT Kanpur and also as first Director General of CPRI.

Dr. Ramamoorty obtained his B.E. (Honors) from Andhra University in 1957 and M.E. from IISc Bangalore in 1959. He obtained his MASc and PhD from Toronto University in 1965 and 1967 respectively.

He was a Commonwealth Fellow at U of T from 1964 to 1967. He then joined IIT Kanpur as a faculty member in the Electrical Engineering Department and became a professor in 1972. He had established the first graduate program in Power Electronics in India in 1968 at IIT Kanpur. He had supervised 12 doctoral projects and was associated with many sponsored research activities with industries like BHEL and Hindustan Steel Limited during his tenure at IIT Kanpur.

Dr.L.S.S Reddy

Vice Chancellor

Dr. L.S.S. Reddy is an eminent Professor in Computer Science and Engineering Department holding Ph.D in Computer Science Engineering from BITS Pilani. Dr. Reddy is an outstanding administrator, a prolific researcher and a forward looking educationist. Dr. Reddy has over 30

years of experience in Teaching, Research and Administration at prestigious institutes like BITS Pilani, CBIT etc.

Dr.L.S.S.Reddy had joined KoneruLakshmaiah College of Engineering in December 1995 and proved his administrative excellence as a Head of Department of Computer Science and Engineering. Dr. Reddy was instrumental and a driving force as Principal (2002-2009) in promoting KLCE as one of leading Institutions in India.

Dr.A.V.S.Prasad

Pro-Vice Chancellor

Dr.A.V.S.Prasad, M.E (Hydraulics & Irrigation Engineering) and Ph.D (Environmental Sciences and Technology) from JNTU, Hyderabad is a Professor in Civil Engineering. He has a rich experience of 27 Years in academics and 20 years in administration at various caders ranging from Head of the Department, Dean, Principal and Director.

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MASTER PLAN OF KL UNIVERSITY

ACADEMIC REGULATIONS

1.0 INTRODUCTION TO THE PROGRAMME

The Koneru Lakshmaiah Education Foundation (K L University), Vaddeswaram shall confer M.Tech Post graduate degree to candidates who are admitted to the Master of Technology Programme and fulfill all the requirements for the award of the degree.

1. Student will be studying 8 CDC courses and 4 electives from the given courses.
2. Evaluation Component Seminar in semesters I/I and I/II will be 2 credits (0-0-2). The students will be registering in the courses of his choice where they will be presenting the seminar on any topic related to the subject but not from the syllabus.
3. Thesis component in 3rd semester should be continued in the 4th semester until unless a student opts for industry project.
4. The minimum credits required for graduation will be 85 – 90 credits.

2.0 BRANCHES OF STUDY

M.Tech duration: 2 Years with following specializations.

- Bio-Technology
- Computer Science & Engineering
- Computer Networks & Security
- Communication & Radar Systems
- VLSI
- Embedded Systems
- Power Electronics & Drives
- Power Systems
- Thermal Engineering
- Structural Engineering
- Mechatronics
- Wireless Sensor Networks
- Signal Processing

3.0 PROGRAMME MODEL

- ❖ The course duration of M.Tech is 2 years.
- ❖ KL University operates in the semester pattern.
- ❖ Each semester has 90 working days.
- ❖ The total number credits to earned is 85 to 90
- ❖ The University awards M.Tech for post graduate degree programme.
- ❖ The maximum course duration is 4 years
- ❖ Academic regulations are approved by the Academic Council.
- ❖ The medium of instruction is English.

4.0 PROGRAMME OBJECTIVES

The Programme Educational Objectives (PEOs) are the statements that describe the expected achievements from the programme. They are guided by global and local needs, vision of the Institution, long term goals etc. The Programme Educational Objectives of M.Tech Programme include:

I. To mould the students to become effective global science students in the competitive environment of modern society.
II. To provide students with strong foundation in contemporary practices of Science, different functional areas and scientific environment
III. To emphasize on application oriented learning.
IV. To develop communication, analytical, decision-making, motivational, leadership, problem solving and human relations skills of the students.
V. To inculcate professional and ethical attitude in students.
VI. To pursue lifelong learning as a means of enhancing knowledge and skills necessary to contribute to the betterment of profession.

5.0 PROGRAMME OUTCOMES

The M.Tech programme is designed to meet the following outcomes:

a. Ability to practically apply various technological concepts.
b. Demonstrate knowledge of innovative and modern engineering practices.
c. Ability to apply the specialized expertise in relevant practical fields.
d. Ability to communicate effectively and professionally.

e. Ability to solve critical practical oriented real time problems.
f. Ability to manage people effectively and become good leaders.
g. Develop professional and ethical attitude and become socially responsible citizens.
h. Ability to carry out cutting edge research in the emerging areas.
i. Understand the global business scenario.
j. Demonstrate their role as engineers or entrepreneurs and contribute to the society.

6.0 PROGRAMME STRUCTURE

6.1 Distribution of courses over the semesters

S No	Course code	SEMESTER – I	L	T	P	Cr
1.		Core Course - 1				
2.		Core Course - 2				
3.		Core Course - 3				
4.		Core Course 4				
5.		**ELECTIVE-I**	3	0	0	3
6.		**ELECTIVE-II**	3	0	0	3
7.		Seminar	0	0	4	2
		TOTAL CREDITS:				**24-26**

S No	Course code	SEMESTER – II	L	T	P	Cr
1.		Core Course - 5				
2.		Core Course - 6				
3.		Core Course - 7				
4.		Core Course 8				
5.		**ELECTIVE-III**	3	0	0	3
6.		**ELECTIVE-IV**	3	0	0	3
7.		Term Paper	0	0	4	2
		TOTAL CREDITS:				**24-26**

S.No	Course Code	Second Year	Credits
1		Dissertation	36
	TOTAL CREDITS:		**85-90**

6.2 Course Precedence

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that caters to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

6.3 Specialization Streams

A student will be awarded a *Degree with Specialization* if he/she completes 4 courses from a particular stream within the discipline. By a careful selection of electives within a particular stream, a student can get a degree with specialization. That is, a student can get a Degree with Specialization during regular M.Tech programme, without overloading himself / herself.

7.0 ELIGIBILITY CRITERIA

Admissions to the M.Tech programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each Programme, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualifying candidates at an Entrance Test conducted by the K.L.University or on the basis of GATE / PGECET score, subject to reservation prescribed by the University or Government policies from time to time.

8.0 ATTENDANCE AND DETENTION

Attendance

a) It is mandatory for, a student to attend all the classes, tutorials, laboratories and other evaluation components conducted by the University. A student may be detained from appearing for an examination on grounds of shortage of attendance.
b) In each course attendance will be treated as evaluation component and marks are awarded as shown below:
c)

% of Attendance in Theory & Practical classes	Marks awarded
≥ 95	5
≥ 90 and < 95	4
≥ 85 and < 90	3
≥ 80 and < 85	2
≥ 75 and < 80	1

Detention

a) 75% attendance and 40% internal marks (internal evaluation components) are mandatory to attain eligibility to appear for the comprehensive examination in a course. If a student fails to maintain 75% attendance and 40% internal marks in a course he/she will be awarded with *NA* Report in that course. In such cases, student will not be permitted to attend the comprehensive examination of that course(s) where he/she has obtained *NA* Report. He/she has to register and repeat the course whenever it is offered.

b) However, some relaxation to this rule is possible in the case of students participating in extra -curricular activities as identified below:
   - One week for state level competitions.
   - Two weeks for National level competitions and
   - Three weeks for International events irrespective of the number of events and/the number of participations in a semester.

c) If the period of absence in a semester is for a short duration (of not more than one week) prior application for leave should be submitted to the Head of the Department clearly stating the reasons for absence along with supporting documents. The Head of the Department will grant such leave at his/her discretion. He/ She may be allowed for makeup of Laboratory/workshop classes conducted during the period of absence.
d) Absence for a period not exceeding one week in a semester due to sickness or any other unavoidable reason for which prior application could not be made may be condoned by the Dean-Academics, provided he is satisfied with the explanation.
e) If the period of absence is likely to exceed one week, a prior application for grant of leave should be submitted to the Head of the Department.
f) In special cases and for sufficient cause shown, the Dean-Academics on the recommendation of the Head of the Department may condone the deficiency not exceeding 10% in attendance due to ill-health, when the application submitted at the time of the actual illness is supported by a certificate from an authorized medical officer.
g) A student must intimate his/her absence to the Superintendent /Warden of the Hostel in which he/she is residing, before availing of any leave. Failing to do so will be construed as breach of discipline.

9.0 REGISTRATION

A student (newly admitted or on rolls) has to register for the course on the day of registration for each semester. Students failing to register for the course will not be permitted to attend classes.

Students will be permitted to register only if they have:

1. Cleared all the fees, outstanding dues of University and / or hostel of previous semesters, paid all prescribed fees for the current semester, and not been debarred from registering for a specified period on disciplinary or any other ground.
2. Normally, no late registration shall be permitted. However, considering any compelling reason, a student may be permitted for late registration (within one week of commencement of semester) with prior approval from the Director (Academic Registration). Late registration may be done with payment of requisite fine.
3. The University reserves the right to cancel the registration of a student from a course or semester or debar from the degree on disciplinary grounds.
4. Registration of students in each semester will be organized by the Academic Section. The registration will be done in respective departments; the course details being verified by the faculty mentor of the batch. Payment of dues etc., will be verified by the Academic Section.
5. A student who does not register on the day announced for the purpose may be permitted by Dean Registration, in consideration of any compelling reason, late registration within next 5 working days on payment of an additional fee as prescribed by the University.

   Normally no late registration shall be permitted after the fifth working day from the scheduled date, except in special cases, a serious medical problem, a family calamity or participation in a national event, to be approved by the Director on recommendation of Dean Registration.

9.1 Fees and payments

A student admitted to any course shall be required to pay, at the time of joining, and also in subsequent semesters, prevalent tuition and other fees as prescribed by the University till he/she is on roll including the period beyond the normal four-year duration.

There is no discount in fees for reduced academic load. Normally the fee structure will not change during the programme; but if the University revises the structure in the middle of a programme, a student is obliged to comply. The fee will be collected under the broad heads: Admission fee, Tuition fee, Student Activity fee, Hostel rent, Caution deposit, Convocation fee and miscellaneous fees. Caution deposit collected will be returned at the end of the programme after due adjustment, if any, except for those who leave the University prematurely.

When a student leaves the University on successful completion of the course, caution deposit is refundable after deduction of dues and charges, if any.

- If a student is removed or he withdraws/leaves the University in the mid-session without completing the entire course, all fees paid including the caution deposit will be forfeited by the University. Mess advance may be refunded after deduction of dues, if any.
- If a student does not register in three consecutive semesters his name will be struck off the rolls.

Exceptions

Notwithstanding anything stated in the rules, the Academic Council can make special provisions and exceptions depending on the merit of a case. Such cases shall not be cited as precedence in future occasions of similar nature.

9.2 Pre-Requisites

Admission to the M.Tech programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each Programme, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualifying candidates at an Entrance Test conducted by the K.L.University or on the basis of GATE / PGECET score, subject to reservations prescribed by the University or Government policies from time to time.

10.0 PROGRAMME DELIVERY SYSTEM

LTP Structure

Learning well is understood as acquiring knowledge and skills at higher cognitive levels, which include Apply, Analyze, Evaluate and Create. Such learning is ensured by making it heavily activity and practice oriented rather than lecture oriented.

Based on the nature of the course the learning pedagogy will change that is reflected by **L-T-P** structure for a course. **'L' (L**ecture classes) stands for class room contact sessions. **'T'** stands for **T**utorial sessions for reinforced learning through participatory discussion/self-study/desk work and such other novel methods that make a student absorb and assimilate more effectively the contents delivered in the lecture classes. '**P'** stands for **P**ractice/**P**ractical sessions for laboratory/field studies that equip students to acquire the much required skill component. A credit is defined to be as one hour of lecture or two hours of laboratory per week or one hour of tutorial per week over a semester.

11.0 BACKLOG COURSES

A course is considered to be a backlog if the student has obtained 'F' grade / *NA* Report in the course; the following regulations apply to a student who has backlog(s):

a) A student having backlogs has to clear backlog courses first.

b) If the backlog course(s) becomes prerequisite for any other course, he cannot register for those prescribed courses.

c) A student, who has backlog courses, when he/she appears in Academic Counseling Board, shall come under all regulations mentioned in ACB.

d) A student detained due to lack of credits / more number of backlogs in a semester has to register only for that semester after acquiring the eligibility for promotion. Under no circumstances he/she is allowed to register for next semester without registering for the detained one. This is applicable for those joined from 2010-11 academic year onwards.

12.0 GRADES AND REPORTS

A candidate shall be eligible for the award of the respective degree if he satisfies the minimum academic requirements in every course and secures 'satisfactory' or higher grade in the courses/report on his dissertation/dissertation and viva-voce.

For the award of M.Tech degree a student must have earned stipulated credits (as approved by respective B.O.S) and obtained a minimum CGPA of 5.5.

- M.Tech Degree with Second class will be offered to those having CGPA < 6.5.
- M.Tech Degree with First class will be offered to those having CGPA ≥ 6.5.
- First class with distinction will be offered to those having CGPA ≥ 7.5 provided the student has cleared all the courses in first attempt (Regular) within the stipulated time.

At the end of all evaluation - components based on the performance of the student in courses and seminars, each student is awarded with **letter grade** on a **relative scale**. The list of letter grades and its connotation are given below:

Grade	Qualitative	Grade
X	Excellent	10
A	Very Good	8
B	Good	7
C	Fair	6
D	Satisfactory	5
E	Pass	4
F	Fail	0

The grades '*X*' and *'F'* will be earned and remaining grades will be awarded. A student scoring 80% or more of overall score will earn an 'X' grade.

A student getting less than 50% of overall score and 40% in the comprehensive examination will be considered to have earned *F* grade.

a) To earn an *X* grade, the student should have scored aggregate marks of ≥ 80%.

b) A student who obtains '*F*' grade has to reappear for the comprehensive examination. However, such a student need not attend the classes and marks obtained in internal evaluation components and attendance will be carried forward to the subsequent attempts of the student.

c) In case of a student who has earned *F* grade, after the student has fulfilled all the requirements for passing it will be converted into a valid grade by considering grade cutoffs of the batch in which he/she had appeared for the course for 1st time.

d) The overall performance of the student is described by Cumulative Grade Point Average (*CGPA*) and is calculated taking into consideration grade obtained by the student in all credited courses and credits attached to it. It is the weighted average of the grade points of all the letter grades obtained in credited courses by the student from his entry into the University. *CGPA* is computed as follows:

$$CGPA = \frac{c_1 g_1 + c_2 g_2 + ... + c_n g_n}{c_1 + c_2 + ... + c_n}$$

where $c_1, c_2 \ldots c_g$ denotes credits associated with the course applied and $g_1, g_2 \ldots$ denotes grades obtained by the student.

e) At the end of each semester the University issues grade sheet indicating the *CGPA* of the student. However, grade sheet will not be issued to the student if he/she has any outstanding dues.

f) The Instructor/Course Coordinator can award the following reports depending on the cases:

(i) **NA (Not Attended)** is awarded to the student if the student has shortage of attendance. When student is given *NA* he/she has to repeat the course. It should be noted here that *NA* is different from *F* grade. For a student with *F* grade his/her internal marks, attendance and attendance marks will be carried forward. While for a student awarded with *NA* Report has to attend the classes.

(ii) **NR (Not Registered)** is awarded when a student has not registered for a course. When a student is given NR grade he/she has to register for the course when offered next. If a course in which a student is given NR grade is pre-requisite grade for another course, the student shall not be registered for such a course.

(iii) **GP (Grade Pending)** is awarded in situations where Course Coordinator cannot communicate the grade in time because of operational difficulties. The *GP* report has to be converted into valid grade by the Course Coordinator at a later stage.

(iv) **RC (Registration Cancelled)** is awarded to a student for various reasons when the registration for the course is cancelled by the University. Such a student will have a register for the course in subsequent semester / summer semester whenever the course is offered next.

(v) **DIP (Discontinued from Programme)** is awarded in situations where a student wants to discontinue with the prior approval of the University.

13.0 ACADEMIC COUNSELING BOARD (ACB)

1. A student will be put under Academic Counseling Board under the following circumstances:

    a. Has CGPA of less than 5.5 for Post graduate degree programmes.

    b. Has ‘F’ grade in more than two courses.

2. The students under Academic Counseling Board may not be allowed to register for all regular courses in the semester based on the recommendation of Academic Council Board. That is, University reserves all rights to decelerate the degree programme of the student.

3. Remedial classes will be conducted for students who are in ACB.

14.0 OVERLOADING AND UNDERLOADING

A student is permitted to overload himself/herself (registering for more courses) in a semester subject to certain restrictive conditions.

15.0 ACCELERATION AND DECELERATION

University offers flexibility for M.Tech degree students in doing the courses. In addition to the prescribed courses, a student can register for more electives, summer term courses, evening courses provided his/her timetable and University facility permits. Any extra courses done by acceleration would be reflected in the transcript but not in the CGPA. The University permits a student to decelerate his degree programme as well. Any student is permitted to withdraw from the courses for which he/she has registered, owing to his personal problems or any other valid reason.

16.0 ELECTIVE COURSE

The University offers a pool of electives in all disciplines. A student is permitted to choose the elective courses of his/her choice within his own discipline.

17.0 RE-APPEARANCE

The University permits a student to repeat a course to improve the grade subject to certain restrictive conditions.

18.0 BETTERMENT BY RE-REGISTRATION

A candidate having low SGPA / CGPA can reappear in the end examination when he has obtained C or D grade for improvement before the completion of M.Tech programme. The internal evaluation components in such case will be carried forward and grading will be done with the current batch of students. However the grades obtained out of improvement will not be considered for award of distinction or Gold medal.

19.0 WITHDRAWAL AND SUBSTITUTION OF COURSE

a) A Student is permitted to withdraw from an elective course within one week after the commencement of the semester with the approval of Dean-Academics.
b) A Student is normally not permitted to withdraw from compulsory course(s) of the discipline.
   However if a student desires to withdraw from compulsory courses of the discipline, he/she should seek prior permission from Dean-Academics.

However, a student is not permitted to withdraw from compulsory course and substitute the same with an elective course.

In situations, when a student withdraws from a compulsory course, he/she must have to complete the course before graduation.

c) Whenever a student withdraws from compulsory course(s), the student has to register for the course(s) from which he/she is permitted to withdraw whenever the course(s) are offered. This implies, a student has to complete all the compulsory courses prescribed by the Department for graduation.

Within one week of the commencement of the semester, a student is permitted to substitute an elective course (substitution) with prior approval of Dean-Academics subject to availability.

20.0 SUMMER TERM AND EVENING COURSES

If the number of F grades and/or registration cancelled (detained) in a course taught in even or odd semester is significant, a department may offer the course during the summer vacation. When a summer course is offered, it will be compulsory for all students who have secured an 'F' grade in that course. There will be no alternative mid semester or supplementary examination in that course. Students who need to sit for supplementary or alternative mid semester exams on medical, family calamity or any other reason except poor academic performance may sit in the corresponding exams of the summer course, without attending classes if they satisfy the attendance requirement.

The summer courses will be identical in scope and manner of execution to the corresponding courses of regular semesters, except that the number of class hours per week may be higher. Attendance requirement will also be identical. The examinations will be conducted by the academic section in the usual manner. No separate examination will be arranged for students who miss the summer course, or any other examination.

21.0 DEGREE WITH SPECIALIZATION

A student will be awarded a *Degree with Specialization* if he/she completes courses from a particular stream within the discipline. By a careful selection of electives within a particular stream, a student can get a degree with specialization. That is, a student can get a Degree with Specialization during regular programme, without overloading himself / herself.

22.0 GRADUATION REQUIREMENTS

A student must fulfill the following requirements for graduating:

1. Must have cleared a minimum of 85-90 credits.
2. Cleared all the requirements of discipline.
3. Obtained a minimum GPA of 5.5.
4. Must have finished all the above mentioned requirements in less than twice the period mentioned in the Academic structure for each programme which includes deceleration period chosen by the student, deceleration imposed by University or debarred from the University.

Credit Distribution

The four semester M.Tech. Programmes offered in various disciplines and streams by different departments of the institute are based on the credit system and provide a student with wide choice of courses. Each programme comprises of several core and elective courses and project work. These programmes, along with the course structure, are indicated here under.

The Programme is spread over a period of four semesters that embodies 12 courses with a credit load of 85-87 credits.

S. No	Type of the course	Number	Credits	Percentage
1	Core courses	8	33-38	40.2
2	Professional electives	4	12-14	13.7
3	Term Paper	1	2	0.25
4	Seminar	6	2	0.25
5	Dissertation work	1	36	41.3
	Total	20	85-90	100

Core Courses

A paper which should compulsorily be studied by a candidate as a core-requirement to complete the requirements of a degree is defined as a Core Paper. A student has to compulsorily undergo 8 core courses.

Elective Courses

The students can pursue elective courses in different areas of his interest. Each student must choose four elective courses.

23.0 EXAMINATIONS

The Examination office of the Academic Section will centrally conduct the Mid-semester and End-semester Examinations in respect of theory courses unless otherwise arranged. The examinations will normally be "closed book type", where the students are not permitted to bring any material. All necessary charts and tables will be provided by the University. It is the responsibility of the course faculty to recommend the material to be provided, and to check with the examination office that the arrangement has indeed been done.

While normal scientific calculators are permitted, other electronic devices such as programmable calculators and calculators containing communication devices are forbidden. Any exception to these provisions must be specially approved by the Academic Council.

24.0 EVALUATION

Teaching and Evaluation

I. Teaching

a. Course(s) taught by a single instructor (theory) is referred to as single section course and course(s) taught by group of instructors in more than one section is referred to as multi-section courses.

b. The teacher for single section courses or associated with multi-section courses is referred to as Instructor.

c. In case of multi- section courses, the team is led by an instructor known as Course Coordinator. For single section courses, an Instructor will be designated as Course Coordinator. Course Coordinator is also an instructor in multi-section course.

d. A team of instructors, under the leadership of Course Coordinator, work together for meeting all requirements of teaching, evaluation and administrative aspects of the course. The Course Coordinator has the responsibility of conducting the course with the cooperation of all instructors in the team.

e. Course Handout shall be given to the students. It shall also be placed on the E-Learning portal.

f. Students will be assessed on formative basis with a weightage of 40 per cent. The summative assessment carries a weightage of 60 per cent.

24.1 Evaluation of Internal Examinations

Evaluation Scheme

a) Formative Assessment: Max Marks: 40

S. No	Component	Duration	Weightage
1	Internal assessment Exams (Test 1 & 2) (75% of the higher score and 25% of the lower score will be considered)	1½ hours	15
2	Assignment/Assignment Test/Written Case Analysis/ Live Project/Reading Seminar/Mini-project/Paper Presentations/Operation workout		15
3	Surprise Test - Objective or Descriptive (Average of two tests will be considered)	10 to 20 minutes	5
4	Class attendance		5
		Total	**40**

i. Two internal assessment exams (Test 1 & Test 2) will be conducted for all courses during the semester. The internal exams will be conducted for 30 marks which in turn will be scaled to 15 marks. The schedule of exams will be notified by the Principal.

ii. A Surprise Test is of objective or subjective nature decided by the Course Coordinator and is conducted without prior intimation. There will be two such tests in a semester.

iii. Assignment /Assignment Test/ Live Project /Reading Seminar / Written Case Analysis/ Mini-project / Paper Presentations / Operation workout:

One or two of these components as detailed in Table No. 1 will be implemented for each course. Applicable component(s) will also be detailed in the Course Handout. Wherever applicable, presentation by a student would be integrated with the component.

iv. Class attendance is monitored by each Instructor and based on the percentage of attendance marks are awarded.

v. In order to maintain transparency in evaluation, the answer sheets of all formative assessment components shall be shown to the students within THREE days of conducting the tests. If a student is not convinced with the marks awarded he/she can apply for recheck. However, the student can apply for recheck on the day of returning the answer sheet within the classroom only.

vi. It shall be the responsibility of the Course Coordinator to display solution key on the notice board immediately after the evaluation component with evaluation scheme. The Instructor should stick to the evaluation scheme announced while checking the answer sheets.

vii. Where there are multiple Course Instructors, the Coordinator shall ensure that a common question paper is administered for Test 1 and Test 2.

Distribution of Weightage

S. No	Nature of examination	Marks %	Type of examination and mode of Assessment		Scheme of examination
1	* Theory	60	Semester end examination (external evaluation)		This examination question paper in theory subjects will be for a maximum of 60 marks.
		40	20	Test 1	2 mid - exams each for 20 marks and of 1 1/2 hr duration are to be conducted. For a total of 20 marks, 75% of better of the two and 25% of the other are added and reported.
				Test 2	
			5	Assignment Test	6 Question to be released in advance. 2 Questions allotted by Examiners choice to be answered. Duration 45 min.
			5	Home Assignment	Average of Home Assignments minimum 2 per subject.
			5	Surprise Quiz	A maximum of two surprise quizzes per subject
			5	Attendance/ Class notes	5 marks are allotted for attendance and class notes

2	* Practical	60	Semester end Lab exam (ext. evaluation)		60 marks are allotted for semester end laboratory/ drawing examination.
		40	20	Internal evaluation	Mid-term Lab Tests in lab experiments/ drawing/Job works and Record.
			15	Internal evaluation	Continuous Viva Voce evaluation.
			5	Attendance.	
3	Dissertation work Semester-IV	100 %	300	Internal evaluation	Two Status reports and two seminars in first semester-50 marks Two Status reports and two seminars in second semester-50 marks Final report – 100 marks Viva-voce – 100 marks
				External evaluation	

*Note:

1. For pure Theory & pure Lab courses follow the above Evaluation.
2. For Combined Theory & Lab courses follow the proportion rule as given below:

a) 3-0-2 nature Theory Credits & Lab Credits are in 3:1 ratio Hence the Internal marks evaluated for Theory & Lab as above to be divided in the ratio 3:1 and clubbed.

b) 3-1-2 nature Theory & Lab credits are in 4:1 ratio. Hence the Internal marks evaluated for Theory & Lab as above to be divided in the ratio 4:1 and clubbed.

The performance of the candidate in each semester shall be evaluated course wise, with a maximum of 100 marks for pure Theory courses and 100 marks for theory and practicals, on the basis of continuous Internal Evaluation and Semester end comprehensive Examination.

Evaluation of Dissertation

Every candidate shall be required to submit dissertation after taking up a topic approved by the Department /University.

- A DAC consisting of HOD and Supervisor shall monitor the progress of the dissertation.

- The duration of the dissertation shall be two semesters. The candidate shall submit dissertation with the approval of DAC at the end of 4th semester.
- A candidate shall be allowed to take viva voce examination only after completion of all the course papers. The Viva-voce examination may be conducted once in two months for all the candidates submitted during that period.
- Three copies of the dissertation in the prescribed format certified by the supervisor & HOD shall be presented to DAC. One copy which is sent to the examiner will be forwarded to the dept. library after adjudication and one copy to the supervisor.
- Besides the supervisor, one senior faculty from the Department of English will adjudicate the dissertation.
- If the report of the examiner is favorable, Viva-voce examination shall be conducted by a board consisting of the Supervisor, HOD and an external examiner. The board shall jointly report on candidate's work based on the total marks obtained in dissertation through both internal evaluation and external evaluation.

If the report of the Viva-voce is not satisfactory the candidate will retake the Viva-voce examination after three months.

25.0 RUSTICATION

A Student may be rusticated from the University on disciplinary grounds based on the recommendations of a committee constituted by the Vice Chancellor.

26.0 AWARD OF DEGREE

A candidate shall be eligible for the award of respective degree if he satisfies the minimum academic requirements in every course and secures 'satisfactory' or higher grade in the courses/report on his Dissertation/dissertation and viva-voce.

- For the award of M.Tech degree a student must have earned stipulated credits (as approved by respective B.O.S) and obtained a minimum CGPA of 5.50.
- M.Tech Degree with Second class will be offered to those having CGPA < 6.5
- M.Tech Degree with First class will be offered to those having CGPA ≥ 6.5
- And first class with distinction will be offered to those having CGPA ≥ 7.5 provided the student has cleared all the courses in first attempt within the stipulated time.

With – Holding of Results

If the candidate has not paid dues to the University or if any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted into the next/higher semester. The issue of degree is liable to be withheld in such cases.

M. TECH (BT)
DEPARTMENT OF BIOTECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	BTC501	Mathematics and Biostatistics	4-0-0	4
2	BTC502	Biochemical Reaction Engineering	3-1-2	5
3	BTC503	Molecular biology and rDNA Technology	3-0-2	4
4	BTC530	Food Biotechnology	3-0-0	3
5	BTC504	Applied Bioinformatics	3-1-2	5
6	BTC531	Medical Biotechnology	3-0-0	3
7	12BT001	Seminar	0-0-4	2
	Total Credits			26
Semester -2				
1	12BT505	Plant and Animal Biotechnology	3-1-2	5
2	12BT506	Immuno Technology	3-0-2	4
3	12BT507	Bioreactor modeling and simulation	4-0-0	4
4	12BT508	Down stream Processing	3-0-2	4
5	12BT532	Enzyme Technology	3-0-0	3
6	12BT533	Molecular modeling and drug design	3-0-0	3
7	KLUC502	Term paper	0-0-4	2
	Total Credits			25
Semester -3 &4				
1	BTCT01	Project		36
Total Credits				36
Total Course credits				**87**

MATHEMATICS & BIOSTATISTICS

Course Code: BTC501 **L-T-P:** 4-0-0
Prerequisites: Nil **Credits:4**
Syllabus:

Numerical Methods Solutions of algebraic & transcendental equations - Bisection Method,New-Raphson Method, Solution of linear simultaneous equations, Simpson's rule, Trapezoidal rule.

Linear-Differential equation:1st order differential equations, solutions of 1st order, variableseparable, homogeneous equation linear and enact equations. Linear differential equations ofhigher order with constant co efficient. Rules for finding complementary function and particular integral.

Presentation of data & Measures of central tendency-Frequency distribution, graphicalpresentation of data by histogram, frequency curve and cumulative frequency curves. Mean,medium, mode, and their simple properties (without derivation), range, mean deviation, standard deviation and coefficient of variation.

Correlation, Regression and Tests of significance -Simple correlation and regression coefficients and their relations. Limits of correlationcoefficient, effect of change of origin and scale on correlation coefficient, Linear regression and equations of line of regression, association and independence of attributes. Paired and unpaired t-test for correlation and regression coefficient. T- test for comparison of variances of two populations. Chi-square testindependence of attributes, goodness of fit, and homogeneity of sample.

Experimental designs- Principles of experimental design, completely randomized design, randomized block design and Latin square design. Analysis of variance (ANOVA) and its use in the analysis of RBD. F-test.

Recommended Textbooks:

1. Norman T.J. Bailey, Statistical methods in biology (3rd edition), Cambridge University Press (1995).
2. Bernard Rosner, Fundamentals of Biostatistics, 5th edition, Thomson Brooks/ Cole, 2000.
3. Higher engineering mathematics by B.S Grawel

References Books:

1. S.C.Gupta and V.K. Kapoor – Fundamentals of Mathematical Statistics, 9th Extensively revised edition, Sultan Chand & Sons, 1999.
2. Advanced Engineering Mathematics, Michael D.Greenberg, Pearson Education.
3. Advanced Engineering Mathematics by Ervin Kreyszic.
4. Higher engineering mathematics by Bird john

BIOCHEMICAL ENGINEERING

Course Code: BTC503 **L-T-P:** 3-1-2
Prerequisites: Nil **Credits:**5

Syllabus:

Introduction to Biochemical reactions : Types of reactions (Simple stepwise and Parallel) andtheir applications in fermentations, reaction rates, kinetics of homogenous reactions,molecularity and order of reaction and temperature dependency of reaction rate.

Design and Operation of Bioreactors : Mass transfer aspect, Bioreactor types and design,Continuous stirred tank bioreactors, fed batch bioreactors, airlift bioreactors, Fluidised bedbioreactor, Bioreactors for plant and animal cell, scale up of bioreactor using constant p/v and constant KLa

Mass Transfer in Bioprocess Operation : Mass transfer by diffusion, Theories of Diffusional mass transfer film theory, Penetration theory, Surface renewal theory Mass transfer byconvection, Gas-liquid mass transfer, correlation for mass transfer coefficient, measurement of KLa, O2 transfer, methodology in fermenters, specific oxygen uptake rate, critical oxygen concentration, maximum cell concentration.

Heterogeneous reactor systems : Classification of reaction systems, (homogenous, heterogeneous), mass transfer consideration in heterogeneous systems, Intra particle diffusion and reaction rates, Effectiveness factor and Thiele modules, observed Thiele modules, criterion for mass transfers limitations.

Non-ideal flow in bioreactors: Reasons for non-ideality, RTD studies (F-Curve, C-Curve for ideal and non-ideal CSTR and plug flow reactors), mean and variance of residence time, conversion using tracer information, modeling of non-ideal flow behavior by dispersion model.

Recommended textbooks:

1. Introduction to Biochemical Engineering by D.G.Rao
2. Biochemical Engineering fundamentals by Bailey and Oliss

Reference Books:

1. Bioprocess Engineering Principles by Pauline and Doran

MOLECULAR BIOLOGY & R-DNA TECHNOLOGY

Course Code: BTC503 **L-T-P:** 3-0-2
Prerequisites: Nil **Credits:** 4

Syllabus:

DNA Structure & Replication : Structure of DNA:-Watson & Crick's model, Types of DNA, Denaturation and renaturation Kinetics, Replication of DNA- Semi conservative, bi-directional replication. DNA damage and repair: Types of DNA damages- deamination, alkylation, pyrimidine dimmers; Repair mechanisms-Excision, mismatch and SOS repair, Recombination: Homologous and non homologous; **rec** gene and its role in DNA repair.

Transcription And Translation : Structure of Promoters-RNA Polymerases of Prokaryotic and Eukaryotic Organism; Transcription- Initiation, Elongation and Termination; Prokaryotic & Eukaryotic transcription; Post Transcriptional Processing of Eukaryotic RNA. Translation in prokaryotic and Eukaryotes: initiation of translation, elongation of polypeptide chain, termination of translation. Post-translational modifications.

Regulation of Gene Expression : Regulation of Gene expression in bacteria- Operon concept, ***lac, trp, ara*** operons. Control of gene expression by sigma factor and post transcriptional control.
Absolute control by antisense RNA's; enhancers, upstream controlling elements, structural Motifs of transcription factors: helix turn, zinc finger motifs, leucine zippers and homeotic genes.

Enzymes And Vectors In Cloning : Restriction Enzymes; DNA ligase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern, Colony hybridization & FISH, Plasmids; Phagemids; Cosmids; Shuttle vectors, Artificial chromosome vectors (YACs; BACs); Expression vectors: Baculovirus and pichia vectors system; Plant based vectors: Ti and Ri vectors, Construction of cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Yeast two hybrid system; Phage display.

PCR, Sequencing & RNA Technologies : Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR; PCR Applications Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; Introduction to siRNA; siRNA technology; Micro RNA; Principle and application of gene silencing; Gene knockouts and Gene Therapy; knockout mice; Disease model; Transgenics; Differential gene expression and protein array.

Text Books:

1. Fundamentals of Molecular Biology by Avinash & Kakoli Upadhyay; Himalaya

Reference books:

1. Current protocols in Molecular biology; Wiley Publishers.

APPLIED BIOINFORMATICS

Course Code: BTC504 **L-T-P:** 3-1-2
Prerequisites: Nil **Credits:**5

Syllabus:

Comparative Genomics Genetic mapping, Physical mapping, SNPs, ESTs, GSS, Gene prediction methods, Gene prediction tools, Gene annotation, Molecular Predictions with DNA sequence, Human Genome Project.

Protein Structure Prediction and Evaluation methods
Structure of Protein – PDB, MMDB; Ramachandran Plots; Structure visualization – Rasmol; Methods of Structure prediction – Homology modeling - SPDBV, Threading, Ab-initio method; Structure Evaluation – DSSP, ProCheck, Verify 3D; Structure comparison.

Protein Identification And Interactions
Proteomics approaches for protein analysis; Protein identification Programs – Mascot, GFS; Comparative Proteomics methods; Protein interactions; Protein Interaction dbs – GRID, MINT; Network Mapping; Biological Pathway dbs – EcoCyc, KEGG; Pathway prediction; Metabolic pathway reconstruction.

Gene Expression Analysis
Introduction; Serial Analysis of Gene Expression; Microarray, Types of Microarrays, Microarray Fabrication, Microarray hybridization and detection, Microarray Image Processing and analysis, Expression ratios, Transformations of the Expression ratio, Data Normalization.

System Biology
Foundations of System Biology- Objectives of System Biology-Strategies relating to In Silico Modeling of biological processes- Metabolic Networks- Signal Transduction pathways, Gene Expression patterns – Applications of System Biology Markup Language (SBML), E-cell, V-cell simulations and Applications

Recommended Textbooks:
1. G. Gibson and SV Muse, A Primer of Genome Science, Second Edition – Sinauer Associates, Inc.
2. CW Sensen, Essentials of genomics and Bioinformatics, Wiley-VCH publication.
Reference textbooks:
1. Speed T. (ed.) Statistical analysis of gene expression microarray data (CRC, 2003)

PLANT AND ANIMAL BIOTECHNOLOGY

Course Code: 12BT505 **L-T-P:** 3-1-2
Prerequisites: Nil **Credits:** 5
Syllabus:

Introduction & Overview
Introduction & Historical Overview of Plant Tissue Culture, Totipotency, Growth & Cytodifferentiation of Cultured Plant Tissues Nutritional Media- Obligatory & Optional Constituents, Growth Regulators. Concept of sterilization and aseptic technique, Incubation Systems: Light & Dark, Static & Agitated, And Problems in Plant Tissue Culture: Contamination, Phenolics, Recalcitrance and Seasonal variation.

Micro Propagation and Secondary Metabolites
Homozygous Plant Production through Anther Culture. Callus & Suspension Culture Systems and Organogenesis: Direct & Indirect- Basic aspects, Somatic Embryogenesis, Somaclonal & Gametoclonal Variation. Plant Secondary Metabolites: Commercial Production using appropriate media supplements (Elicitors, Growth Factors, Stress Factors, Precursors, Anti-metabolites and Defense Proteins.

Gene Transfer Techniques and Applications
Gene transfer methods (Direct and Indirect), current status and limitations. Agro bacterium mediated genetic transformation and application in crop improvement. Herbicide, stress and disease resistant plants and callus/cell line selection for resistance. Applications of Plant Tissue culture.

Animal cell culture
Basic requirements for animal cell culture; Cell culture media and reagents; Animal cell, tissue and organ cultures; Primary culture, secondary culture; Continuous cell lines; Suspension cultures; Somatic cell cloning and hybridization. Transfection and transformation of cells; Commercial scale production of animal cells; Stem cells and their application; Application of animal cell culture, for in vitro testing of drugs; Testing of toxicity of environmental pollutants in
cell culture; Application of cell culture technology in production of human and animal vaccines and pharmaceutical proteins.

Animal Reproductive Biotechnology
Culture of embryos; Micromanipulation of animal embryos; Cryopreservation of embryos; Embryo transfer; Embryo-splitting; Embryo sexing; Transgenic animal technology and its different applications; Animal viral vectors; Animal cloning- basic concepts; Cloning from embryonic cells and adult cells; Ethical, social and moral issues related to cloning. Introduction to animal genomics; Different methods for the characterization of animal genomes, SNP, STR, QTLS, RFLP, RAPD, Genetic basis for disease resistance; Biocrimes and Bioterrorism.

Recommended textbooks:

1. Experiments in Plant Tissue Culture (Dodds, J.H. and Roberts, L.W.) 1985.
2. Ed. John R.W. Masters, Animal Cell Culture - Practical Approach, 3rd Edition, OUP, 2000.
3. Ed. Martin, Clynes Animal Cell Culture Techniques, Springer, 1998.

4. Plant Tissue Culture methods and application in agriculture (Thorpe, T.A.) 1981;

Reference books:

1. An Introduction to Plant Tissue Culture.MK Razdan.2nd Ed.2003. Oxford and IBH.
2. Plant Biotechnology by C.Chawla.2004.Oxford and IBH.
3. Animal Cell Biotechnology. Portner, 2nd Edition, Humana Press, 2007.
4. Plant Biotechnology and its applications in Plant tissue culture by Ashwani Kumar and Shikha Roy.

IMMUNO TECHNOLOGY

Course Code: 12BT506 **L-T-P:** 3-0-2
Prerequisites: Nil **Credits:**4

Syllabus:

Immune system overview, innate and acquired immune system. Components of immune system.Phagocytosis; Inflammation, opsonization. Primary and secondary lymphoid organs. Complement. B cell, T cell ontogeny. Characteristics of antigen, T cell dependent and independent antigens and Super antigens. Types and applications of Hapten and Adjuvant.

Immune response

Generation of immune response - Primary and Secondary immune responses. Structure, functions of antibody and BCR.. Generation of Antibody diversity. TCR structure, $\delta\gamma$TCR. MHCI and II gene, polymorphism. T helper, T cytotoxic cells. MHC peptide interaction. Antigen presentation, secondary signaling.

Immunological disorders

Immunological disorders; Hypersensitivity and autoimmune diseases. Immune response to viral and bacterial lymphatic infection. Kinetics of immune response. Techniques in humoral and cellular immunology.

Immunotechnology

Animal models and transgenic animals and their use in immunology. Experimental immunology. Hybridoma technology. Chimeric antibodies, phage display, antibody engineering; Large scale manufacture of antibodies. Manufacturing of immunodiagnostics.

Disease diagnosis and Vaccines

Concept of vaccination & Vaccine development. Strategies for development of vaccines against dreadful diseases – malaria, tuberculosis, HIV. Diagnostic tools and Kit development technology.

Recommended textbooks:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.

Reference books:

1. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
2. Paul.W.E, Fundamental of Immunology, 4th edition, Lippencott Raven.

BIOREACTOR MODELING AND SIMULATION

Course Code:12BT507 **L-T-P:** 4-0-0
Prerequisites: Nil **Credits:** 4

Syllabus:

Fundamentals of Modeling
Different approaches towards modeling, (Empirical and Modeling approach), applications and advantages of modeling and simulations, general flow diagrams for model building, simulation tools (Berkeley-Madonna, Mat Lab- Simu Link)

Enzymes and growth kinetic models
Michaelis-Menten equation, graphical determination of Km and Vmax, Double Michaelis Menten kinetic model, inhibition models (Competitive, Non-Competitive, Uncompetitive, Deactivation Kinetics models) Monad growth kinetics model, equation for inhibition of growth, Product inhibition, , Teisser equation for growth, Contoin equation, Moses equation for growth models.

Modeling of batch cultures
Unstructured growth models, structural kinetic model, metabolic models for batch cultures.

Product formation Kinetics
Product formation kinetic models, unstructured models, chemically structured models, genetically structured models.

Case studies of simulations
Programme for simulation of Batch fermentation, continuous fermentation, steady state and fed batch fermentation.

Recommended textbooks:
1. Biological reaction Engineering- J.J.Dunn, E.Heinzle, J.Ingham, J.E.Presnosil
2. Biochemical Engineering fundamentals- James.E.Bailey and David.F.Ollis, TMH Edition
3. Franks.R.G.E (1973), Modeling and simulation in chemical Engineering, Wiley, NY

Reference Books
1. Modeling and simulation in Biochemical Engineering. Adv, Biochemical Engineering, 3, 127-165
2. Hanm, B, Ruth. B (1997) Modeling dynamic biological systems, Springer-Verlag, NY.

DOWN STREAM PROCESSING

Course Code: 12BT508 **L-T-P:** 3-0-2
Prerequisites: Nil **Credits:**4

Syllabus:

Down Stream Processing In Biotechnology
Overview of bioseparations, Characterization of Biomolecules, characterization of Bioprocess, characterization of fermentation broth: Morphology of cells, structure of the cell wall, product concentrations, Biomass density, Rheological Behavior of fermentation broth.

Primary Separation and Recovery Processes : **Recovery of intracellular products:** Cell disruption methods-physical methods (osmotic shock, grinding with abrasives, solid shear, liquid shear) – chemical methods (alkali, detergents)- enzymatic methods.

Removal of suspended solids:
Foam separation, filtration. Filtration equipment, centrifugation, tubular bowl centrifuge, disk. Bowl centrifuge, basket centrifuge, scale up of centrifuges.

Product Enrichment Operations : Membrane based separations – Classification & characteristics of membrane separation, merits of the process. Micro filtration, ultra filtration, Reverse osmosis, dialysis & electro dialysis. Selection of membrane, operational requirements of membrane. Retention coefficient, concentration factor, permeate yield & solid yield in membrane separation processes. Membrane modules: Plate & Frame, hollow fiber, spiral wound, shell & tube, cross flow micro filtration.

Aqueous two-phase extraction process: Applications of aqueous two-phase extraction, reversed micelles extraction principle, micellar structures, critical micelle concentration. Protein solubilization, limitation of reversed micelles. Precipitations of proteins with salts and organic solvents, kinetics of protein aggregation.

Product Purification : Chromatographic Separations: Classification of chromatographic techniques, column chromatography, elusion frontal displacement techniques, partition coefficient, retention time and volume, capacity factor, column efficiency, design and scale up of chromatography. Principles & practices of Gel Filtration, Ion Exchange and Affinity chromatography.

Alternative Separation Methods and Product Polishing
Super critical extraction: principles of SCE, Flow scheme of a simple SCE system.

Formulation
strategies: Importance of formulation, formulation of beakers yeast, Enzymes, formulation of pharmaceutical products.

Polishing: Crystallization, Principles of crystallization and equipment. Principles of drying and lyophilization, Freeze dryer.

Recommended Textbooks

1. Butterworth and Heinmann. Product recovery in bioprocess Technology-Biotol series,
2. B.Siva Sankar. Bioseperations

References Books:

1. Harvey Blanch. Biochemical Engineering
2. Christie J.Geankoplis., Transport processes and Unit operations

(ELECTIVES)

FOOD TECHNOLOGY

Course Code: BTC530 **L-T-P:** 3-0-0
Prerequisites: Nil **Credits:**3

Syllabus:

Food associated Microbes

History of microorganisms in food, historical developments. Biotechnology in relation to the food industry, nutritive value of food, types of microorganism's associated with food, its sources, types and behavior in foods. Role and significance of microorganisms in food. Intrinsic and extrinsic parameters of foods that affect microbial growth.

Food processing

Bioprocessing of meat, fisheries, vegetables, diary product, enzymes and chemicals used in food processing, biochemical engineering for flavour and food productions. Emerging processing and preservation technologies for milk and dairy products.

Food preservation

Food preservation using irradiation, Characteristics of Radiations of interest in food preservation. Principles underlying the destruction of Microorganisms by irradiation, processing of foods for irradiation. Application of radiation, Radappertization, Radicidation, and Radurization of foods. Legal status of food irradiation. Effect of irradiation of food constituents.

Storage of foods

Stability of food preservation with low temperatures, high temperatures, drying. Indicator and food borne pathogens. Food borne illness, quality control, HFCS (High Fructose Corn Syrup) and mycoproteins. Air sampling, metabolically injured organisms, enumeration and detection of foodborne organisms.

Food microbiology

Utilization of microorganisms in food industries, genetic manipulations. Thermophiles and Radiation-resistant microorganisms, characteristics and growth of thermophilic microorganisms, Nature of Radiation resistance in microorganisms. Rheology of food production.

Recommended textbooks:

1. Lidsay, Willis Biotechnology, Challenges for the flavour and food industries, Elsevier Applied Science. 1988.

2. Food Science and Food Biotechnology by F.F.G. Lopez & G.V. B. Canovas (2003), CRC Press, Florida, USA.

Reference Books:

1. George J.B. Basic Food Microbilogy, CBS Publishers & Distributors, 1987.
2. Roger, A., Gordan B., and John T. Food Biotechnology, 1989.

MEDICAL BIOTECHNOLOGY

Course Code: BT C531 **L-T-P:** 3-0-0
Prerequisites: Nil **Credits:**3
Syllabus
SYLLABUS:

UNIT I

INTRODUCTION TO MEDICAL TECHNOLOGY: Introduction and applications of medical Biotechnology. Artificial organs – methods and production principles. Artificial pancreas, Liver and Heart. Therapeutic proteins: Production of interferons, cytokinins, insulin etc.

UNIT II

MEDICAL DIAGNOSIS: Immunodiagnostic techniques: monoclonal antibodies production as diagnostic reagents; Diagnosis by ELISA and Western blot. DNA sequencing and diagnosis. PCR and Array based techniques in diagnosis; Present methods for diagnosis of Specific diseases like Tuberculosis, Malaria and AIDS ethics in Molecular Diagnosis.

UNIT III

GENE TRANSFER TECHNOLOGY: Gene therapy; Intracellular barriers to gene delivery; Overview of inherited and acquired diseases for gene therapy , Retro and adeno virus mediated gene transfer. Liposome and nanoparticles mediated gene delivery Cellular therapy.

UNIT IV

STEM CELL TECHNOLOGY: Stem cells; definition, properties and potency of stem cells; Sources; embryonic and adult stem cells Concept of tissue engineering; Role of scaffolds; Role of growth factors; Role of adult and embryonic stem cells. Clinical applications; Ethical issues.

UNIT V

HYBRIDOMA TECHNOLOGY: Hybridoma techniques and monoclonal antibody production. Production, purification, characterization and applications of monoclonal antibodies. Antibody engineering – chimeric antibody, diabody.

Text Books:

1. F.C. Hay, O.M.R. Westwood, Practical Immunology, 4th Edition-, Blackwell Publishing,2002.

2. Pratibha Nallari, V. Venugopal Rao; Medical Biotechnology, oxford University press, 2010.

Reference Books:

1. James W. Goding , Monoclonal antibodies; Principles and Practice , 3rd Edition , Academic Press 1996.
2. George Patrinos and Wilhelm Ansorage, Molecular Diagnostics, 1st Edition , Academic Press,2005.
3. Lela Buchingham and Maribeth L Flawsm , Molecular Diagnostics; Fundamentals, Methods and Clinical Application , 1st Edition F.A. Davis Company Philadelphia USA, 2007.

ENZYME TECHNOLOGY

Course Code: 12BT532 **L-T-P:** 3-0-0
Prerequisites: Nil **Credits:**3
Syllabus:

SYLLABUS:

UNIT–I

INTRODUCTION TO ENZYME TECHNOLOGY: Source of enzymes; Production, isolation and purification of enzymes; Characterization in terms of pH, temperature, ionic strength, substrate and product tolerance, effects of metal ions etc.; Various production methods for commercial enzymes; Large scale production of enzymes. Production of recombinant proteins (Insulin, Interleukin, Interferon); Important commercial enzymes; Amylases; Proteases; Lipases; Cellulases.

UNIT–II

ENZYME KINETICS: Michaelis-Menten equation, alterations and significance. General mechanisms of enzyme regulation, Types of inhibition; Irreversible inhibition (proteases), Reversible (glutamine synthase & phosphorylase), competitive inhibition, Non & Un-competitive, mixed inhibition, and substrate & product.inhibition; Allosteric enzymes, qualitative description of concerted & sequential models for allosteric enzymes. Allo-steric regulation of enzymes; Deactivation kinetics. Feed back inhibition and feed forward stimulation. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate transcarbamoylase. Protein-ligand binding measurement, analysis of binding isotherms, Hill and Scatchard plots.

UNIT–III

ENZYME ENGINEERING: Enzymes as biological catalysts; Active site, Functional group, Enzyme substrate complex, Cofactors; Acidbase catalysis, covalent catalysis, proximity, orientation effect. Strain & distortion theory. Chemical modification of active site groups. Random and rational approach of protein engineering; Directed evolution and its applications in the field of biocatalysis; Various approaches of creating variant enzyme molecules; Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin, lysozyme, carboxypeptidase and alcohol dehydrogenase.

UNIT–IV

ENZYME IMMOBILIZATION AND APPLICATIONS: Introduction to enzyme immobilization; various immobilization methods; physical and chemical techniques for enzyme immobilization – adsorption; Matrix entrapment, encapsulation; Cross-linking; Covalent binding; Medical and analytical applications of immobilized enzymes; Design of enzyme electrode & their application in clinical diagnostics. Role of enzymes in recombinant DNA technology; Enzymes for diagnostic and Analytical purposes. Use of enzymes in analysis-types of sensing-gadgetry and methods. Case studies on application – chiral conversion, esterification.

UNIT–V

MASS TRANSFER EFFECTS IN IMMOBILIZED SYSTEMS: Analysis of Film and Pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Calculations of diffusion resistances and Thiele's modulus; Multi step immobilized enzyme systems; Solutions of numerical problems; Application and future of immobilized enzyme technology. Concentration gradients and Reaction rates in solid catalysts; Internal mass transfer and reaction; Steady state Shell Mass balance; Formulation of dimensionless groups and calculation of Effectiveness factors .

Text Books:

1. Nelson and Cox, Principles of Biochemistry, 4th Edition, W. H. Freeman, 2004.
2. J. Rehm and G. Reed, Enzyme Technology, Vol. 7a, VCH-Verlag.
3. Trevor Palmer: ENZYMES – Biochemistry, Biotechnology, Clinical chemistry. Harwood Publishing Ltd. Affiliated East – West Press Pvt. Ltd. New Delhi.

Reference Books:

1. Biotol Series (This series has many volumes pertaining to different subjects including white, red, blue and green biotechnology).

MOLECULAR MODELING AND DRUG DESIGN

Course Code: 12BT533 **L-T-P:** 3-0-0
Prerequisites: Nil **Credits:**3

Syllabus:

Empirical Force Fields and Molecular Mechanisms

Models, Approximations and Reality, Force Field concepts and Mathematical Expressions, Molecular Mechanical and Quantum Mechanical Force Fields, Parameterization, Generation of Potential energy surfaces. Bond Stretching, Angle bending, Torsional I terms, Out of plane, Bonding Motions, Electrostatic interactions, Vander Walls interactions, Effective pair potentials, Hydrogen Bonding, Simulation of liquid water.

Computer Simulation Methods

Time averages, Ensemble averages, Free energy methods, Thermo dynamic Perturbation Methods, Thermodynamic Integration Methods. Calculation of thermodynamics properties. Phase space; Practical aspects of computer simulation; Boundaries monitoring Equilibrium; Long range process; Analyzing results of simulation and estimation errors.

Molecular Dynamics Simulation Methods

Molecular Dynamics using simple modules; Molecular Dynamics with continuous potentials; Running Molecular Dynamics Simulation; Constant Dynamics; Time dependent properties; Molecular Dynamics at constant temperature and pressure.

Monte Carlo Simulation Methods

Metropolis methods; Monte Carlo simulation of molecules; Monte Carlo simulation of Polymers; Calculating Chemical potentials; Monte Carlo simulation and molecular dynamics.

Molecular Modeling In Drug Discovery

Molecular modeling in drug discovery-Deriving and using 3D Pharma cores, Molecular docking Structure Based methods to identify lead components-Denovo ligand design. QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronic; Topology;
Quantum Chemical based Descriptors

Recommended textbooks:

1. Molecular Modeling Principles and Applications- AR Leach, Longman, 1996.
2. Molecular Dynamics Simulation-Elementary Methods- John Wiley and Sons, 1997.

Reference textbooks:

1. Current Protocols in Protein Science, Wiley Publishers, 2005; Deuflhard P., et al.
Computational molecular dynamics - Challenges, methods, ideas.(Springer,1999).

M. TECH (CE)

DEPARTMENT OF CIVIL ENGINEERING

M.Tech- STRUCTURAL ENGINEERING

First Year [First Semester]						
S No	**Code**	**Course Title**	**L**	**T**	**P**	**Cr**
1	11CE501	Applied Mathematics	3	2	0	4
2	11CE502	Theory of Elasticity	3	2	0	4
3	11CE503	Structural Dynamics	3	0	2	4
4	11CE504	Advanced Prestressed Concrete	3	0	2	4
5	11CE531	REPAIR AND REHABITAITON OF STRUCTURES	3	0	0	3
6	11CE541	GEO TECHNICAL EARTH QUAKE ENGINEERING	3	0	0	3
7	11CE551	Seminar	0	0	4	2
		Total Credits:				24

First Year [Second Semester]						
S No	**Code**	**Course Title**	**L**	**T**	**P**	**Cr**
1	11CE601	Finite Element Analysis	3	0	2	4
2	11CE602	Bridge Engineering	3	2	0	4
3	11CE603	Earthquake Resistant Design of Structures	3	0	2	4
4	11CE604	Theory of Plates and Shells	3	2	0	4
5	11CE631	INDUSTRIAL STRUCTURES	3	0	0	3
6	11CE643	GREEN BUILDINGS	3	0	0	3
7	11CE651	Term Paper	0	0	4	2
		Total Credits:				24

Second Year						
S No	**Code**	**Course Title**	**L**	**T**	**P**	**Cr**
1	15 IE 6050	DISSERTATION	0	0	72	36
		Total Credits:				36

APPLIED MATHEMATICS

Course Code :11 CE 501 **L-T-P : 3-2-0**
Pre-requisite: NIL **Credits: 4**
Syllabus:

One Dimensional Wave and Heat Equations
Laplace transform methods for one-dimensional wave equation – Displacements in a long string – longitudinal vibration of an elastic bar – Fourier transform methods for one-dimensional heat conduction problems in infinite and semi-infinite rods.

Elliptic Equation
Laplace equation – Properties of harmonic functions – Solution of Laplace's equation by means of Fourier transforms in a half plane, in an infinite strip and in a semi-infinite strip – Solution of Poisson equation by Fourier transform method.

Calculus of Variations
Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries –Direct methods – Ritz and Kantorovich methods.

Eigen Value Problems
Methods of solutions: Faddeev – Leverrier Method, Power Method with deflation – Approximate Methods: Rayleigh – Ritz Method

Numerical Integration
Gaussian Quadrature – One and Two Dimensions – Gauss Hermite Quadrature – Monte Carlo Method – Multiple Integration by using mapping function

TEXT BOOKS:

1. Introduction to Partial Differential Equations by K. Sankara Rao, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
2. Numerical Methods in Science and Engineering A Practical Approach by S. Rajasekaran, A. H. Wheeler and Company Private Limited, 1986.
3. Calculus of Variations with Applications by A.S. Gupta, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4. Integral Transforms for Engineers by L.C. Andrews and B. K. Shivamoggi, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

THEORY OF ELASTICITY

Course Code :11 CE 502 **L-T-P : 3-2-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Two-dimensional problems in rectangular coordinates
Plane stress ; Plane strain; Differential equations of equilibrium; Boundary conditions; Compatibility equations; Stress function; Governing differential equation; Solution by Polynomials; End effects – Saint-Venant's Principle; Determination of displacements; Bending of a cantilever loaded at the end; Bending of a beam by uniform load

Two-dimensional problems in polar coordinates
General equations in polar coordinates; Stress distribution symmetrical about an axis; Effect of circular holes on stress distribution in plates; Concentrated force at a point of a straight boundary; Concentrated force acting on a beam; Stresses in a circular disc, general solutions of the two dimensional problem in polar coordinates, applications of the general solutions in polar coordinates.

Strain energy methods
Total strain energy; Principle of virtual work; Griffith's theory of rupture; Castigliano's theorem; Principle of least work (Stationary potential energy), applications of the principle of least workrectangular plates, shear lag

Analysis of stress and strain in three dimensions
Stress at a point – components of stress; Principal stresses; Stress ellipsoid and stress director surface; Determination of principal stresses; Stress invariants; Determination of maximum shear stresses; Octahedral shear stress; strain at a point – Components of strain; differential equations of equilibrium, the principle of superposition

Torsion
Torsion of straight bars – Saint Venant's theory; Elliptic cross section; Membrane analogy; Torsion of a bar of narrow rectangular cross-section; Torsion of rolled profile sections; Torsion of thin tubes

Text Books:
1. Theory of Elasticity by Timoshenko, S. and Goodier J.N., McGraw Hill Book Co., Newyork, 1988.

Reference Books
1. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.
2. Hearn , E.J. "Mechanics of Materials", Vol.2, Pergamon Press, Oxford, 1985
3. Irving H.Shames and James, M.Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India Pvt. Ltd., Newl Delhi -2002.

STRUCTURAL DYNAMICS

Course Code :11 CE 503 **L-T-P : 3-0-2**
Pre-requisite: NIL **Credits: 4**
Syllabus:

Equation of Motions, Problem Statement, Solution Methods of Single Degree of Freedom Systems (SDOF) *:* Basic concepts of structural dynamics; single degree of freedom system, force displacement relationship, damping force, equation of motion, mass-spring-damper system, methods of solution of differential equation.

Free Vibration (SDOF): Undamped free vibration, viscously damped free vibration, energy in free vibration.

Response to Harmonic and Periodic Excitations (SDOF) : Harmonic vibration of undamped systems, Harmonic vibration with viscous damping, response to vibration generator, natural frequency and damping from harmonic test, force transmission and vibration isolation, vibration measuring instruments, energy dissipated in viscous damping. Response to periodic force.

Response to Arbitrary, Step And Pulse Excitations (SDOF) : Response to unit impuse, response to arbitrary force, step force, ramp force, response to pulse excitations, solution methods, effects of viscous damping.

Numerical Evaluation of Dynamic Response (SDOF) : Time stepping methods, methods based on interpolation of excitation, central difference method, newmark's method, stability and computational error, analysis of nonlinear response by newmark's method.Earthquake Response to Linear Systems (SDOF)

Earthquake excitation, equation of motion, response quantities, response history, response spectrum concept, deformation, pseudo-velocity and pseudo acceleration response spectra, peak structural response from the response spectrum, response spectrum characteristics, elastic design spectrum, comparison and distinction between design and response spectra.

Generalised Single Degree of Freedom Systems : Generalised SDOF systems, rigid body assemblages, systems with distributed mass and elasticity, lumped mass system-shear building, natural vibration frequency by Rayleigh's method.

Multi -degree of freedom systems (MDOF) : Equation of motions: simple system-two storey shear building, general approach for linear systems, static condensation, symmetric plan systems: ground motion. Multiple support excitation, methods of solving the equation of motions.

Free Vibration (MDOF) : Natural frequencies and modes: systems without damping, modal and spectral matrices, orthogonality of modes, normalization of modes. Solution of undamped free vibration systems, solution methods for eigenvalue problem.

Text Books:

1. Dynamics of structures by Anil K Chopra; Prentice-Hall of India Limited, New Delhi.3rd edition 2006.
2. Dynamics of Structures by R.W. Clough and P.E. Penzien, McGraw-Hill. 1st edition 1975

Reference Books:

1. Structural Dynamics for Structural Engineers by G. C. Hart & K. Wang; John Wiley & Sons. 1st edition 1991
2. Structural Dynamics by Mario Paz, CBS Publishers.1st edition.

ADVANCED PRESTRESSED CONCRETE

Course Code :11 CE 504 **L-T-P : 3-0-2**
Pre-requisite: NIL **Credits: 4**
Syllabus:

Introduction, Prestressing Systems and Material Properties

Basic concepts of pre-stressing; Historical development; Advantages and Types of Pre-stressing, Pre-tensioning Systems and Devices, Post-tensioning Systems and Devices, Need for High strength steel and High strength concrete; **Losses Of Prestress:** Nature of losses of pre-stress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

Analysis of Prestressed Member

Analysis of Members under Axial Load: Analysis at Transfer, Analysis at Service , Analysis for Ultimate Strength, Analysis of Member under Flexure:, Analysis at Transfer and at Service, Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, design loads and strength, Calculation of Crack Width, Variation of Stress in Steel, Analysis of a Rectangular Section, Analysis of a Flanged Section.

Deflections of Prestressed Concrete Members:

Importance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members. Long term deflection of cracked member; **Transmission Of Pre-Stress:** Transmission of Pre-stressing force by bond; Transmission length; Bond stresses; Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre –tensioned and post – tensioned grouted beams, stress distribution in end block, Anchorage zone reinforcements; **Shear And Torsion Resistance Of Prestressed Concrete Member:** Shear and Principal stresses; Ultimate shear resistance of pre-stressed concrete members; Design of shear reinforcement, pre-stressed concrete members in torsion, Design of reinforcements for torsion, shear and bending.

Design of Pre-Stressed Members : Design of sections for flexure, Design of Sections for Axial Tension, Design of Sections for compression and bending, design of pre-stressed section for shear and torsion, design of pre-stressed member for bond. Dimensioning of flexural member, design for pre-tensioning member, design of post-tensioning members.

Composite Construction of Prestressed Concrete : Composite structural member, types of composite construction, analysis of stresses, differential shrinkages, deflection of composite member, flexural strength of composite sections, shear strength of composite section; **Design of Continuous Prestressed Concrete Member:** Advantages of continuous members, ultimate load analysis of continuous pre-stressed member, design of continuous pre-stressed concrete beams.

Text Books: (supplemented with IS: 1343)

1. Prestressed Concrete by N. Krishna Raju; Tata Mc Graw - Hill Publishing Company Limited, New Delhi.3rd edition, 1995.
2. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns; John Wiley & Sons, 3rd edition, 1981.

Reference Books

1. Prestressed concrete by N. Rajagopalan; Narosa Publishing House.2nd edition, 2005.
2. Design of Prestressed Concrete by A. Nilson; John Willey & Sons.2nd edition, 1987.

REPAIR AND REHABILITATION OF STRUCTURES

Course Code :11 CE 531 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**
Syllabus:

Introduction
Deterioration of structures with aging; Need for rehabilitation
Distress in concrete /steel structures
Types of damages; Sources or causes for damages; effects of damages; Case studies

Damage assessment and evaluation models
Damage testing methods; Non-destructive testing methods

Rehabilitation methods
Grouting; Detailing; Imbalance of structural stability; Case studies

Methods of Repair
Shortcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling

Seismic Retrofitting of reinforced concrete buildings
Introduction; Considerations in retrofitting of structures; Source of weakness in RC frame building – Structural damage due to discontinuous load path; Structural damage due to lack of deformation; Quality of workmanship and materials; Classification of retrofitting techniques; Retrofitting strategies for RC buildings – Structural level (global) retrofit methods; Member level (local) retrofit methods; Comparative analysis of methods of retrofitting

Text Books:

1. Diagnosis and treatment of structures in distress by R.N.Raikar, Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
2. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.
3. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.

GEOTECHNICAL EARTHQUAKE ENGINEERING

Course Code :11 CE 541 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**
Syllabus:

Seismology and Earthquakes
Introduction, Seismic Hazards, seismic waves, internal structure of earth, Continental drift and plate tectonics, faults, elastics rebound theory, geometric notations, location of earthquakes, size of earthquakes.

Strong Ground Motion
Strong ground motion measurement, ground motion parameters, estimation of ground motion parameters.
Seismic Hazard Analysis: Identification and Evaluation of Earthquake Sources, deterministic seismic hazard analysis, probabilistic seismic hazard analysis.

Wave propagation
Waves in unbounded media, waves in a semi – infinite body, waves in a layered media, attenuation of stress waves.
Dynamic soil properties: Measurement of dynamic soil properties using field and laboratory tests (overview), stress strain behavior of cyclically loaded soils, strength of cyclically loaded soils.

Ground Response Analysis
One – Dimensional Ground response Analysis – Linear and Non-Linear Approaches.
Local Site Effects: Effect of local site conditions on ground motion, design parameters, development of design parameters.

Liquefaction
Flow liquefaction, cyclic mobility, evaluation of liquefaction hazards, liquefaction susceptibility, initiation of liquefaction, effects of liquefaction.
Soil Improvement for Remediation of Seismic Hazards: Densification techniques, Reinforcement Techniques, Grouting and Mixing techniques, Drainage techniques.

TEXT BOOK:
Geotechnical Earthquake Engineering by Steven L. Kramer, prentice Hall, 1st edition, 1996.

REFERENCE BOOK:
Geotechnical Earthquake Engineering Handbook by Robert W. Day, McGraw-Hill.2nd edition,
2010.

FINITE ELEMENT ANALYSIS

Course Code :11 CE 601 **L-T-P : 3-0-2**
Pre-requisite: NIL **Credits: 4**
Syllabus:

Basic Principles
Equilibrium equations; Strain-displacement relations; linear constitutive relations;Principle virtual work; Principle of stationary potential energy

Element Properties
Different types of elements; Displacement models; Relation between nodal degrees of freedom and generalized coordinates; Convergence requirements; Compatibility requirement; Geometric invariance; Natural coordinate systems; Shape functions; Element strains and stresses; Element stiffness matrix; Element nodal load vector. Isoparametric elements – Definition, Two-dimensional isoparametric elements – Jacobian transformation, Numerical integration

Direct Stiffness method and Solution Technique
Assemblage of elements–Obtaining Global stiffness matrix and Global load vector; Governing equilibrium equation for static problems; Storage of Global stiffness matrix in banded and skyline form; Incorporation of boundary conditions; Solution to resulting simultaneous equations by Gauss elimination method

Plane-stress and Plane-strain analysis
Solving plane stress and plane-strain problems using constant strain triangle and four nodded isoparametric element

Analysis of plate bending
Basic theory of plate bending; Shear deformation plates; Plate bending analysis using four noded isoparametric elements

Text Books:

1. Introduction to Finite Elements in Engineering by R.T. Chandrupatla and A.D. Belegundu, Prentice Hall of India, 1997.

Reference Books:

1. Finite Element Analysis by Abel and Desai, New Age Publishers, 2007.
2. Finite Element Analysis: Theory and Programming by C. S. Krishnamoorthy, Tata McGraw-Hill, 1995
3. Finite Element Procedures in Engineering Analysis by K. J. Bathe, Prentice Hall Inc., 1996.
4. The Finite Element Method by O.C. Zienkiewicz, and R.L.Taylor, McGraw – Hill, 1987.

BRIDGE ENGINEERING

Course Code :11 CE 603 **L-T-P : 3-2-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

I.R.C. Specifications For Road Bridges
Different types of bridges; I.R.C. specifications for road bridges; **Design Of R.C Slab Culvert:** Loads considered for design, Design of R.C. slab culvert.

Design of T – Beam Bridge
Pigeaud's method for computation of slab moments; courbon's method for computation of moments in girders; Design of simply supported T-beam Bridge.

Design of Sub Structure For Bridges
Pier and abutment caps; Materials for piers and abutments' Design of pier; Design of abutment; Backfill behind abutment; approach slab.

Design of Bearings For Bridges
Importance of bearings; bearings for slab bridge; bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing; **Foundations For Bridges:** Scour at abutments and piers; Grip length; Types of foundations; Design of well foundation.

Cable Supported Bridge
Different types of cable supported bridge, difference between suspension bridge and cable stayed bridge. Different components and factors considered for design of a) suspension bridge, b) cable stayed bridge.

Text Books:

1. Essentials of Bridge Engineering by Johnson Victor; Oxford & IBH publishing Co. Pvt. Ltd.2007
2. Cable supported bridges, concepts and design by N J Gimsing. John Willey and Sons, 2nd edition

Reference Books:

1. Design of Bridge Structures by T. R Jagadeesh, M.A Jayaram, Prentice Hall of India Pvt. Ltd. 2nd edition.

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Course Code :11 CE 603 **L-T-P : 3-0-2**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Seismic-resistant building architecture
Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements

Design forces for buildings
Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS 1893(Part 1) – Equivalent static method, Model analysis using response spectrum

Ductility considerations in earthquake resistant design of RCC buildings
Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920

Earthquake resistant design of a long two-storey, two-bay RCC building
Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member ,typical column, footing and detailing of a exterior joint as per IS13920.

Base isolation of structures
Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; seismic-isolation design principle; Feasibility of seismic isolation; Seismic-isolation configurations

Text Books:

1. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.
2. Seismic design of reinforced concrete and masonry buildings by T. Paulay and M.J.N. Priestley, John Wiley & Sons, 1991.
3. The seismic design handbook, Edited by F. Naeim, Kluwer Academic publishers, 2001.

THEORY OF PLATES AND SHELLS

Course Code :11 CE 604 **L-T-P : 3-2-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Introduction: Assumptions in the theory of thin plates – Pure bending of Plates – Relations between bending moments and curvature - Particular cases of pure bending of rectangular plates, Cylindrical bending - immovable simply supported edges – Synclastic bending and Anticlastic bending – Strain energy in pure bending of plates in Cartesian and polar co-ordinates – Limitations.

Laterally Loaded Circular Plates:- Differential equation of equilibrium – Uniformly loaded circular plates with simply supported and fixed boundary conditions – Annular plate with uniform moment and shear force along the boundaries.

Laterally Loaded Rectangular Plates: - Differential equation of plates – Boundary conditions – Navier solution for simply supported plates subjected to uniformly distributed load and point load – Levy's method of solution for plates having two opposite edges simply supported with various symmetrical boundary conditions along the other two edges loaded with u. d. l. – Simply supported plates with moments distributed along the edges - Approximate Methods.

Effect of transverse shear deformation - plates of variable thickness – Anisotropic plates-thick plates- orthotropic plates and grids - Large Deflection theory.

Deformation of Shells without Bending:- Definitions and notation, shells in the form of a surface of revolution, displacements, unsymmetrical loading, spherical shell supported at isolated points, membrane theory of cylindrical shells, the use of stress function in calculating membrane forces of shells.

General Theory of Cylindrical Shells:- A circular cylindrical shell loaded symmetrically with respect to its axis, symmetrical deformation, pressure vessels, cylindrical tanks, thermal stresses, in extensional deformation, general case of deformation, cylindrical shells with supported edges, approximate investigation of the bending of cylindrical shells, the use of a strain and stress function, stress analysis of cylindrical roof shells.

Text Books:

1. S.P Timoshenko and S.W Krieger, Theory of Plates and Shells, McGraw Hill, 1989.

Reference Books:

1. R. Szilard, Theory and Analysis of Plates – Classical Numerical Methods', Prentice Hall inc, 1974.
2. P.L Gould, Analysis of Shells and Plates, Springer-Verlag, New York, 1988.

INDUSTRIAL STRUCTURES

Course Code :11 CE 631 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

PLANNING AND FUNCTIONAL REQUIREMENTS
Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety – Protection against noise and vibration - Guidelines of Factories Act.

INDUSTRIAL BUILDINGS
Roofs for Industrial Buildings - Steel and RCC - Gantry Girders - Design of Corbels and Nibs – Machine foundations.

POWER PLANT STRUCTURES
Types of power plants – Design of Turbo generator foundation – containment structures.

POWER TRANSMISSION STRUCTURES
Transmission Line Towers - Substation Structures - Tower Foundations - Testing Towers.

AUXILLIARY STRUCTURES
Chimneys and Cooling Towers – Bunkers and Silos – Pipe supporting structures.

Text Books:

1. Manohar S.N, "Tall Chimneys - Design and Construction", Tata McGraw Hill, 1985
2. Santha kumar A.R. and Murthy S.S., "Transmission Line Structures", Tata McGraw Hill, 1992.
3. Srinivasulu P and Vaidyanathan.C, "Handbook of Machine Foundations", Tata McGraw Hill, 1976.
4. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings: A Design Manual", Birkhauser Publishers, 2004.
5. Proceedings of Advanced course on "Industrial Structures", Structural Engineering Research Centre, Chennai, 1982.

GREEN BUILDINGS

Course Code :11 CE 643 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits:3**

Syllabus:

Introduction

What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green
Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

Green Building Concepts and Practices

Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

GreenBuilding Design

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

AirConditioning

Introduction,CIIGodrej Green business centre,Design philosophy,Design interventions,Energy modeling, HVAC System design,Chiller selection,pump selection,Selection of cooling towers,Selection of air handing units,Precooling of fresh air,Interior lighting system,Key feature of the building. Eco-friendly captive power generation for factory,Building requirement.

MaterialConservation

Handling of non process waste, waste reduction during construction,materials with recycledcontent,local materials,material reuse,certified wood ,Rapidly renewable building materials and furniture;

Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference Books:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

M. TECH (CSE)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF CSE (Y12)				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	11CS501	DATA STRUCTURES AND ALGORITHMS	3-1-2	5
2	11CS502	COMPUTER ORGANIZATION	3-1-0	4
3	11CS503	OPERATING SYSTEMS	3-1-0	4
4	11CS504	OBJECT ORIENTED PROGRAMMING	3-1-2	5
5	11CSE12	MOBILE COMPUTING	3-0-0	3
6	11CSE23	DATA WARE HOUSING	3-0-0	3
7	11CS505	SEMINAR	0-0-4	2
Semester -2				
1	11CS506	COMPUTER NETWORKS	3-1-2	5
2	11CS507	SOFTWARE ENGINEERING	3-0-0	3
3	11CS508	DATABASE MANAGEMENT SYSTEMS	3-1-2	5
4	11CS509	EMBEDDED SYSTEMS	3-1-0	4
5	11CSE32	CLOUD COMPUTING	3-0-0	3
6	11CSE43	DATA SECURITY	3-0-0	3
7	11CS510	TERM PAPER	0-0-4	2
Semester -3 & 4				
1	11 CS 601	THESIS/PROJECT		36

I/II M.Tech **I Semester**

Course Code : 11CS501

Course Title : Data Structures and Algorithms

Course Structure : 3 – 1 - 2

SYLLABUS:

UNIT-I

INTRODUCTION: Algorithms, algorithms as a technology, Analyzing algorithms , Designing algorithms, Asymptotic notations, standard notations, common functions, Recurrences – substitution method, master method.

SORTING AND ORDER STATISTICS: Merge sort, Quick sort, Heap sort, sorting in linear time, Median and order statistics.

UNIT-II

DATA STRUCTURES: Elementary Data Structures – Linked lists, Stacks, Queues, Hash Tables – Direct address tables, Hash tables, Hash functions, Open addressing, Search Trees – Binary search trees, Red-Black Trees.

ADVANCED DATA STRUCTURES: B – Trees, Binomial Heaps, Fibonacci Heaps, Data Structures for Disjoint Sets.

UNIT-III

GRAPH ALGORITHMS: Elementary graph algorithms – Representation of graphs, BFS, DFS, Topological Sort, Strongly connected components, Minimum Spanning Trees – The algorithms of Kruskal and Prim's. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single source shortest paths in DAG's, Dijkstra's algorithm, All-Pair Shortest paths – Shortest paths and Matrix multiplication, Floyd-Warshall algorithm. Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum Bipartite matching.

UNIT-IV

ADVANCED DESIGN AND ANALYSIS TECHNIQUES: Greedy Algorithms – An activity – selection Problem, Elements of greedy strategy, Huffman codes. Dynamic Programming: Matrix Chain multiplication, Elements of dynamic programming, Optimal Binary Search Trees.

UNIT-V

STRING MATCHING: The naïve string matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm.

NP-COMPLETENESS: Polynomial time, Verification, NP-Completeness and reducibility, NP-Completeness proofs, NP-Complete problems.

Text Books:

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein,PHI Pvt.Ltd./ Pearson Education.

Reference Books:

1. Algorithm Design: Foundations,Analysis and Internet examples, M.T.Goodrich and R.Tomassia,John wiley and sons.
2. Fundamentals of Computer Algorithms,Ellis Horowitz,Satraj Sahni and S.Rajasekharam,Galgotia publications pvt. Ltd.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.
5. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

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Course Code : 11CS502
Course Title : Computer Organization
Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

REGISTER TRANSFER & MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus & memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

UNIT II

BASIC COMPUTER ORGANIZATION AND DESIGN: Introduction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction cycle, Memory-Reference Instruct ion, Input-Output and Interrupt, Design of Basic Computer, Design of Accumulator Logic. MICRO PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

UNIT III

CENTRAL PROCESSING UNIT: General registers Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC). COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication Algorithms, Division Algorithms Floating-point Arithmetic operations.

UNIT IV

MEMORY ORGANIZATION: Memory Hierarchy, Main Memory, Auxiliary memory, Associative Men Cache Memory, Virtual Memory, Memory Management hardware.

UNIT V

INPUT-OUTPUT ORGANISATION: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor, Serial Communication.

Text Books:

1. Morris M. Mano, ‘Computer Systems Architecture’, 3rd Edition.

Reference Books:

1. John P Hayes, ‘Computer Architecture and Organisation’ 2nd edition.
2.V.Carl Hamacher et.al, ‘Computer Organization’ 2nd edition.

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Course Code : 11CS503

Course Title : Operating Systems

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

INTRODUCTION: Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems.

OPERATING-SYSTEM STRUCTURES: Operating-System Services , User Operating-System Interface, System Calls , Types of System Calls, System Programs , Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation, System Boot.

UNIT II

PROCESSES: Concept, Process Scheduling, Operations on Processes, Inter-process Communication Examples of IPC Systems, Communication in Client-Server Systems.

MULTITHREADED PROGRAMMING: Multithreading Models, Thread Libraries, Threading Issues.

PROCESS SCHEDULING: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.

UNIT III

SYNCHRONIZATION: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples, and Atomic Transactions.

DEADLOCKS: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance, Deadlock Detection. Recovery from Deadlock.

UNIT IV

MEMORY MANAGEMENT STRATEGIES: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

VIRTUAL MEMORY MANAGEMENT: Demand Paging, Page Replacement, Allocation of Frames, Thrashing , Memory-Mapped Files , Allocating Kernel Memory.

UNIT V

FILE-SYSTEM: The Concept of a File, Access Methods, Directory Structure, File-System Mounting, File Sharing, Protection.

IMPLEMENTING FILE SYSTEM: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery.

Text Book:

1. Silberschatz & Galvin, 'Operating System Concepts', 7th edition, Wiley.

Reference Books:

1. William Stallings-"Operating Systems"- 5th Edition – PHI.
2. Charles Crowley, 'Operating Systems: A Design-Oriented Approach', Tata McGraw Hill Co., 1998 edition.
3. Andrew S.Tanenbaum, 'Modern Operating Systems', 2nd edition, 1995, PHI.

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Course Code : 11CS504

Course Title : Object Oriented Programming

Course Structure : 3 – 1 - 2

SYLLABUS:

UNIT I

INTRODUCTION TO OOPS: Origins of C++, Object Oriented Programming, C++ fundamentals, Headers & Name Spaces, C++ Classes, Function overloading, Operator overloading, Inheritance, Constructors & Destructors.

CLASSES & OBJECTS: Parameterized Constructors, Friend functions, Default function arguments. Structures, Unions, and Inline functions, passing objects to functions, Returning objects, Object assignment, Arrays of objects, Pointers to objects.

UNIT II

FUNCTION & OPERATOR OVERLOADING: Overloading constructors, Localizing variables, Function overloading & Ambiguity, Finding the address of an overloaded function, This Pointer, Operator overloading, References using reference to overload a unary operator, Overloading [] and (), Applying operator overloading.

INHERITANCE: Inheritance and the access specifiers, Constructors and Destructors in derived classes, Multiple Inheritance, Multilevel Inheritance, Diamond Inheritance, Hybrid Inheritance, Passing parameters to a basic class.

UNIT III

POLYMORPHISM AND VIRTUAL FUNCTIONS: Pointer Objects, Pointer to Objects, Pointers and references to derived types, Virtual Functions, Pure virtual functions and abstract types, Early vs Late binding, Virtual Base Class.

THE C++ 1/0 CLASS LIBRARY: C++ streams, The C++ Stream classes, Creating own inserter and extractors, Formatting I/O, Creating your own manipulator functions.

UNIT IV

FILES IN C++: File I/O, Unformatted and Binary I/O.

TEMPLATES: Generic Functions and classes.

EXCEPTIONS: Exception Handling, Fundamentals, options Un-caught exception (), Applying exception Handling, and RTTI, casting operators.

UNIT V

MISCELLANEOUS C+ + TOPICS: Dynamic allocation using new and delete, static class members, constant member functions and mutable, volatile member functions, Using the asm keyword, linkage specification, The .* and ->* operators, Creating conversion functions, Copy constructors, Granting access, Namespaces, Explicit constructors.

THE STANDARD TEMPLATE LIBRARY AND THE STRING CLASS: An overview of the STL

Text Books:

1. Herbert Schieldt ,The Complete Reference - Borland C++ Builder ,2007,4th ed., TMH.

Reference Books:

1. E. Balaguruswamy, Object Oriented Programming using C++, 2nd ed., TMH.
2. Deitel HM and Deitel PJ: C++ How to Program, Third Edition, PHI.

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Course Code : 11CSE12

Course Title : Mobile Computing

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT–I

MOBILE COMMUNICATIONS: AN OVERVIEW: Mobile communication, Mobile computing, Mobile computing architecture, Mobile Devices, Mobile system Networks, Data dissemination, Mobility management.

MOBILE DEVICES AND SYSTEMS: Mobile phones, Digital music players, Handheld pocket computers, Handheld devices, Smart systems, Limitations of mobile devices, Automotivesystems.

UNIT–II

GSM AND SIMILAR ARCHITECTURES: GSM – Services and system architecture, Radio interfaces, Protocols, Localization, Calling, Handover, Security, New data services, General packet radio service, High speed circuit switched data, DECT.

WIRELESS MEDIUM ACCESS CONTROL AND CDMA-BASED COMMUNICATION: Medium access control, Introduction to CDMA- based systems, Spread spectrum in CDMA systems, Coding methods in CDMA, IMT-2000, i-mode, OFDM.

UNIT–III

MOBILE IP NETWORK LAYER: IP and mobile IP network layers, Packet delivery and handover Management, Location management, Registration, Tunneling and encapsulation, Route optimization,Dynamichostconfigurationprotocol.

MOBILE TRANSPORT LAYER: Conventional TCP/ IP transport layer protocol, Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP-layer transmission for mobile networks, TCPover2.5G/3Gmobilenetworks.

DATABASES: Database hoarding techniques, Data caching, Client-Server computing and Adaptation, Transactional models, Query processing, Data recovery process, Issues relating to Quality of service.

UNIT–IV

DATA DISSEMINATION AND BROADCASTING SYSTEMS: Communication asymmetry, Classification of data-delivery mechanisms, Data dissemination broadcast models, Selective tuning and indexing techniques, Digital audio broadcast models, Selective tuning and indexing techniques, Digital audio broadcasting, Digital video broadcasting.

DATA SYNCHRONIZATION IN MOBILE COMPUTING SYSTEMS: Synchronization, Synchronization software for model devices, Synchronization protocols, SyncML-Synchronization language for mobile computing, Sync4J, Synchronized multimedia markup language.

MOBILE DEVICES: SERVER AND MANAGEMENT: Mobile agent, Application server, Gateways, Protocol, Service discovery, Device management, Mobile file systems, Security.

MOBILE AD-HOC AND SENSOR NETWORKS: Introduction to Mobile Ad-hoc Networks, MANET, Wireless sensor networks.

UNIT–V

WIRELESS LAN, MOBILE INTERNET CONNECTIVITY, AND PERSONAL AREA NETWORK: Wireless LAN architecture and protocol, WAP 1.1 and WAP 2.0 architecture, XHTML-MP, Bluetooth-enabled devices network, Layers in Bluetooth protocol, Security in Bluetooth protocolIrDA,ZigBee.

MOBILE APPLICATION LANGUAGESXML, JAVA, J2ME, AND JAVACARD: Introduction , XML, JAVA,Java2microedition,JavaCard.

MOBILE OPERATING SYSTEMS: Operating system, palmOS, Windows CE, Symbian OS, Linux for mobile devices.

Text Books:

1. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, 2007.

References Books:

1. Jochen H. Schller, "Mobile Communications", second edition, Pearson Education, New Delhi, 2007.
2. Jon W. Mark, Weihua Zhuang, "Wireless Communications and Networking", Prentice Hall, New Delhi, 2007.

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Course Code : 11CSE23

Course Title : Data warehousing

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT–I

THE COMPELLING NEED FOR DATA WAREHOUSING: Escalating need for strategies information, Failures of Past Decision-Supporting System, Operational Versus Decision-Supporting System, Data Warehousing- The only Viable Solution, data Warehouse Defined.

THE BUILDING BLOCKS: Defining Features, Data Warehouse and Data Marts, Overview of the Components, Metadata in the Data Warehouse.

TRENDS IN DATA WAREHOUSING: Continues Growth in Data Warehousing, Significant Trends, Emergence of Standards.

PLANNING AND PLANNING MANAGEMENT: Planning your Data Warehousing, The Data Warehouse Project, The project team, Project Management Considerations.

DEFINING THE BUSINESS REQUIREMENT: Dimension Analysis, Information Package- A New Concept, Requirements Gathering Methods, Requirements Definition: Scope and content.

REQUIREMENTS AS THE DRIVING FORCE FOR DATA WAREHOUSING: Data Design, The Architectural Plan, Data Storage Specification, and Information Delivery Strategy.

UNIT–II

THE ARCHITECTURAL COMPONENT: Understanding Data Warehouse Architecture, Distinguishing Characteristics, Architectural framework, Technical Architecture.

INFRASTRUCTURE AS THE FOUNDATION FOR DATA WAREHOUSING: Infrastructure Support Architecture, Hardware Operational System, Database Software, Collection of Tools.

THE SIGNIFICANT ROLE OF METADATA: Why Metadata is Important, Metadata Types by Functional Areas, Business Metadata, How to Provide Metadata.

UNIT–III

PRINCIPLES OF DIMENSIONAL MODELING: From Requirement to Data Design, The STAR Schema, STAR Schema keys, Advantages of STAR Schema.

DIMENSIONAL MODELING: Updates to the Dimensional Tables, Miscellaneous Dimensions, The Snowflake Schema, Aggregate Fact Tables, and Families of STARS.

DATA EXTRACTION, TRANSFORMATION, AND LOADING: ETL overview, Data Extraction, Data Transformation, Data Loading, ETL Summary.

DATA QUALITY: Why data is quality critical, Data Quality Challenges, Data Quality Tools, Data Quality Initiative.

UNIT–IV

MATCHING INFORMATION TO THE CLASSES OF USERS: Information from the Data Warehouse, Who will Use the Information?, Information Delivery, Information Delivery Tools.

OLAP IN THE DATA WAREHOUSE: Demand for Online Analytical Processing, Major Features and Functions, OLAP Models, OLAP Implementation Consideration.

DATA WAREHOUSING AND THE WEB: Web-Enabled Data Warehouse, Web-Based Information Delivery, OLAP and the Web, Building a Web- Enabled Data Warehouse.

UNIT–V

THE PHYSICAL DESIGN PROCESS: Physical Design Steps, Physical Design Considerations, Physical Storage, Indexing the Data Warehouse, Performance Enhancement Techniques.

DATA WAREHOUSE DEPLOYMENT: Major Deployment Activities, Considerations for a Pilot, Security, Backup and Recovery.

GROWTH AND MAINTENANCE: Monitoring the Data Warehouse, User Training and Support, Managing the Data Warehouse.

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Course Code : 11CS506

Course Title : Computer Networks

Course Structure : 3-1-2

SYLLABUS:

UNIT–I

INTRODUCTION: Use of Computer Networks, Network Hardware, Network software, Reference models, Example Networks.

PHYSICAL LAYER: The theoretical basis for Data Communication, Guided Transmission media, Modems, ADSL, Trunks and Multiplexing, switching.

UNIT–II

DATA LINK LAYER: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols.

MEDIUM ACCESS CONTROL SUB LAYER: Channel allocation problem, multiple access protocols, Ethernet, Data link Layer switching.

UNIT–III

NETWORK LAYER: Network layer design issues, Routing algorithms, congestion control algorithms, Quality of service, Internetworking, network layer in the Internet

UNIT–IV

TRANSPORT LAYER: Transport service, Elements of transport protocols, Internet transport protocols: TCP & UDP, Performance Issues

UNIT–V

APPLICATION LAYER: Domain Name System, Electronic Mail, World Wide Web.

Text Books:

1. Andrew S.Tanenbaum, Computer Networks, 2003,PHI, Fourth Edition.

Reference Books:

1. William Stallings, Data and Computer Communications, Pearson Edition,Seventh Edition ,2007.
2. Behrouz A. Fourouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Third Edition, 2006.

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Course Code : **11CS507**

Course Title : **Software Engineering**

Course Structure : **3 – 0 – 0**

SYLLABUS:

UNIT–I

SOFTWARE AND SOFTWARE ENGINEERING: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths.

PROCESS MODELS: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process.

AGILE DEVELOPMENT: Agility, agile process, extreme programming and other agile process models.

UNIT–II

MODELING: Core principles, principles that guide each frame work activity.

UNDERSTANDING REQUIREMENTS: Identify stakeholders, Recognizing multiple view points, Eliciting requirements, building requirement model, negotiating requirements, validating requirements.

REQUIREMENT MODELING: Analysis, Rules of Thumb, domain analysis, requirement modeling approaches, scenario based modeling, Data modeling concepts, Flow oriented modeling, creating behavioral model, patterns for requirement modeling,

UNIT–III

DESIGN CONCEPTS: Design process, Design concepts, design model.

ARCHITECTURE DESIGN: Software architecture, architectural styles, architectural design, assessing alternative architectural designs, architectural mappings using data flow.

COMPONENT-LEVEL DESIGN: Designing class based components, conducting component level design.

UNIT–IV

USER INTERFACE DESIGN: The golden rules, user interface analysis and design, interface analysis, interface design steps**.**

QUALITY CONCEPTS: software quality, software quality dilemma, achieving software quality.
SOFTWARE QUALITY ASSURANCE: Elements of software quality assurance, sqa tasks, goals. Formal approaches.

UNIT–V

SOFTWARE TESTING STRATEGIES: A strategic approach to software testing, strategic issues, test strategies for conventional software, validation testing, system testing**.**

Text Books:

1. Roger S.Pressman ,"Software Engineering – A Practitioner's Approach 7th Edition 2010, Mc Graw Hill.

Reference Books:

1. Ian Sommerville,'Software Engineering', Sixth Edition,2001,Pearson Education.

Course Code : 11CS508

Course Title : Database Management System

Course Structure : 3-1-2

SYLLABUS:

UNIT–I

DATABASE FUNDAMENTALS: DBMS characteristics & Advantages, Database environment, Data base users, Database architecture, data independence, Languages, tools and interfaces in DBMS. DBMS Types.

UNIT-II

DATA MODELING: ER Model, Notation used in ER diagram, Constraints, types, relationships in ER Model and other considerations in designing ER diagram. Enhanced ER Data Model, EER Diagram, Specialization and Generalization, Lattice, Union and Disjoint properties, Constraints and relationships, other issues in designing EER Diagram. Algorithms for ER to Relational mapping

UNIT–III

SQL: Data definition and other languages in SQL, Creating Tables, and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations. Embedded SQL - Writing Functions and procedures with PL/SQL. Relational Model, Relational Algebra, Operators in Relational Algebra.

UNIT–IV

NORMALIZATION: Guidelines for good database design, Normalization – Normal Forms, First, Second, Third Normal Forms, BCNF (Boyce Codd Normal Form). Multi value and join dependencies, 4th and 5th Normal forms. Decomposition algorithms for normalization. File and storage structures: File storage, index structures, indexing and hashing (Basics) Query Processing: Issues in query processing, simple algorithms for insert, project, join and other operators.

UNIT–V

TRANSACTION PROCESSING: Transaction processing issues, Transaction states, problems during multiple transaction processing, ACID properties, System Log.

CONCURRENCY CONTROL TECHNIQUES: Binary Locks, Exclusive Locks, Lock based Techniques, Timestamp based techniques. Versioning in Locks, Multiversion Locking techniques.

Text Books:

1. Elmasri & Navathe Fundamentals of Data base Systems, 2008,4th edition, Pearson.

Reference Books:

1. A Silberschatz , Henry F Korth, S. Sudarshan ,"Database System Concepts" ,2003 , Fifth Edition, Tata McGraw-Hill.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database management systems", 2004 , 2nd edition, Tata McGraw Hill.

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Course Code : 11CS509

Course Title : Embedded Systems

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT-I

ES BASICS: Introduction to Embedded Systems: Definition, Comparison with Loaded Systems, Challenges of Embedded systems, Application of Embedded Systems. Hardware fundamentals and devices: CHIPS, GATES, PCB, Power and decoupling, Timing Diagrams, Signal Processing related issues, Clocks, Flip Flops, Memories, Micro Processors, PINS, ports, Address Resolution, Address Decoding within Micro Processors, Micro Processors VS Micro Controllers, Busses and Bus Handling, DMA, UART and RS232, PAL, FPGA, Timers, Counters, Pulse width Modulators for speed control, LCD Controllers, Key Pad Controllers, Stepper motor controllers, A/D Converters.Introduction to temp Sensors, Flow Control devices, Humidity Control devices, Speed Control devices**.**

UNIT II

INTERFACING: Communication basics, Basic Terminology, Basic Protocol concepts, I/O Addressing: Port Based Addressing, Bus Based addressing, Memory mapped I/O, Standard I/O, Interfacing Micro Processors through Interrupts and DMA, Arbitration Techniques, Multi Bus Architecture Serial Communication and Protocols: I2C, CAN, Fire-wire, USB, Parallel Communication and protocols: PCI Bus, ARM Bus, Wireless Communication and Protocols: IrDA, Blue Tooth, 802.11g.

UNIT III

ES SOFTWARE PROCESSING PLATFORM: Micro Processor Architecture both CISC and RISC, Interrupt Processing, Shared data problem, Interrupt Latency, Software Architectures: Round Robin, Round Robin with Interrupts, Function Queue Scheduling, RTOS, Selecting architecture.

UNIT IV

REAL TIME OPERATING SYSTEMS: Tasks and Task data, Scheduler, Re-Reentrancy, Semaphores, Semaphore Problems, Message Queues, Mail Boxes, Pipes, Timer Functions, Event Handling, Memory Management, Interrupt Processing, and Power saving Functions. Introduction to µcos and VxWorks.

UNIT V

ANALYSIS, DESIGN AND SOFTWARE DEVELOPMENT: Analysis and designing Embedded Systems using RTOS, Overview, General Design Principles, Hardware and software CO design in Embedded Systems, Encapsulating Semaphores and Queues, Real Time Scheduling

Considerations, Software development process and tools Testing and Debugging Techniques, Testing and Debugging Tools.

Text Books:

1. Am embedded Software Premier, David E. Simon, Person Education, 1999.
2. Embedded Systems Design, Frank Vahid /Tony Givargis, John Wiley and sons inc.

Reference Books:

1. Embedded Systems, Raj kamal, Tata McGraw- Hill Publishing Company Limited, 2003.

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Course Code : 11CSE43

Course Title : Data Security

Course Structure : 3-0-0

SYLLABUS:

INTRODUCTION: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Recommended Reading & Web Sites.

CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

BLOCK CIPHERS & THE DATA ENCRYPTION STANDARD: Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential & Linear Cryptanalysis, Block Cipher Design Principles.

ADVANCED ENCRYPTION STANDARD: Evaluation Criteria for AES, The AES Cipher.

MORE ON SYMMETRIC CIPHERS: Multiple Encryption & Triple DES, Block Cipher Modes of Operation, Stream Ciphers & RC4.

CONFIDENTIALITY USING SYMMETRIC ENCRYPTION: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

PUBLIC – KEY CRYPTOGRAPHY & RSA: Principles of Public – key Cryptosystems, The RSA Algorithm.

KEY MANAGEMENT; OTHER PUBLIC-KEY CRYPTOSYSTEMS: Key Management, Diffie – Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

MESSAGE AUTHENTICATION & HASH FUNCTIONS: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions & Macs.

HASH & AC ALGORITHMS: Secure Hash Algorithm, Whirlpool, HMAC, CMAC.

DIGITAL SIGNATURES & AUTHENTICATION PROTOCOLS: Digital Signatures, Authentication Protocols, Digital Signature Standard.

AUTHENTICATION APPLICATIONS: Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

ELECTRONIC MAIL SECURITY: Pretty Good Privacy, S/MIME.

IP SECURITY: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.

WEB SECURITY: Web Security Considerations, Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction.

FIREWALLS: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

Text Books:

1. 'Cryptography and Network Security', William Stallings, 4/E Publisher: Prentice Hall.

Reference Books:

1. 'Network Security: Private Communication in a Public World', Charlie Kaufman, Radia Perlman Mike Speciner, Publisher: Prentice Hall 2/E.
2. 'Cryptography and Network Security', Atul Kahate, Publisher TATA McGraw- Hill Publishing Co Edition 2003.
3. 'Fundamentals of Network Security', Eric Maiwald, Publisher TATA McGraw-Hill Publishing Co 2003.

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Course Code : 11CSE32
Course Title : Cloud Computing
Course Structure : 4 – 0 - 0

SYLLABUS:

UNIT-I

CLOUD COMPUTING BASICS: Overview, Applications, Intranet and the Cloud, First Movers on the cloud, the need for Cloud Computing, Benefits of cloud Computing, Limitations of the Cloud Computing, security concerns and regulatory issues, over view of different cloud computing applications which are implemented, Business case for implementing a Cloud.

INTRODUCTION TO CLOUD COMPUTING(Book-2): What and what is not cloud computing, Moving from collaboration to cloud, Cloud Architectures, cloud storage, cloud Services, reasons for cloud computing, pros and cons of cloud computing, benefits of cloud computing, users of cloud computing.

UNIT-II

CLOUD COMPUTING TECHNOLOGIES: Hardware and Infrastructure: Clients, Security, Network, services.

ACCESSING THE CLOUDS: Platforms, WEB applications, WEB APIS, WB Browsers.

CLOUD STORAGE: Overview, Storage provides.

CLOUD STANDARDS: Applications, Client, Infrastructure, Services.

UNIT-III

CLOUD COMPUTING MECHANISMS: Software as a service: Overview, Driving Forces, Company offerings, Industries, Software + services: Overview, Mobile Device Integration, Providers, Microsoft Online.

APPLICATION DEVELOPMENT: Google, Microsoft, Intuit Quick base, Cast Iron Cloud, Bungee. Connect.

DEVELOPMENT PLATFORMS: Google, Sales Force, Azure, Trouble shooting, Application management.

UNIT-IV

LOCAL CLOUDS: Virtualization, server solutions, Thin Clients.

MIGRATING TO THE CLOUDS: Cloud services for individuals, Mid-market, and Enterprise wide, Migration, best practices, analyzing the service.

UNIT V

USING CLOUD SERVICES: Collaborating on Calendars, Schedules, and Task Management, Collaborating on Event management, Collaborating on Contact management, collaborating on Project Management, Collaborating on Word Processing, Collaborating on Spread sheets, Collaborating on Databases, Collaborating on presentations, Storing and sharing Files and other online content, sharing Digital Photographs, controlling the collaborations with Web-Based Desktops.

ONLINE COLLABORATIONS: Collaborating Via WEB based communication Tools, Collaborating Via Social Networks and Groupware, collaborating Via Blogs and Wikis.

Text Books:

1. Cloud Computing a Practical approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, Tata McGraw-HILL, 2010 Edition.
2. Cloud Computing-Web Based applications that change the way you work and collaborate online, Michael Miller, Pearson Education, 2009 Edition.

Reference Books:

1. Cloud Computing ,Antonopoulos, Nick; Gillam, Lee,Springer 2010.

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M. TECH (CNS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF CNS (Y12)				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	11CN501	DATA STRUCTURES AND ALGORITHMS	3-1-2	5
2	11CN502	ADVANCED COMPUTER NETWORKS	3-1-0	4
3	11CN503	TCP / IP PROTOCOLS	3-1-2	5
4	11CN504	ADHOC NETWORKS	3-1-0	4
5	11CNE12	WIRELESS COMMUNICATION & NETWORKS	3-0-0	3
6	11CNE24	CLOUD COMPUTING	3-0-0	3
7	11CN505	SEMINAR	0-0-4	2
8				26
Semester -2				
1	11CN506	CRYPTOGRAPHY AND NETWORK SECURITY	3-1-0	4
2	11CN507	NETWORK PROGRAMMING	3-0-2	4
3	11CN508	NETWORK ROUTING	3-1-0	4
4	11CN509	SECURE SYSTEMS DEVELOPMENT WITH UML	3-1-2	5
5	11CNE32	NETWORK MANAGEMENT	3-0-0	3
6	11CNE41	MOBILE COMPUTING	3-0-0	3
7	11CN510	TERM PAPER	0-0-4	2
8				25
Semester -3 & 4				
1	11 CS 601	THESIS/PROJECT		36

Course Code : 11CS501

Course Title : Data Structures and Algorithms

Course Structure : 3 – 1 - 2

SYLLABUS:

UNIT-I

INTRODUCTION: Algorithms, algorithms as a technology, Analyzing algorithms , Designing algorithms, Asymptotic notations, standard notations, common functions, Recurrences – substitution method, master method.

SORTING AND ORDER STATISTICS: Merge sort, Quick sort, Heap sort, sorting in linear time, Median and order statistics.

UNIT-II

DATA STRUCTURES: Elementary Data Structures – Linked lists, Stacks, Queues, Hash Tables – Direct address tables, Hash tables, Hash functions, Open addressing, Search Trees – Binary search trees, Red-Black Trees.

ADVANCED DATA STRUCTURES: B – Trees, Binomial Heaps, Fibonacci Heaps, Data Structures for Disjoint Sets.

UNIT-III

GRAPH ALGORITHMS: Elementary graph algorithms – Representation of graphs, BFS, DFS, Topological Sort, Strongly connected components, Minimum Spanning Trees – The algorithms of Kruskal and Prim's. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single source shortest paths in DAG's, Dijkstra's algorithm, All-Pair Shortest paths – Shortest paths and Matrix multiplication, Floyd-Warshall algorithm. Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum Bipartite matching.

UNIT-IV

ADVANCED DESIGN AND ANALYSIS TECHNIQUES: Greedy Algorithms – An activity – selection Problem, Elements of greedy strategy, Huffman codes. Dynamic Programming: Matrix Chain multiplication, Elements of dynamic programming, Optimal Binary Search Trees.

UNIT-V

STRING MATCHING: The naïve string matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm.

NP-COMPLETENESS: Polynomial time, Verification, NP-Completeness and reducibility, NP-Completeness proofs, NP-Complete problems.

Text Books:

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein,PHI Pvt.Ltd./ Pearson Education.

Reference Books:

1. Algorithm Design: Foundations,Analysis and Internet examples, M.T.Goodrich and R.Tomassia,John wiley and sons.
2. Fundamentals of Computer Algorithms,Ellis Horowitz,Satraj Sahni and S.Rajasekharam,Galgotia publications pvt. Ltd.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.
5. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

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Course Code : **11 CN 502**

Course Title : **Advanced Computer Networks**

Course Structure : **3 – 1 - 0**

SYLLABUS:

UNIT–I

INTERNETWORKING: Introduction, History and Context, Packet switching. Internetworking: Architectural Principles, Names, Addresses. Interdomain Routing.

UNIT–II

RESOURCE MANAGEMENT: End-to-End Congestion Control , Fair Queuing –WFQ,CSFQ, Router congestion control –RED,XCP. Quality of Service – Future requirements and IntServ, Router Design.

UNIT–III

WIRELESS NETWORKS: Wireless Networks Overview and Architectures (MACAW, WTCP), Wireless Networks in the Real World - roofnet, Routing in ad-hoc Networks, Sensor networks, topology.

UNIT-IV

APPLICATIONS, NAMING, AND OVERLAYS: Overlay Networks, Distributed Hash Tables, DNS and the Web, Names, Identifiers, and Network architecture.

UNIT–V

MEASUREMENT and Tracing, Internet Measurement, X Trace, Data-oriented networking and DTNs, Multicast, Datacenter Networking.

Text Books:

1. Computer Networks: A Systems Approach, 4th Ed. (2007), by Larry Peterson and Bruce Davie.
2. Computer Networks, Fourth Edition, A. Tanenbaum, Prentice-Hall, 2002.

Reference Books:

1. Computer Networking: A Top-Down Approach Featuring the Internet, 4th Ed. (2007), by James F. Kurose and Keith W. Ross.
2. TCP/IP Illustrated, Volume 1: The Protocols by W. Richard Stevens.
3. Unix Network Programming: Networking APIs: Sockets and XTI (Volume 1) by W. Richard Stevens.
4. Advanced Programming in the Unix Environment by W. Richard Stevens, Addison-Wesley, 1993.
5. Computer Networks and Internets with Internet Applications, Third Edition, D.E. Comer,Prentice-Hall, 2001.
6. Communication Networks, Fundamental Concepts and Key Architecture, A. Leon-Garcia and I. Wadjaja, McGraw-Hill, 2000.

7. Data and Computer Communications, Sixth Edition, W.S. Stallings, Prentice-Hall, 1999.
8. Data Communications, Computer Networks and Open Systems, Fourth Edition, F. Halsall, Addison-Wesley, 1995.
9. Data Networks, Second Edition, D. Bertsekas and R. Gallager, Prentice-Hall, 1992.

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Course Code : 11CN503
Course Title : TCP IP Protocols
Course Structure : 3 – 1 - 2

SYLLABUS:

UNIT I

INTRODUCTION TO INTERNETWORKING: Internetworking Concepts – Architectural model(TCP/IP-OSI) – Routing – Internet Addressing – Multicast Address Resolution Protocol (ARP) – Reverse Address Resolutions Protocol (RARP) –BOOTP – DHCP. Fragmentation and Reassembling – Error Processing (ICMP) – Multicast Processing (IGMP).

UNIT II

INTERNET PROTOCOL: IPv-4, IPV6 Protocol – Addressing, IP Security Protocol, Routing Algorithms – RIP, OSPF.

UNIT III

TCP/IP 1: BGP, and MPLS-MPLS fundamentals, signaling protocol, LDP, traffic engineering. In MPLS, Transport Layer – TCP, UDP, SCTP and RTP.

UNIT IV

TCP/IP 2: Data Structures Input Processing – Output Processing – Timer Management – Flow Control and Adaptive Retransmission – Urgent Data Processing.

UNIT V

SERVICE MANAGEMENT: Differentiated Services, Integrated Services, RSVP, Traffic Engineering – ECMP, OSPF-TE, IS-IS – TE Dynamic TE.

Text Books:

1. Adrian Farrel, "The Internet and Its Protocols – A Comparative Approach" Morgan Kaufmann, April 2004.
2. Douglas E Comer "Internetworking with TCP/IP principles protocol and architectures", 4th edition Volume 2, Prentice Hall, 2000.

Reference Books:

1. Pete Loshin "IPV6 Theory, Protocol and Practice, 2nd Edition", Morgan Kaufmann. December 2003.
2. W.Richard Stevens "TCP/IP Illustrated, the Protocols. Volume I", Pearson Education India 2003.
3. Comer D.E & Stevens D.L. "Internetworking TCP/IP – Volume III", Prentice Hall of India 1997.

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Course Code : 11CN504

Course Title : ADHOC Networks

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

AD HOC NETWORK: Introduction & definition, applications, Design challenges, evaluating ad hoc Network protocols.Collision avoidance protocols: performance of collision avoidance protocols, Frame work &mechanisms for fair access in ieee802.11.

UNIT II

ROUTING IN MOBILE AD HOC NETWORKS: Flooding, Proactive routing, On-demand routing, Proactive vs on-demand, Location based routing.Multicasting in ad hoc network: Classification of protocols, Multicasting protocols, broadcasting, Protocol comparisons, and Overarching issues.

UNIT III

TRANSPORT LAYER PROTOCOL IN AD HOC NETWORKS: Tcp &ad hoc networks
Tcp &ad hoc networks, Transport layer for adhoc networks, Modified TCP,TCP-aware cross-layered solutions, Ad-hoc transport protocol. Energy conservation: energy consumption in adhoc networks, Communication-time energy conservation, Idle-time energy conservation.

UNIT IV

USE OF SMART ANTENNAS: Smart antenna basics, Models, Medium access control with directional antennas, Medium access control with directional antennas, Medium access control with directional antennas, Medium access control with directional antennas, Routing with directional antennas, Broadcast with directional antennas, Broadcast with directional antennas.

UNIT V

QOS ISSUES IN AD HOC NETWORKS: Physical layer, Medium access layer, QoS Routing, QoS at other networking layer, Inter-layer design approaches,Security in mobile ad hoc network: Security, Potential attacks, Attack prevention techniques, Intrusion detection techniques.

Text Books:

1. Ad hoc Networks technologies & protocols, prasant mohapatra and srikanth Krishnamurthy.

Reference Books:

1. Adhoc networks, charless E.perkin, person education.
2. William Stallings “Wireless communication and networking” (Pearson Education/ PHI).
3. Vijay K. Garg “Wireless communication and networking” Morgan Kaufmann Publishers 2007.
4. Andrea GoldSmith “Wireless Communication” Cambridge Press.
5. Anurag Kumar, D. Manjunath and Joy Kuri “Wireless Networking”, Morgan Kaufmann Publishers.

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Course Code : 11CNE12

Course Title : Wireless Communication and Networks

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT I

INTRODUCTION, TRANSMISSION FUNDAMENTALS: signals for conveying information, analog and digital data transmission, channel capacity, transmission media, multiplexing.

ANTENNAS AND WAVE PROPAGATION: antennas, propagation modes, line-of-sight transmission, fading in the mobile environment.

MODULATION TECHNIQUES: signal encoding criteria, digital data, analog signals, analog data, analog signals, analog data, digital signals, spread spectrum modulation, frequency hopping spread spectrum, code division multiple access.

COMMUNICATION NETWORKS: LANs, MANs, and WANs, switching techniques, circuit switching, packet switching, asynchronous transfer mode.

UNIT II

WIRELESS NETWORKS PROTOCOLS AND THE TCP/IP : suite- the need for protocol architecture, the TCP/IP protocol architecture, the OSI model, internetworking.

CELLULAR WIRELESS NETWORKS: principles of wireless networks, first generation analog, second-generation TDMA, CDMA, third-generation systems.

UNIT III

WIRELESS LINK IMPROVEMENT TECHNIQUES: equalization, diversity, error detection, block error correction codes, convolutional codes, automatic repeat request.

MULTIPLE ACCESS IN WIRELESS SYSTEM: multiple access scheme, frequency, time, code, space division multiple access, packet radio access.

SATELLITE COMMUNICATIONS: satellite parameters and configurations, capacity allocation-frequency division, time division.

UNIT IV

WIRELESS SYSTEM OPERATIONS AND STANDARDS: cordless systems, wireless local loop, WiMAX and IEEE 802.16 broadband wireless access standards.

MOBILE IP AND WIRELESS APPLICATION PROTOCOL: mobile IP, wireless application protocol.

WIRELESS LAN TECHNOLOGY: overview, infrared LANs, spread spectrum LANs, narrowband microwave LANs.

UNIT V

WI-FI AND THE IEEE 802.11 WIRELESS LAN STANDARD: IEEE 802 architecture, IEEE 802.11 architecture and services, IEEE 802.11 medium access control, IEEE 802.11 physical layer, other IEEE 802.11 standards, Wi-Fi protected access.

BLUETOOTH AND IEEE 802.15.500: overview, radio specification, baseband specification, link manager specification, logical link control and adaptation protocol, IEEE 802.15,538.

Text Books:

1. William Stallings "Wireless communication and networking" (Pearson Education/ PHI).
2. Vijay K. Garg "Wireless communication and networking" Morgan Kaufmann Publishers 2007.

Reference Books:

1. Andrea GoldSmith "Wireless Communication" Cambridge Press.
2. Anurag Kumar, D. Manjunath and Joy Kuri "Wireless Networking" , Morgan Kaufmann Publishers.

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Course Code : 11CNE24
Course Title : Cloud Computing
Course Structure : 3 – 0 - 0
SYLLABUS:
UNIT I

CLOUD COMPUTING BASICS: Overview, Applications, Intranet and the Cloud, First Movers on the cloud, the need for Cloud Computing, Benefits of cloud Computing, Limitations of the Cloud Computing, security concerns and regulatory issues, over view of different cloud computing applications which are implemented, Business case for implementing a Cloud.

INTRODUCTION TO CLOUD COMPUTING(BOOK-2): What and what is not cloud computing, Moving from collaboration to cloud, Cloud Architectures, cloud storage, cloud Services, reasons for cloud computing, pros and cons of cloud computing, benefits of cloud computing, users of cloud computing.

UNIT-II

CLOUD COMPUTING TECHNOLOGIES: Hardware and Infrastructure: Clients, Security, Network, services.

ACCESSING THE CLOUDS: Platforms, WEB applications, WEB APIS, WB Browsers. **CLOUD STORAGE:** Overview, Storage provides.

CLOUD STANDARDS: Applications, Client, Infrastructure, Services.

UNIT-III

CLOUD COMPUTING MECHANISMS: Software as a service: Overview, Driving Forces, Company offerings, Industries, Software + services: Overview, Mobile Device Integration, Providers, Microsoft Online.

APPLICATION DEVELOPMENT: Google, Microsoft, Intuit Quick base, Cast Iron Cloud, Bungee Connect.

DEVELOPMENT PLATFORMS: Google, Sales Force, Azure, Trouble shooting, Application management.

UNIT-IV

LOCAL CLOUDS: Virtualization, server solutions, Thin Clients.

MIGRATING TO THE CLOUDS: Cloud services for individuals, Mid-market, and Enterprise wide, Migration, best practices, analyzing the service.

UNIT-V

USING CLOUD SERVICES: Collaborating on Calendars, Schedules, and Task Management, Collaborating on Event management, Collaborating on Contact management, collaborating on Project Management, Collaborating on Word Processing, Collaborating on Spread sheets, Collaborating on Databases, Collaborating on presentations, Storing and sharing Files and other online content, sharing Digital Photographs, controlling the collaborations with Web-Based Desktops.

ONLINE COLLABORATIONS: Collaborating Via WEB based communication Tools, Collaborating Via Social Networks and Groupware, collaborating Via Blogs and Wikis.

Text Books:

1. Cloud Computing a practical approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter , Tata McGraw-HILL,2010 Edition.

2. Cloud Computing-web Based application that change the way you work and collaborate online, Michael Miller, Pearson Eduction,2009 Edition.

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Course Code : 11CN506
Course Title : Cryptography and Network Security
Course Structure : 3-1-0

SYLLABUS:

UNIT I

BASIC CRYPTOGRAPHIC TECHNIQUES

ENCRYPTION - SYMMETRIC TECHNIQUES: Substitution Ciphers, Transposition Ciphers, Classical Ciphers: Usefulness and Security, The Data Encryption Standard (DES), The Advanced Encryption Standard (AES), Confidentiality Modes of Operation, Key Channel Establishment for Symmetric Cryptosystems.

ENCRYPTION - ASYMMETRIC TECHNIQUES: Insecurity of "Textbook Encryption Algorithms", The Diffie-Hellman Key Exchange Protocol, The Diffie-Hellman Problem and the Discrete Logarithm Problem**,** The RSA Cryptosystem (Textbook Version)**,** Cryptanalysis Against Public-key Cryptosystems**,** The RSA Problem**,** The Integer Factorization Problem**,** Insecurity of the Textbook RSA Encryption**,** The Rabin Cryptosystem (Textbook Version)**,** Insecurity of the Textbook Rabin Encryption**,** The ElGamal Cryptosystem (Textbook Version)**,** Insecurity of the Textbook ElGamal Encryption**,** Need for Stronger Security Notions for Public-key Cryptosystems, Combination of Asymmetric and Symmetric Cryptography, Key Channel Establishment for Public-key Cryptosystems.

UNIT II

AUTHENTICATION PROTOCOLS - PRINCIPLES: Authentication and Refined Notions**,** Convention**,** Basic Authentication Techniques**,** Password-based Authentication**,** Authenticated Key Exchange Based on Asymmetric Cryptography**,** Typical Attacks on Authentication Protocols.

HASH AND MESSAGE DIGESTS: MD5, SHA1, HMAC.

AUTHENTICATION FRAMEWORK FOR PUBLIC-KEY CRYPTOGRAPHY: Directory-Based Authentication, Non-Directory Based Public-key Authentication Framework.

UNIT III

FORMAL APPROACHES TO SECURITY ESTABLISHMENT

FORMAL AND STRONG SECURITY DEFINITIONS FOR PUBLIC-KEY CRYPTOSYSTEMS: Introduction, A Formal Treatment for Security, Semantic Security — the Debut of Provable Security, Inadequacy of Semantic Security, Beyond Semantic Security.

PROVABLY SECURE AND EFFICIENT PUBLIC-KEY CRYPTOSYSTEMS: Introduction, The Optimal Asymmetric Encryption Padding, The Cramer-Shoup Public-key Cryptosystem, An Overview of Provably Secure Hybrid Cryptosystems.

UNIT IV

FORMAL METHODS FOR AUTHENTICATION PROTOCOLS ANALYSIS: Toward Formal Specification of Authentication Protocols, A Computational View of Correct Protocols — the Bellare-Rogaway Model, A Symbolic Manipulation View of Correct Protocols, Formal Analysis Techniques: State System Exploration, Reconciling Two Views of Formal Techniques for Security.

ZERO-KNOWLEDGE PROTOCOLS: Basic Definitions**,** Zero-knowledge Properties Proof or Argument, Protocols with Two-sided-error, Round Efficiency, Non-interactive Zero-knowledge.

UNIT V

NETWORK SECURITY STANDARDS: Kerberos V5, PKI, IPsec: AH and ESP, SSL/TLS, PEM & S/MIME, PGP.

Text Books:

1. Modern Cryptography Theory and Practice, Wenbo Mao, Pearson Education 2008.
2. Network Security: Private Communication in a Public World, Charlie Kaufman, Radia Perlman Mike Speciner, Prentice Hall 2/E**.(Hash and Message Digests, Unit V)**

Reference Books:

1. Cryptography and Network Security, William Stallings, 4/E Publisher: Prentice Hall.
2. Information Security Principles & Practice, Mark Stamp, WILEY INDIA 2006.

* * *

Course Code : 11CN507
Course Title : Network Programming
Course Structure : 3 – 0 - 2

SYLLABUS:

UNIT-I

POSIX IPC: IPC Names, Creating and Opening IPC Channels, IPC Permissions.

SYSTEM V IPC: key_t Keys and ftok Function, ipc_perm Structure, Creating and Opening. IPC Channels, IPC Permissions, Identifier Reuse, ipcs and ipcrm Programs, Kernel Limits.

PIPES AND FIFOS: Pipes, Full-Duplex Pipes, popen and pclose Functions, FIFOs. Additional Properties of Pipes and FIFOs, Streams and Messages, Pipe and FIFO Limits.

POSIX MESSAGE QUEUES: mq_open, mq_close, and mq_unlink Functions, mq_getattr and mq_setattr Functions, mq_send and mq_receive Functions, Message Queue Limits.

UNIT-II

SYSTEM V MESSAGE QUEUES: msgget Function, msgsnd Function, msgrcv Function, msgctl Function, Simple Programs, Client-Server Example, Multiplexing Messages, Message Queues with select and poll, Message Queue Limits.

POSIX SEMAPHORES: sem_open, sem_close, and sem_unlink Functions, sem_wait and sem_trywait Functions, sem_post and sem_getvalue Functions, Simple programs.

SYSTEM V SEMAPHORES: semget Function, semop Function, semctl Function, Simple Programs, File Locking, Semaphore Limits.

UNIT-III

SHARED MEMORY INTRODUCTION: mmap, munmap, and msync Functions, Increment Counter in a Memory-Mapped File.

POSIX SHARED MEMORY: shm_open and shm_unlink Functions, ftruncate and fstat Functions, Simple Programs, Incrementing a Shared Counter.

SYSTEM V SHARED MEMORY: SHMGET FUNCTION, SHMAT FUNCTION, SHMDT FUNCTION, SHMCTL Function, Simple Programs, Shared Memory Limits.

DOORS: Introduction, door_call Function, door_create Function, door_return Function, door_cred Function, door_info Function, Examples, Descriptor Passing.

UNIT-IV

SOCKETS INTRODUCTION: Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, inet_aton, inet_addr, and inet_ntoa Functions, inet_pton and inet_ntop Functions, sock_ntop and Related Functions, readn, writen, and readline Functions.

ELEMENTARY TCP SOCKETS: socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions.

TCP CLIENT/SERVER EXAMPLE: TCP Echo Server, TCP Echo Client.

I/O MULTIPLEXING: THE SELECT AND POLL FUNCTIONS: I/O Models, select Function, str_cli Function (with Multiplexing) , Batch Input and Buffering**,** shutdown Function**,** TCP Echo Server (with Multiplexing) , pselect Function, poll Function.

UNIT-V

SOCKET OPTIONS: getsockopt and setsockopt Functions, Checking if an Option Is Supported and Obtaining the Default, Socket States, Generic Socket Options, IPv4 Socket options, CMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options.

ELEMENTARY UDP SOCKETS: recvfrom and sendto Functions, UDP Echo Server, UDP Echo Client.

NAME AND ADDRESS CONVERSIONS: Domain Name System (DNS) , gethostbyname Function, gethostbyaddr Function, getservbyname and getservbyport Functions, getaddrinfo Function, gai_strerror Functionfreeaddrinfo Function, getaddrinfo Function: IPv6, getaddrinfo Function: Examples, host_serv Function, tcp_connect Function, tcp_listen Function, udp_client Function, udp_connect Function, udp_server, Function, getnameinfo Function .

Text Books:

1. UNIX Network Programming, Volume 1: The Sockets Networking API, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Prentice Hall 3/E, 2008 (Chapters 3, 4, 5.1-5.5, 6.1-6.6, 6.8-6.10, 7.1-7.9, 8.1-8.6, 11.1-11.17).

2. UNIX Network Programming, Volume 2: Interprocess Communications, W. Richard Stevens, Prentice Hall 2/E.2007 (Chapters 2, 3, 4, 5.1-5.5, 6, 10.1-10.5, 11, 12.1-12.3, 13.1-13.5, 14, 15.1-15.8).

Reference Books:

1. TCP/IP Illustrated, Volume 2: The Implementation, Gary R. Wright, W. Richard Stevens, Addison Wesley, 2005.
2. Internetworking with TCP/IP Volume : III Client and Server Programming and Applications BSD Socket Versions, Douglas E Comer, David L Stevens, Second edition PHI, 2007.
3. Advanced Programming in the UNIX® Environment, Richard Stevens, Stephen A. Rago, Addison Wesley Professional/ Pearson, Second Edition, 2009.
4. UNIX Systems Programming: Communication, Concurrency, and Threads, Kay A. Robbins, Steven Robbins, Prentice Hall PTR, 2009.

* * *

Course Code : 11CN508
Course Title : Network Routing
Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

NETWORK AND NETWORK ROUTING: AN INTRODUCTION: Addressing and internet service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits.

ROUTING ALGORITHMS: SHORTEST PATH WIDEST PATH: Background, Bellman-Ford Algorithm and Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman-Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, K-Shortest Paths Algorithm.

ROUTING PROTOCOLS: FRAME WORK AND PRINCIPLES: Routing Protocol, Routing Algorithm And Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost.

NETWORK FLOW MODELING: Terminologies, Single-Commodity Network Flow, Multi Commodity Network Flow: Three-Node Example, Multi Commodity Network Flow Problem: General Formulation, Multi Commodity Network Flow Problem: Non-Splittable Flow.

UNIT II

IP ROUTING AND DISTANCE VECTOR PROTOCOL FAMILY: Routers, Networks and Routing Information: Some Basics, Static Routes, Routing Information Protocol Version 1(RIP v1), Routing Information Protocol Version 2 (RIP v2), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution.

OSPF AND INTEGRATED IS-IS: From a Protocol Family To Instance of a Protocol, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF.

IP TRAFFIC ENGINEERING: Traffic, stochasticity, Delay and Utilization, Applications View, Traffic Engineering: An Architectural Framework, Traffic Engineering: A Four-Node Illustration, Link weight Determination Problem: Preliminary Discussion, Duality of the MNCF Problem, Illustration Of Link Weight Determination Through Duality, Link Weight Determination: Large Networks.

UNIT III

BGP: BGP:A brief Overview, BGP: Basic Terminology, BGP Operations, BGP Configuration Initialization, Two Faces of BGP: External BGP and Internal BGP, Path Attributes, BGP Decision Process, Internal BGP Scalability, Route Flap Dampening, BGP Additional Features, Finite State Machine of a BGP Connection, Protocol Message Format.

INTERNET ROUTING ARCHITECTURES: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS

Number, Policy-Based Routing, Point Of Presence, Traffic Engineering Implications, Internet Routing Instabilities.

ROUTER ARCHITECTURES: Functions of a Router, Types of Routers, Elements of a Router, Packet Processing: Fast Path Vs Slow Path, Router Architectures.

UNIT IV

IP ADDRESS LOOKUP ALGORITHMS: Impact of addressing on lookup, Longest Prefix Matching, Naïve Algorithms, Binary Trees, Multibit Trees, Compressing Multibit Trees, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches.

IP PACKET FILTERING AND CLASSIFICATION: Importance of Packet Classification, Packet Classification Algorithms, Naïve Solutions, Two-dimensional Solutions, Approaches for d dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.

UNIT V

QUALITY OF SERVICE ROUTING: Background, QOS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy and Impact on Routing, Lessons from dynamic call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-based QOS Routing with Path Caching, Routing Protocols for QOS Routing.

MPLS AND GMPLS: Background, Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks.

ROUTING AND TRAFFIC ENGINEERING WITH MPLS: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS.

VOIP ROUTING: INTEROPERABILITY THROUGH IP AND PSTN: Background, PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP –PSTN Interworking for VOIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment, All-IP Environment for VOIP Services, Addressing Revisited.

Text Books:

1. Network Routing Algorithms, Protocols, and Architectures Deepankar Medhi, Karthikeyan Ramasamy 2007 by Elsevier Inc.

References Books:

1. Nader F.Mir, ”Computer and Communication Networks”, PHI.
2. Kurose & Ross, “Computer Networks” – A Top-down approach featuring the Internet”, Pearson Education – Alberto Leon – Garciak.
3. Tanenbaum, “Computer Networks”, 4th Edition, (Pearson Education / PHI).

* * *

Course Code : 11 CN 509
Course Title : Secure Systems Development with UML
Course Structure : 3-1-2
SYLLABUS:

UNIT-I

UML OVERVIEW: Use case diagram, Sequence diagram, Collaboration diagram, Class diagram, State Chart diagram, Activity diagram, Component diagram, Deployment diagram, Package Diagram.

UNIT-II

INTRODUCTION: Overview,outline,how to use this book.

WALK THROUGH USING UML FOR SECURITY: security requirements capture with use case diagrams,secure business processes with activity diagrams,physical security using deployment diagrams, security-critical Interaction with sequence diagrams**.**

BACKGROUND: Security Engineering,UML,Analyzing UML Models.

MODEL-BASED SECURITY ENGINEERING WITH UML: UML Security profile,Design principles for secure systems,Applying security patterns.

UNIT-III

APPLICATIONS: Secure channels,A variant of the IP TLS,Common Electronic Purse Specifications,Developing Secure Java Programs,Further Applications.

UNIT-IV

TOOL SUPPORT FOR UML SECURITY: Extending UML CASE Tools with analysis tools,Automated Tools for UML Security,Linking Models to Run time data ,Linking models to code.

A FORMAL FOUNDATION: UML Machines,UML Machine systems, Refinement,Rely-Guarantee Specifications,Reasoning about security properties.

UNIT-V

FORMAL SYSTEMS DEVELOPMENT WITH UML: Formal Semantics for a Fragment of UML,Development with UML.

FURTHER MATERIAL: More on the UML security approach,Other approaches to security Engineering.

Text Books:

1. Secure Systems Development with UML .JAN, JURJENS. SPRINGER 2004.
2. Object Oriented systems development .Ali Bahrami.

Reference Books:

1. R.Heldal and F.Hultin,Bridging model based and language based security.
2. R.Anderson. Security Engineering,A Guide to building dependable distributed systems , john willey & Sons ,Newyork 2001.

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Course Code : 11CNE32
Course Title : Network Management
Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT-I

DATA COMMUNICATIONS AND NETWORK MANAGEMENT OVERVIEW: Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT-II

SNMPV1 NETWORK MANAGEMENT: Organization and Information and Information Models.

MANAGED NETWORK: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

SNMPV1 NETWORK MANAGEMENT: Communication and Functional Models. The SNMP Communication Model, Functional model.

UNIT–III

SNMP MANAGEMENT SNMPV2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

SNMP MANAGEMENT: RMON: What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT–IV

TELECOMMUNICATIONS MANAGEMENT NETWORK: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, implementation Issues.

NETWORK MANAGEMENT TOOLS AND SYSTEMS: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management, and Enterprise Management Solutions.

UNIT–V

WEB-BASED MANAGEMENT: NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network: , Future Directions**.**

Text Books:

1. Network Management, Principles and Practice, Mani Subramanian, Pearson Education.

Reference Books:

1. Network management, Morris, Pearson Education.
2. Principles of Network System Administration, Mark Burges, Wiley Dreamtech.

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Course Code : 11CNE41

Course Title : Mobile Computing

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT – I

MOBILE COMMUNICATIONS: AN OVERVIEW: Mobile communication, Mobile computing, Mobile computing architecture, Mobile Devices, Mobile system Networks, Data dissemination, Mobility management.

MOBILE DEVICES AND SYSTEMS: Mobile phones, Digital music players, Handheld pocket computers, Handheld devices, Smart systems, Limitations of mobile devices, Automotive systems.

UNIT–II

GSM AND SIMILAR ARCHITECTURES: GSM – Services and system architecture, Radio interfaces, Protocols, Localization, Calling, Handover, Security, New data services, General packet radio service, High speed circuit switched data, DECT.

WIRELESS MEDIUM ACCESS CONTROL AND CDMA-BASED COMMUNICATION: Medium access control, Introduction to CDMA- based systems, Spread spectrum in CDMA systems, Coding methods in CDMA, IMT-2000, i-mode, OFDM.

UNIT-III

MOBILE IP NETWORK LAYER: IP and mobile IP network layers, Packet delivery and handover Management, Location management, Registration, Tunneling and encapsulation, Route optimization,Dynamichostconfigurationprotocol.

MOBILE TRANSPORT LAYER: Conventional TCP/ IP transport layer protocol, Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP-layer transmission for mobile networks, TCPover2.5G/3Gmobilenetworks.

DATABASES: Database hoarding techniques, Data caching, Client-Server computing and Adaptation, Transactional models, Query processing, Data recovery process, Issues relating to Quality of service.

UNIT-IV

DATA DISSEMINATION AND BROADCASTING SYSTEMS: Communication asymmetry, Classification of data-delivery mechanisms, Data dissemination broadcast models, Selective tuning and indexing techniques, Digital audio broadcast models, Selective tuning and indexing techniques, Digital audio broadcasting, Digital video broadcasting.

DATA SYNCHRONIZATION IN MOBILE COMPUTING SYSTEMS: Synchronization, Synchronization software for model devices, Synchronization protocols, SyncML-Synchronization language for mobile computing, Sync4J, Synchronized multimedia markuplanguage.

MOBILE DEVICES: SERVER AND MANAGEMENT: Mobile agent, Application server, Gateways, Protocol, Service discovery, Device management, Mobile file systems, Security. **MOBILE AD-HOC AND SENSOR NETWORKS:** Introduction to Mobile Ad-hoc Networks, MANET, Wireless sensor networks.

UNIT–V

WIRELESS LAN, MOBILE INTERNET CONNECTIVITY, AND PERSONAL AREA NETWORK: Wireless LAN architecture and protocol, WAP 1.1 and WAP 2.0 architecture, XHTML-MP, Bluetooth-enabled devices network, Layers in Bluetooth protocol, Security in Bluetooth protocol,IrDA,ZigBee.

MOBILE APPLICATION LANGUAGESXML, JAVA, J2ME, AND JAVACARD: Introduction , XML, JAVA,Java2microedition,JavaCard.

MOBILE OPERATING SYSTEMS: Operating system, palmOS, Windows CE, Symbian OS, Linux for mobile devices.

Text Books:

2. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, 2007.

References Books:

3. Jochen H. Schller, "Mobile Communications", second edition, Pearson Education, New Delhi, 2007.
4. Jon W. Mark, Weihua Zhuang, "Wireless Communications and Networking", Prentice Hall, New Delhi, 2007.

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M. Tech (CRS)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

MASTER OF TECHNOLGY 2012-13 A.Y

ELECTRONICS AND COMMUNICATION ENGINEERING

COMMUNICATION AND RADAR SYSTEMS

S.NO	COURSE CODE	COURSE TITLE	L-T-P	CREDITS
	SEMESTER1			
1	12EC501	MODERN DIGITAL COMMUNICATION	3-1-2	5
2	12EC502	RADIATION SYSTEM	3-1-0	4
3	12EC503	MICROWAVE AND MILLIMETERWAVE CIRCUITS	3-1-2	5
4	12EC520	IMAGE AND VIDEO PROCESSING	3-1-0	4
5		ELECTIVE1	3-0-0	3
6		ELECTIVE2	3-0-0	3
7	KLU C503	SEMINAR	0-0-4	2
				26

S.NO	COURSE CODE	COURSE TITLE	L-T-P	CREDITS
	SEMESTER2			
1	12EC521	ADVANCED DIGITAL SIGNAL PROCESSING	3-1-2	5
2	12EC522	RADAR SIGNAL PROCESSING	3-1-0	4
3	12EC504	WIRELESS CELLULAR COMMUNICATION	3-1-0	4
4	12EC566	CMOS RF CIRCUIT DESIGN	3-1-0	4
5		ELECTIVE3	3-0-0	3
6		ELECTIVE4	3-0-0	3
7	KLU C501	TERMPAPER	0-0-4	2
				25

S.NO	COURSE CODE	COURSE TITLE	L-T-P	CREDITS
	SEMESTER3&4			
1		THESIS	0-0-36	36
		TOTAL CREDITS		87

		ELECTIVES 1 SEM		
1	12EC530	ADAPTIVE SIGNAL PROCESSING	3-0-0	3
2	12EC559	VLSI SIGNAL PROCESSING	3-0-0	3
3	12EC223	ARRAY SIGNAL PROCESSING	3-0-0	3
4	12EC526	BIOMEDICAL SIGNAL PROCESSING	3-0-0	3
5	12EC534	OPTICAL SIGNAL PROCESSING	3-0-0	3
6	12EC525	WIRELESS COMMUNICATION SIGNAL PROCESSING	3-0-0	3
7	12EC524	SPEECH PROCESSING	3-0-0	3
8	12EC580	BROAD BAND ACCESS TECHNOLOGIES	3-0-0	3
9	12EC582	OPTICAL NETWORKS	3-0-0	3
			3-0-0	3
		ELECTIVE 2 SEM	3-0-0	3
1	12EC506	ESTIMATION AND DETECTION THEORY	3-0-0	3
2	12EC583	WIRELESS SENSOR NETWORKS	3-0-0	3
3	12EC507	RF SYSTEM DESIGN	3-0-0	3
4	12EC581	HIGH PERFORMANCE COMMUNICATION NETWORKS	3-0-0	3

L	T	P	C
3	1	2	5

COURSE CODE: 12EC501

MODERN DIGITAL COMMUNICATION

Syllabus:

Modern Digital Modulation Techniques:

Introduction, Information Capacity, Bits, Bit Rate, Baud rate & M-ary Encoding, ASK, FSK, PSK QAM Bandwidth Efficiency Carrier Recovery, Clock Recovery, DPSK, Trellis Code Modulation, Probability of Error & Bit Error Rate, Error Performance.

Baseband Data Transmission:

Introduction – Baseband Binary PAM Systems – Baseband Pulse Shaping, Optimum Transmitting and Receiving Filters – Duobinary Baseband PAM System – Use of Controlled ISI in Duobinary Signaling Schemes, Transmitting and Receiving Filters for Optimum Performance.

M-ary Signaling Schemes

Analysis and Design of M-ary Signaling Schemes, Binary Versus M-ary Signaling Schemes - Shaping of the Transmitted Signal Spectrum – Effect of Pre coding on the Spectrum, Pulse Shaping by Digital Methods - Equalization - Transversal Equalizer, Automatic Equalizers

Block and Convolutional Channel Codes: Linear Block Codes - The Generator Matrix and Parity Check Matrix, Cyclic Codes, Bounds on Minimum Distance of Linear Block Codes, Non Binary Block Codes – Convolutional Codes – Transfer Function of a Convolutional Code, Optimum Decoding of Convolutional Code –Distance Properties of Binary Convolutional Codes

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System – Direct Sequence Spread Spectrum Signals – Error Rate Performance of the Decoder, Some Applications of DS Spread Spectrum Signals, Generation of PN Sequences – Frequency Hopped Spread Spectrum Signals – Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum

Signals Emerging Digital Communication Technologies: The North American Hierarchy, Digital Services, Broad band Digital Communication: SONET, Digital Switching Technologies, Broadband Services for Entertainment and Home office Applications, Video Compression, High Definition Television(HDTV)

Text Books

1. Advanced Electronic Communications Systems, by Wayne Tomasi, 6 Edition Pearson Education.
2. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and sons (Asia) Pvt Ltd.

References

1. Simon Haykin, Digital communications, John Wiley and sons, 1998
2. Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson Education Asia, 1998
3. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press
4. Ravindranathan" Communication Systems Modeling Using Matlab & Simulink" Universities Press

COURSE CODE: 12EC502

L	T	P	C
3	1	0	4

RADIATION SYSTEMS

Syllabus

Basics Concepts of Radiation
Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer

Radiation from Apertures
Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas

Synthesis of Array Antennas
Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques

Micro Strip Antennas
Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Microstrip dipole, Microstrip arrays

EMI/EMC/Antenna Measurements:
Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarization measurement, Antenna range, Design and Evaluation

Text Books
1. Kraus.J.D.,"Antennas"II Edition, John wiley and Sons.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982

References
1. RF System Design**,** Peter Kinget Bell Laboratories, Lucent Technologies Murray Hill,
2. Practical RF system design, Wiley-IEEE, 2003 - Technology & Engineering

COURSE CODE: 12EC503

L	T	P	C
3	1	2	5

MICROWAVE AND MILLIMETER WAVE CIRCUITS

Syllabus

Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering

Transformers & Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.

Filters And Periodic Structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures

Obstacles In Wave Guides: Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures

Millimeter Wave Circuits: Wave Propagation in microstriplines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits

Text Books

1.Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mc graw-hill
2.Robert E Collin, "Foundation For Microwave Engineering", Mc Graw-Hill.

Reference Books

1.Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures by Cam Nguyun

COURSE CODE: 12EC520

IMAGE AND VIDEO PROCESSING

Syllabus

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms

Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation

Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations

2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

Text Books

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI

Reference Text Book

1. M. Tekalp ,"Digital video Processing", Prentice Hall International

Simulation Text Books

1. Relf, Christopher G.,"Image acquisition and processing with LabVIEW", CRC press
2. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons
3. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons

L	T	P	C
3	0	0	3

COURSE CODE: 12EC530

ADAPTIVE SIGNAL PROCESSING

Syllabus

Complex-Valued Adaptive Signal Processing: Optimization in the Complex Domain, Widely Linear Adaptive Filtering, Nonlinear Adaptive Filtering with Multilayer Perceptrons, Complex Independent Component Analysis

Robust Estimation Techniques for Complex-Valued Random Vectors: Statistical Characterization of Complex Random Vectors, Complex Elliptically Symmetric (CES) Distributions, Tools to Compare Estimators, Scatter and Pseudo-Scatter Matrices Array Processing Examples, MVDR Beamformers Based on M-Estimators

Turbo Equalization: Communication Chain, Turbo Decoder: Overview, Forward-Backward Algorithm, Simplified Algorithm: Interference Canceler, Capacity Analysis, Blind Turbo Equalization, Convergence, Multichannel and Multiuser Settings

Subspace Tracking for Signal Processing: Linear Algebra Review, Observation Model and Problem Statement, Preliminary Example: Oja's Neuron, Subspace Tracking,, Eigenvectors Tracking, Convergence and Performance Analysis Issues

Particle Filtering: The Basic Idea, The Choice of Proposal Distribution and Resampling, Some Particle Filtering Methods, Handling Constant Parameters, Rao–Blackwellization, Prediction, Smoothing,

Text Books

1. Tu¨lay Adalı ,Simon Haykin," Adaptive Signal Processing", John Wiley & Sons

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COURSE CODE: 12EC559

VLSI SIGNAL PROCESSING

Syllabus

Introduction to DSP Systems: Introduction, representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph.

Iteration Bound: Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs.

Pipelining and Parallel Processing: Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving.

Retiming, Unfolding and Folding: retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodogy.

Fast Convolution, Filters and Transforms: Cook-toom algorithm, modified cook-toom algorithm, winogard algorithm, iterated convolution Algorithm strength reduction in filters and transforms.

Text Book

1.Keshab k. Parhi," VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, inter science.

Reference Books

1.S.Y.kung, H.J.White house, T. Kailath," VLSI and Modern Signal Processing", Prentice hall

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COURSE CODE: 12EC523

ARRAY SIGNAL PROCESSING

Syllabus

Spatial Signals, Signals in space and time. Spatial frequency, Direction vs. frequency. Wave fields. Far field and near field signals.

Sensor Arrays, Spatial sampling, Nyquist criterion. Sensor arrays. Uniform linear arrays, planar and random arrays. Array transfer (steering) vector. Array steering vector for ULA. Broadband arrays.

Spatial Frequency, Aliasing in spatial frequency domain. Spatial Frequency Transform, Spatial spectrum. Spatial Domain Filtering. Beam Forming. Spatially white signal.

Direction of Arrival Estimation, Non parametric methods - Beam forming and Capon methods. Resolution of Beam forming method. Subspace methods - MUSIC, Minimum Norm and ESPRIT techniques. Spatial Smoothing.

Text Books

1. Dan E. Dugeon and Don H. Johnson.," Array Signal Processing: Concepts and Techniques. Prentice Hall.
2. Petre Stoica and Randolph L. Moses. "Spectral Analysis of Signals. Prentice Hall.

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COURSE CODE: 12EC526

BIOMEDICAL SIGNAL PROCESSING

Syllabus

Introduction To Biomedical Signals - Examples of Biomedical signals - ECG, EEG, EMG etc - Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random & Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments

Concurrent, Coupled and Correlated Processes - illustration with case studies – Adaptive and optimal filtering - Modelling of Biomedical signals - Detection of biomedical signals in noise - removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Muscle-contraction interference. Event detection - case studies with ECG & EEG - Independent component Analysis - Cocktail party problem applied to EEG signals - Classification of biomedical signals.

Cardio Vascular Applications : Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multiscale analysis for ECG parameters estimation - Noise & Artifacts- ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection - Arrhythmia analysis

Data Compression: Lossless & Lossy- Heart Rate Variability – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals.

Neurological Applications: The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modelling EEG- linear, stochastic models – Non linear modelling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels.

Text Books

1. D.C.Reddy, “Biomedical Signal Processing: Principles and techniques” ,Tata McGraw Hill, New Delhi, 2005
2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall, 1993

References Books

1. R. Rangayan, “Biomedical Signal Analysis”, Wiley 2002.
2. Bruce, “Biomedical Signal Processing & Signal Modelling,” Wiley, 2001
3. Sörnmo, “Bioelectrical Signal Processing in Cardiac & Neurological Applications”, Elsevier
4. Semmlow, “Bio-signal and Biomedical Image Processing”, Marcel Dekker
5. Enderle, “Introduction to Biomedical Engineering,” 2/e, Elsevier, 2005

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COURSE CODE: 12EC534

OPTICAL SIGNAL PROCESSING

Syllabus

Basics of signal processing and optics, Characterization of a General signal, examples of signals, Spatial signal. Basic laws of geometrical optics, Refractions by mirrors, the lens formulas, General Imaging conditions, the optical invariant, Optical Aberrations.

Physical Optics, The Fresnel Transforms, the Fourier transform, Examples of Fourier transforms, the inverse Fourier transform, Extended Fourier transform analysis, Maximum information capacity and optimum packing density, System coherence.

Spectrum Analysis and Spatial Filtering, Light sources, spatial light modulators, and the detection process in Fourier domain, System performance parameters, and Dynamic range. Some fundamentals of signal processing, Spatial Filters

Binary Spatial Filters, Magnitude Spatial Filters, Phase Spatial Filters, Real valued Spatial Filters, Interferometric techniques for constructing Spatial Filters. Optical signal processor and filter generator, Applications for optical signal processing.

Acousto-optic cell spatial light modulators, Applications of acousto-optic devices. Basic Acousto-optic power spectrum analyser. Heterodyne systems: Interference between two waves, the optical Radio.

Text Books

1. Anthony Vanderlugt ,"Optical signal processing" ,Wiley-Interscience
2. Hiroshi Ishikawa ,"Ultrafast All-Optical Signal Processing Devices",Wiley

References

1. D. Casasent, "Optical data processing-Applications", Springer-Verlag, Berlin,
2. H.J. Caulfield, "Handbook of holography", Academic Press New York 1979
3. P.M. Dufffieux, "The Fourier Transform and its applications to Optics", John Wiley and sons
4. J. Horner ,"Optical Signal Processing ",Academic Press 1988
5. Joseph W. Goodman," Introduction to Fourier Optics", second edition Mc Graw Hill.
6. Francis T. S. Yu, Suganda Jutamulia, "Optical Signal Processing, Computing, and Neural Networks", Krieger Publishing Company; 2nd edition

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COURSE CODE: 12EC525

WIRELESS COMMUNICATION SIGNAL PROCESSING

Syllabus

Linear Diversity Techniques for Fading Channels System and Fading Channels Models: Transmission with out Diversity, Spectral Diversity, Temporal Diversity, spatial Diversity, Diversity methods for multiuser system

Adaptive Interference Suppression: Multiple Access Signal Model, Elements of multiuser detection, Linear interference suppression, Application to DS-CDMA, Adaptive algorithms

Equalization of Multiuser Channels: Characterization of wireless channels, equalization of known multipath fading, Blind equalization in multipath slowly time varying channel

Blind Space Time Signal Processing : The wireless propagation environment, signal model and structure, channel identification & equalization, Blind techniques

Network Capacity, Power control & effective Bandwidth: Basic spread spectrum model & the MMSE Receiver, performance under random spreading sequences, Capacity and performance under power control, Multiple classes, maximum power constraints, effective Bandwidth

Text Book

1. H V Poor & G W Wornell, ”Wireless Communication Signal Processing Perspectives”, PHI

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COURSE CODE: 12EC524

SPEECH PROCESSING

Syllabus

Basic Concepts: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Text Books

1.Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2.Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.

References

1.Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
2.Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.
3.Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
4.Ben gold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, Wiley- India Edition, 2006 Edition.
5.Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press.

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COURSE CODE: 12EC580

BROAD BAND ACCESS TECHNOLOGIES

Syllabus

Review Of Access Technologies: Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless

Digital Subscriber Lines: Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line (RADSL)-ISDN Digital subscriber line (IDSL) - High bit rate DSL (HDSL)-Single line DSL (SDSL)- very high bit rate DSL (VDSL)- Standards for XDSL & Comparison.

Cable Modem: Cable Modem, DOCSIS – Physical Cabling, Dual Modem Operation, Hub Restriction, Upstream Operation – Downstream operation – Access control – framing Security sub layer – Data link layer – LLC & Higher layers – ATM centric VS IP – centric cable modem.

Fiber Access Technologies: Optical Fiber in access networks, Architecture and Technologies-Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison.

Broad Band Wireless: Fixed Wireless, Direct Broadcast Satellite (DBS), Multi channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS), Mobile Wireless 3G – IMT 2000.

Text Books

1.Niel Ransom and Albert A. Azzam, "Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS, McGraw Hill 1999.
2.Gilbert Held, "Next Generation Modems: A Professional Guide to DSL and cable modems", John Wiley & sons.

Reference Books

1.Walter j Woralski, "ADSL and DSL Technologies", McGraw Hill computer Communication series, 1998.
2.William Webb, "Introduction to Wireless Local Loop broadband and narrow band system", Artech House, 2000.
3.Martin P. Clarke, "Wireless Access Network: Fixed Wireless Access and WLL network Design and operation", John Wiley & Sons 2000.

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COURSE CODE: 12EC582

OPTICAL NETWORKS

Syllabus

Optical System Components And Network Design: Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters; Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations.

Optical Network Architectures: Introduction to Optical Networks; SONET / SDH, Metropoliton-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies, Media-Access Control Protocols and Testbeds; Wavelength Routing Architecture.

Wavelength Routing Networks: WDM Network Elements; WDM Network Design - Cost tradeoffs, Virtual Topology Design, Routing and wavelength assignment, Statistical Dimensioning Models.

Packet Switching And Access Networks: Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Header Processing, Buffering, Burst Switching, Testbeds; Access Networks.

Network Management And Survivability: Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface; network Survivability- Protection in SONET / SDH and IP Networks, Optical layer Protection, Interworking between layers.

Text Books

1.Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2006.

References Books

1.C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks : Concept, Design and Algorithms”, Prentice Hall of India, Ist Edition, 2002.
2.P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.
3.Biswanath Mukherjee, “Optical WDM Networks”, Springer, 2006.

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COURSE CODE: 12EC504

WIRELESS CELLULAR COMMUNICATION

Syllabus

Introduction to Cellular Mobile Systems: Cellular Mobile Telephone Systems, A Basic Cellular System, Operation of Cellular Systems.

Elements of Cellular Mobile Radio System Design: General Description of the problem, Concept of Frequency reuse channels, Co-Channel Interference Reduction Factor, Handoff Mechanism, Cell Splitting.

Speech Coding for Wireless Systems Applications: Introduction to Digital Signal Processing (DSP) Techniques in Wireless Telephone and Broadcast Systems, Speech Coding Techniques for Audio and Voice – Pulse Code Modulation, DPCM, Delta Modulation, Vocoder and Linear Predictive Coding, Performance Comparison of Speech Processing Techniques.

Radio Propagation and Cellular Engineering Concepts: Fundamental Radio Propagation and System Concepts, Propagation Characteristics, Models of Multipath-faded radio signals – Un modulated Carrier, Envelope and Phase faded, Level Crossing rate and fade Duration, Delay Spread Measurements.

Digital Modulation-Demodulation (Modem) Principles and Architectures: Coherent Modem – Baseband Modem Equivalence, Coherent and Differentially Coherent Binary Phase Shift Keying Systems, Synchronization – Carrier Recovery and Symbol Timing Recovery, Differential Encoding and Decoding Requirement, Quadrature Phase shift Keying – Coincident and offset Types, Pi/4 DQPSK Modems – Architecture.

Interference In Wireless Digital Communication: Carrier-to-Interference and Carrier-to-Noise Limited Systems, Cochannel Interference, Adjacent Channel Interference. Externally caused Cochannel Interference, Definitions and performance of Spectral and Power Efficiency, Relationship of the Bit-Energy to Noise-Density Ratio and the Carrier-to-Noise Ratio, Power Efficiency and Bit-Error-Rate performance in an Additive White Gaussian Noise Environment, Concepts of Diversity Branch and Signal paths; Combining and Switching Methods.

Text Books

1.DR Kamilo Feher Wireless Digital Communications, Prentice Hall of India, New Delhi – 1999
2.William Cy Lee, Mobile Cellular Telecommunications, 2nd Edition, MC Graw Hill.

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COURSE CODE: 12EC521

ADVANCED DIGITAL SIGNAL PROCESSING

Syllabus

Multirate Digital Signal Processing Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion

Multirate Digital Signal Processing Multistage Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals

Linear Prediction And Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

Power Speciral Estimation: Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

Parametric Method Of Power Spectrum Estimation: Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstructrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method**.**

Text Books

1.Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms and Application, PHI.
2.Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

Simulation Text Books

1.Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.
2.ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab, " Springer.
3.Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, " CRC Press,2005.

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COURSE CODE: 12EC522

RADAR SIGNAL PROCESSING

Syllabus

Angle-of-Arrival Estimation in the Presence of Multipath: The Low-Angle Tracking Radar Problem, Spectrum Estimation Background, Thomson's Multi-Taper Method, Test Dataset and a Comparison of Some Popular Spectrum Estimation Procedures, Multi-taper Spectrum Estimation, *F*-Test for the Line Components, Experimental Data Description for a Low-Angle Tracking Radar Study

Time–Frequency Analysis of Sea Clutter: An Overview of Non-stationary Behaviour and Time–Frequency Analysis, Theoretical Background on Non-stationary, High-Resolution Multi-taper Spectrograms

Dynamics of Sea Clutter: Statistical Nature of Sea Clutter: Classical Approach, Is There a Radar Clutter Attractor, Hybrid AM/FM Model of Sea Clutter, Evidence for Amplitude Modulation, Frequency Modulation, and More, Modelling Sea Clutter as a Non-stationary Complex Autoregressive Process

Sea-Clutter Non-stationary: The Influence of Long Waves: Radar and Data Description, Statistical Data Analyses, Modulation of Long Waves: Hybrid AM/FM Model, Non-stationary AR Model, Parametric Analysis of Texture Process

Two New Strategies for Target Detection in Sea Clutter: Bayesian Direct Filtering Procedure, Operational Details, Experimental Results on the Bayesian Direct Filter, Additional Notes on the Bayesian Direct Filter, Correlation Anomally Detection Strategy

Text Books

1. I. Haykin, Simon S,"Radar Adaptive signal processing", John Wiley & Sons
2. Mark A Richards, "Fundamentals of Radar signal processing", M C Graw Hill

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COURSE CODE: 12EC566

CMOS RF CIRCUIT DESIGN

Syllabus

Introduction to RF Design and Wireless Technology: Design and Applications, Complexity and Choice of Technology. Basic concepts in RF design: Nonlinearly and Time Variance, Inter symbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion

RF Modulation: Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, Direct conversion and two-step transmitters

RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers.

BJT and MOSFET behavior at RF Frequencies: BJT and MOSFET behavior at RF frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation

RF Circuits Design: Overview of RF Filter design, Active RF components & modeling, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technologies, Design of Mixers at GHz frequency range, Various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers, Design issues in integrated RF filters.

Text Books

1. B. Razavi, “RF Microelectronics” PHI 1998
2. R. Jacob Baker, H.W. Li, D.E. Boyce “CMOS Circuit Design, layout and Simulation”, PHI

Reference Books

1. Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press 1998.
2. Y.P. Tsividis, “Mixed Analog and Digital Devices and Technology”, TMH 1996

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COURSE CODE: 12EC506

ESTIMATION AND DETECTION THEORY

Syllabus

Detection Theory: Maximum likelihood decision criterion; Neumann-Pearson criterion; Probability of error criterion; Bayes risk criterion; minimax criterion; robust detection; Receiver operating characteristics.

Detection Theory: Vector observations; the general Gaussian problem; Waveform observation in additive Gaussian noise; the integrating optimum receiver; Matched filter receiver.

Maximum Likelihood Estimation; Bayes cost method Bayes estimation criterion – Mean square error criterion; Uniform cost function; absolute value cost function; Linear minimum variance - Least squares method;

Estimation in the presence of Gaussian noise -Linear observation; Non-linear estimation. Properties of estimators**:** Bias, Efficiency, Cramer Rao bound asymptotic properties; Sensitivity and error analysis

Prediction; Kalman filter. Sufficient statistics and statistical estimation of parameters: Concept of sufficient statistics; Exponential families of distributions; Exponential families and Maximum likelihood estimation; uniformly minimum variance unbiased estimation.

Text Books

1.Steven M. Kay, Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory, Prentice Hall Inc., 1998.
2.Harry L. Van Trees, Detection, Estimation and Modulation Theory, Part 1, John Wiley & Sons

References

1.James L. Melsa and David L. Cohn, Decision and Estimation Theory, McGraw Hill, 1978.
2.Dimitri Kazakos, P. Papantoni Kazakos, Detection and Estimation, Computer Science Press,
3.Jerry M. Mendel, Lessons in Estimation Theory for Signal Processing,
Communication and Control, Prentice Hall Inc.
4. Sophocles J. Orfanidis, Optimum Signal Processing 2nd edn., McGraw Hill.
5.Monson H. Hayes, Statistical Digital Signal Processing and Modelling, John Wiley & Sons
6. Scott C. Statistical Signal Processing, June 14, 2004.

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COURSE CODE: 12EC583

WIRELESS SENSOR NETWORKS

Syllabus

Characteristics of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Embedded Operating Systems: Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components - Programming in Tiny OS using NesC, Emulator TOSSIM.

Applications of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

Text Books

1.Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books

1.K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2.Philip Levis, " TinyOS Programming"
3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.

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COURSE CODE: 12EC581

HIGH PERFORMANCE COMMUNICATION NETWORKS

Syllabus

Principles Of Networks networking principles, Network services, High performance networks, Network elements, network mechanisms, layered architecture Packet Switched Networks Principles, OSI & TCP/IP models, transmission media, routing algorithms, Congestion control algorithms, Internetworking, Ethernet(IEEE 802.3), Tokenring (IEEE 802.5),Token bus (IEEE802.4). FDDI,

Network security(cryptography, symmetric key algorithms, private key algorithms, digital signatures, authtication protocols) The Internet And TCP/IP Networks & Circuit Switched Networks Overview of Internet protocols, Internet control protocols, Elements of transport Protocols, TCP & UDP ,

Performance of TCP/IP networks, SONET, DWDM, Solitons, Optical Networks fiber principles (elements of optical fiber communication, acceptanceangle, Numerical aperture, modes, fiber types), optical links(point to point links,attenuation,optical budgeting, dispersion),splices ,connectors optical Lans,non Semiconductors, opticalamplifiers,Erbium doped Fiber mplifiers, couplers/splitters, optical switches ATM networks Main features of ATM, Addressing ,signaling, routing, ATM header structure

Text Books

1. Jean Walrand and Pravin variya , " High performance Communication networks", 2nd edition, Harcourt and Morgan Kauffman, London 2000
2. Andrew S. Tanenbaum, "Computer networks", PHI Private limited, new Delhi

References

1. Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition
2. John M Senior, PHI limited, optical fiber communication , third edition
3. Leon Gracia, Widjaja, "Communication Networks", Tata Mc Graw –Hill, New Delhi, 2000.
4. Behroz a. Forouzan, "Data communication and networking ", Tata MC Graw –Hill, New Delhi
5. Sumit Kasera, Pankaj Sethi, " ATM Networks", Tata Mc Graw- Hill, New Delhi , 2000

M. TECH (VLSI)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

	SEMESTER-1			
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
1	12EC551	ALGORITHM FOR VLSI AUTOMATION	3-1-0	4
2	12EC552	HDL AND PLD ARCHITECTURES	3-1-2	5
3	12EC553	IC FABRICATION TECHNOLOGY	3-1-0	4
4	12EC520	IMAGE AND VIDEO PROCESSING	3-0-0	3
5	12EC559	VLSI SIGNAL PROCESSING	3-0-0	3
6	12EC550	MOS CIRCUIT DESIGN	3-1-2	5
7	KLUC503	SEMINAR	0-0-4	2
		TOTAL CREDITS		26

	SEMESTER-2			
SN	Subj Code	Description	L-T-P	Credits
1	12EC554	ANALOG AND MIXED SIGNAL DESIGN	3-1-2	5
2	12EC555	LOW POWER VLSI CIRCUITS	3-0-2	4
3	12EC556	VLSI SYSTEM DESIGN	3-1-0	4
4	12EC557	DIGITAL SYSTEMS AND TESTABLE DESIGN	3-1-0	4
5	12EC562	SYSTEM ON CHIP DESIGN	3-0-0	3
6	12EC566	CMOS R F CIRCUIT DESIGN	3-0-0	3
7	KLUC501	TERM PAPER	0-0-4	2
		TOTAL CREDITS		25

	SEMESTER-3&4			
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
1		THESIS	0-0-36	36

TOTAL CREDITS **87**

MOS CIRCUIT DESIGN

COURSE CODE: 12EC550

L	T	P	C
3	1	2	5

SYLLABUS:

UNIT I

INTRODUCTION: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules.

UNIT II

MOS TRANSISTOR AND CIRCUIT MODELING: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.

UNIT III

MOS INVERTER STATIC CHARACTERISTICS: Introduction, Resistive-Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter.

UNIT IV

COMBINATIONAL AND SEQUENTIAL MOS LOGIC CIRCUITS: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop.

UNIT V

DYNAMIC LOGIC AND SEMICONDUCTOR MEMORIES: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, High-performance dynamic CMOS circuits, DRAM, SRAM, Nonvolatile memory.

TEXT BOOKS:

1. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH 2003.
2. Neil H. E. Weste and David. Harris Ayan Banerjee,, “CMOS VLSI Design” - Pearson Education, 1999.

REFERENCES BOOKS:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits” Pearson Education, 2003.
2. Uyemura, “Introduction to VLSI Circuits and Systems” Wiley-India, 2006.
3. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.
4. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

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ALGORITHMS FOR VLSI DESIGN AUTOMATION

COURSE CODE: 12EC551

L	T	P	C
3	1	0	4

SYLLABUS:

UNIT I

INTRODUCTION TO DESIGN METHODOLOGIES: Design Automation tools, Algorithmic Graph Theory, Computational Complexity, Tractable and Intractable Problems.

UNIT II

LAYOUT: Compaction, Placement, Floor planning and Routing Problems, Concepts and Algorithms.

UNIT III

MODELING: Gate Level Modeling and Simulation, Switch level modeling and simulation, Basic issues and Terminology, Binary – Decision diagram, Two – Level Logic Synthesis.

UNIT IV

HARDWARE MODELS: Internal representation of the input algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some aspects of Assignment problem, High – level Transformations.

FPGA TECHNOLOGIES: Physical Design cycle for FPGA's partitioning and routing for segmented and staggered models. MCM technologies, MCM physical design cycle, Partitioning, Placement – Chip array based and full custom approaches, Routing –Maze routing, Multiple stage routing, Topologic routing, Integrated Pin – Distribution and routing, routing and programmable MCM's.

TEXT BOOKS:

1. S.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley 1999.
2. Naveed Sherwani, "Algorithms for VLSI Physical Design Automation" 3rd edition, Springer International Edition, 2005.

REFERENCES BOOKS:

1. Hill & Peterson, "Computer Aided Logical Design with Emphasis on VLSI" Wiley,1993.
2. Wayne Wolf, "Modern VLSI Design: Systems on silicon" Pearson Education Asia, 2nd Edition, 1998.

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HDL AND PLD ARCHITECTURES

COURSE CODE: 12EC552

L	T	P	C
3	1	2	5

SYLLABUS:

INTRODUCTION TO VERILOG HDL: Basic concepts, Design modeling, Tasks and functions, Timing and delays, user-defined primitives, PLI, Simulation and Synthesis Tools.

SYNTHESIS OF COMBINATIONAL & SEQUENTIAL LOGIC: Decoders and encoders, Multiplexers and Demultiplexers, Priority encoder, Priority decoder, Comparators, Adders, synthesis of three-state devices and bus interfaces. **,** Latches & Flip-flops, counters, registers, explicit state machines, , implicit state machines.

PROGRAMMABLE LOGIC DEVICES: Full Custom Design, Semicustom Design, Programmable Logic Devices, Read Only Memory (ROM), Programmable Read Only Memory (PROM), and Programmable Logic Array (PLA), and Programmable Array Logic (PAL).

CPLDS: Basic Architecture, XC9500 CPLD, GAL, Altera series – Max 5000, Max 7000 Series , ALTERA FLEX Logic – 10000 Series CPLDs. AMD's – CPLD (Mach 1 to 5).

FPGAS: Introduction, Basic Architecture, Design flow, Xilinx XC3000 & XC4000 Architectures, Actel Architectures, ALTERA's FLEX 8000, and ALTERA's FLEX 10000 FPGAs.

TEXT BOOKS:

1. Michael D.Celetti "Advanced Digital Design with the Verilog HDL" Prentice Hall, 2009.
2. S.Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.

REFERENCE BOOKS:

1. Verilog digital system design RT level synthesis testbench and verification by Zainalabedin Navabi, 2008 Mc Graw Hill Publishers.
2. Stephen Brown Zvonko Vranesic "Fundamentals of Digital Logic with VHDL Design" McGraw-Hill, 2008.

SIMULATION BOOKS:

1. Verilog Hdl A Guide To Digital Design And Synthesis, Edition: 2 by Samir Palnitkar.

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IC FABRICATION TECHNOLOGY

COURSE CODE: 12EC553

L	T	P	C
3	1	0	4

SYLLABUS:

INTRODUCTION TO IC TECHNOLOGY: Basic fabrication steps and their Importance.

ENVIRONMENT OF IC TECHNOLOGY: Concepts of Clean room and safety requirements, Concepts of Wafer cleaning processes and wet chemical etching techniques.

IMPURITY INCORPORATION: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing, characterization of Impurity profiles.

OXIDATION: Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films, Oxidation technologies in VLSI and ULSI, Characterization of oxide films, High k and low k dielectrics for ULSI.

LITHOGRAPHY: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation.

CHEMICAL VAPOUR DEPOSITION TECHNIQUES: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films.

EPITAXIAL GROWTH OF SILICON: modeling and technology.

METAL FILM DEPOSITION: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes.

PLASMA AND RAPID THERMAL PROCESSING: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

TEXT BOOKS:

1. S.M.Sze(2nd Edition)"VLSI Technology", McGraw Hill Companies Inc,2003.

2. C.Y. Chang and S.M.Sze (Ed), **"**ULSI Technology**"**, McGraw Hill Companies Inc, 1996.

REFERENCES BOOKS:

1. Stephena, Campbell, **"**The Science and Engineering of Microelectronic Fabrication**"**, Second Edition, Oxford University Press, 2005.

2. James D.Plummer, Michael D.Deal, "Silicon VLSI Technology" Pearson Education.

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IMAGE AND VIDEO PROCESSING

COURSE CODE: 12EC520

L	T	P	C
3	0	0	3

UNIT I

FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.

UNIT II

IMAGE PROCESSING TECHNIQUES: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.

UNIT III

IMAGE COMPRESSION: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

UNIT IV

BASIC STEPS OF VIDEO PROCESSING: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

UNIT V

2-D MOTION ESTIMATION: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

Text Books:

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson.
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI.

Reference Books:

1. M. Tekalp ,"Digital video Processing", Prentice Hall International.

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VLSI SIGNAL PROCESSING

COURSE CODE: 12EC559

L	T	P	C
3	0	0	3

SYLLABUS:

INTRODUCTION TO DSP SYSTEMS: Introduction; representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph.

ITERATION BOUND: Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs.

PIPELINING AND PARALLEL PROCESSING: Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving.

RETIMING, UNFOLDING AND FOLDING: retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodogy.

FAST CONVOLUTION, FILTERS AND TRANSFORMS: Cook-toom algorithm, modified cook-toom algorithm, winogard algorithm, iterated convolution Algorithm strength reduction in filters and transforms.

TEXT BOOK:

1. Keshab k. Parhi," VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, inter science, 1999.

REFERENCE BOOKS:

1. S.Y.kung, H.J.White house, T. Kailath," VLSI and Modern Signal Processing", Prentice hall, 1985.

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ANALOG AND MIXED SIGNAL DESIGN

COURSE CODE: 12EC554

L	T	P	C
3	1	2	5

BASIC MOS DEVICE PHYSICS: General considerations of MOS devices, second order effects, MOS device models.

PASSIVE & ACTIVE CURRENT MIRRORS: Basic current mirrors, Cascode current mirror, Active Current Mirrors - large signal analysis, small signal analysis, common mode properties.

AMPLIFIERS DESIGN: Single Stage (CS,CG,CD) configurations, Cascade Stage; frequency response(miller effect) of CG, CS, CD, Types of noise, noise in single stage amplifiers.

DIFFERENTIAL PAIR: Operation, Basic Differential Pair, differential pair with MOS loads, Frequency response of Cascade & Differential Pair.

OPERATIONAL AMPLIFIERS: Op-Amp topologies, single stage, Two stage, cascade, Gain BW product, Slew rate, Stability & frequency compensation, noise in differential and operational amplifiers.

FEEDBACK: properties of feedback, Feedback topologies and effect of loading.

ANALOG MULTIPLIER AND PLL: Analysis of four quadrant and variable transconductance multiplier, Voltage Controlled Oscillator, closed loop analysis of PLL.

SWITCHED CAPACITOR: Sampling Switches, Switched capacitor amplifiers, design techniques for switched capacitor filters.

TEXT BOOKS:

1. Behzad Razavi, "Design Of Analog CMOS Integrated Circuits", Tata Mc Graw Hill,2005.

REFERENCES BOOKS:

1. Jacob Baker, "CMOS Mixed Signal Circuit Design", John Wiley, 2008.
2. Gray & Mayer, Analysis & Design of Analog Integrated Circuits, 4th edition, Wiley,2001.

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LOW POWER VLSI CIRCUITS

COURSE CODE: 12EC555

L	T	P	C
3	0	2	4

SYLLABUS:

INTRODUCTION: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches.

DEVICE & TECHNOLOGY IMPACT ON LOW POWER: Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

SIMULATION POWER ANALYSIS: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

PROBABILISTIC POWER ANALYSIS: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

LOW POWER CIRCUIT'S: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library.

LOGIC LEVEL: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

LOW POWER ARCHITECTURE & SYSTEMS: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components.

LOW POWER CLOCK DISTRIBUTION: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

SPECIAL TECHNIQUES: Power Reduction in Clock networks, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques for SRAM.

Text Books:

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002.
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic.

References Books:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000.
2. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" Pearson Education.

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VLSI SYSTEM DESIGN

COURSE CODE: 12EC556

L	T	P	C
3	1	0	4

SYLLABUS:

DESIGN METHODOLOGY: Structured design techniques; Programmable logic; Gate array and sea of gates design; cell based design; full custom design; Design flow; Design Economics.

DATA PATH SUBSYSTEMS: Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off.

MEMORY AND ARRAY SUBSYSTEMS: SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array yield, reliability; Power dissipation in Memories.

SPECIAL-PURPOSE SUBSYSTEMS: Packaging; power distribution; I/O pads.

INTERCONNECT: Interconnect parameters; Electrical wire models, capacitive parasitics; Resistive parasitics; Inductive parasitic; Crosstalk; Advanced Interconnect Techniques.

TIMING ISSUES: Timing classification; Synchronous design; Self-timed circuit design.

CLOCK SYNTHESIS AND SYNCHRONIZATION: Synchronizers; Arbiters; Clock Synthesis; PLLs; Clock generation; Clock distribution; Synchronous Vs Asynchronous Design.

Text Books:

1. Neil H. E. Weste, David. Harris and Ayan Banerjee,, "CMOS VLSI Design" - Pearson Education, Third Edition, 2004.
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, Second Edition, 2003.

References Books:

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH, Third Edition, 2003.
2. Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.

Simulation Books:

1. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2005.

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DIGITAL SYSTEM AND TESTABLE DESIGN

COURSE CODE: 12EC557

L	T	P	C
3	1	0	4

UNIT–I

DESIGN FOR TESTABILITY: Introduction: Importance of Testing, Testing During the VLSI Lifecycle, Challenges in VLSI Testing, Levels of Abstraction in VLSI Testing, Historical Review of VLSI Test Technology. Testability Analysis, Design for Testability Basics, Scan Cell Designs, Scan Architectures, Scan Design Rules, Scan Design Flow Scan Extraction, Scan Verification, Scan Design Costs, Special-Purpose Scan Designs, RTL Design for Testability.

UNIT–II

LOGIC AND FAULT SIMULATION: Introduction, Simulation Models, Logic Symbols, Logic Element Evaluation, Timing Models, Logic Simulation, Fault Simulation. Boundary Scan and Core-Based Testing: Digital Boundary Scan, Boundary Scan for Advanced Networks, Embedded Core Test Standard.

UNIT–III

TEST GENERATION: Introduction, Random Test Generation, Theoretical Background, Designing a Stuck-At ATPG for Combinational Circuits, Designing a Sequential ATPG, Un-testable Fault Identification, Designing a Simulation-Based ATPG, Advanced Simulation-Based ATPG, Advanced Simulation-Based ATPG, ATPG for Non-Stuck-At Faults.

UNIT–IV

LOGIC BUILT-IN SELF-TEST: Introduction, BIST Design Rules, Test Pattern Generation, Output Response Analysis, Logic BIST Architectures, BIST Architectures Using Concurrent Checking Circuits, Fault Coverage Enhancement, BIST Timing Control, A Design Practice: BIST Rule Checking and Violation Repair ,Logic BIST System Design, RTL BIST Synthesis, Design Verification and Fault Coverage Enhancement.

UNIT–V

MEMORY DIAGNOSIS AND BUILT-IN SELF-REPAIR: Introduction, Refined Fault Models and Diagnostic Test Algorithms, BIST with Diagnostic Support, RAM Functional Fault Models and Test Algorithms, RAM Defect Diagnosis and Failure Analysis, RAM Redundancy Analysis Algorithms, Memory Built-In Self-Test, Built-In Self-Repair.

Text Books:

1. LAUNG-TERNG WANG,CHENG-WEN WU XIAOQING WEN “VLSI Test Principles and Architectures” ELSEVIER Publishers, 2006.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.

Reference Books:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design” Jaico Publishing House, 2002.
2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.

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SYSTEM ON CHIP DEIGN

COURSE CODE: 12EC562

L	T	P	C
3	0	0	3

SYLLABUS:

SYSTEM LEVEL DESIGN: System Level Design – Tool & methodologies for system level design, System level space & modeling language, SOC block based design & IP assembly, Performance evaluation methods for multiprocessor SOC design.

POWER MANAGEMENT AND SYNTHESIZING: System level power management, Processing modeling & design tools, embedded software modeling & design using performance metrics to select microprocessor for IC deign, Parallelizing High Level Synthesize. Acode Transformational approach to High Level Synthesize.

MICRO ARCHITECTURE DESIGN AND POWER OPTIMIZATION: Micro architecture design, Cycle accurate system level modeling, performance evaluation, Micro Architectural power estimation optimization, Design planning.

SOFTWARE DESIGN VERIFICATION: Logical verification, Design & Verification languages, Digital simulation, using transactional, level models in an Soc design, Assertion based verification.

HARDWARE DESIGN VERIFICATION: Hardware acceleration & emulation, Formal property verification, TEST, DFT, ATPG, Analog & mixed signal test.

Text Books:

1. Louis Scheffer Luciano Lavagno and Grant Martin, "EDA for IC System Verififcation and Testing", CRC,2006.

Reference Books:

1. Wayone Wolf, "Modern VLSI Design: SOCDesign"
2. Prakash Rashnikar, Peter Paterson, Lenna Singh" System On A chip Verification methodlogy & Techniques", Kluwer Academic Piblishers.
3. Alberto Sangiovanni Vincentelli," Surviving the SOC Revolution: A Guide to Platformbased Design ", Kluwer Academic Publishers.

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CMOS RF CIRCUIT DESIGN

COURSE CODE: 12EC566

L	T	P	C
3	0	0	3

SYLLABUS:

INTRODUCTION TO RF DESIGN AND WIRELESS TECHNOLOGY: Design and Application, Complexity and choices of Technology. Basic concepts in RF design Non linearly and Time Variance, Inter symbol interference, random process and noise. Sensitivity and dynamic range, conservation of gains and distortion.

RF MODULATION: Analog and Digital modulation of RF circuits, Comparison of various techniques for power efficiency, coherent and non coherent detection, Mobile RF communication and basics of Multi access techniques. Receiver and Transmitter architectures, direct conversion and two step transmitters.

RF TESTING: RF testing for heterodyne, Homodyne, Image reject, Direct If and sub sampled receivers.

BJT AND MOSFET BEHAVIOR AT RF FREQUENCIES: BJT and MOSFET behavior at RF Frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation.

RF CIRCUITS DESIGN: Overview of RF Filter design, Active RF components and modeling Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technology , Design of Mixers at GHz frequency range, various mixers working and implementation. Oscillators Basic topologies VCO and definition of phase noise, Noise power and trade off. Radio frequency Synthesizers PLLS, Various RF synthesizer architectures and frequency dividers, Design issues in integrated RF filters.

Text Books:

1. B.Razavi, " RF Microelectronics" PHI 1998
2. R. Jacob Baker, H.W Li D.E. Boyce "COMS Circuits Design, Layout and Simulation", PHI 1998.

Reference Books:

1. Thomas H.Lee "Design of COMS RF Integrated Circuits" Cambridge University press 1998.
2. Y.P. TSIVIDIS, "Mixed Analog and Digital Devices and Technology", TMH 1996.

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M. TECH (Embedded Systems)

DEPARTMENT OF ELECTRONICS & COMPUTER ENGINEERING

M.Tech Embedded Systems
Course structure for the A.Y. 2012-2014

S No	Course Code	Semester: - 1	L	T	P	Cr
1	12-EM501	Microcontrollers for Embedded System Design.	**3**	**1**	**2**	**5**
2	12-EM502	Real Time Concepts for Embedded Systems	**3**	**1**	**0**	**4**
3	12-EM503	VLSI Technology & Design	**3**	**1**	**2**	**5**
4	12-EM504	Wireless communications & Networks	**3**	**1**	**0**	**4**
5		Elective – 1 –GROUP-A	**3**	**0**	**0**	**3**
6		Elective – 2 –GROUP-B	**3**	**0**	**0**	**3**
7		Seminar	**0**	**0**	**4**	**2**
		Total Credits				**26**

S No	Course Code	Semester: - 2	L	T	P	Cr
1	11-EM601	Advanced Embedded Processor Architectures	**3**	**1**	**2**	**5**
2	11-EM602	Digital Signal Processors and Architectures	**3**	**1**	**0**	**4**
3	11-EM603	Hardware Software Co –Design	**3**	**1**	**0**	**4**
4	11-EM604	Linux System Concepts	**3**	**1**	**2**	**5**
5		Elective – 3 --GROUP-A	**3**	**0**	**0**	**3**
6		Elective -4 --GROUP-B	**3**	**0**	**0**	**3**
7		Term Paper	**0**	**0**	**4**	**2**
		Total Credits				**26**

S.No.	Course Code	Second Year	Credits
1		Thesis	36
TOTAL CREDITS			**88**

COURSE CODE	GROP-A
11-EM-E30	CPLD & FPGA Architectures and Applications
11-EM-E31	Network Security & Cryptography
11-EM-E32	Embedded Networking
11-EM-E33	Ad-hoc & Wireless Sensor Networks
11-EM-E34	Robotics
11-EM-E35	System Modeling and Simulation
	GROUP-B
11-EM-E40	Embedded Linux
12-EM-E41	System On Chip Architecture
11-EM-E42	Advanced Computer Networks
11-EM-E43	Image and Video Processing
12-EM-E44	Real Time Operating Systems
12-EM-E45	Object Oriented Analysis and Design

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) First Semester 2012-2013

Course No. : 12-EM501
Course Title : Micro Controllers for Embedded System Design
Course Structure : 3-1-2
SYLLABUS:

UNIT – I: Introduction to Embedded Systems
Overview of Embedded Systems, Processor Embedded into a system, Embedded Hardware Units and Devices in system, Embedded Software, Complex System Design, Design Process in Embedded System, Formalization of System Design, Classification of Embedded Systems.

UNIT – II: Microcontrollers and Processor Architecture & Interfacing
8051 Architecture. Real world interfacing, Introduction to advanced architectures, processor & memory organization, Instruction-level parallelism, and performance metrics.

UNIT – III: PIC Microcontroller Hardware
Introduction, Architectural overview, Memory organization, interrupts and reset, I/O ports, Timers

Unit – IV: Device Drivers & Interrupt service Mechanism
Programmed-I/O Busy-wait approach without ISM,ISR concept, Interrupt sources, Interrupt service mechanism, Multiple Interrupts, context and the periods for context switching, Interrupt latency and deadline, Classification of processors ISM from context-saving angle, Direct Memory Access, Device driver programming

UNIT – V: Devices &Communication Buses for Devices Network
IO Types and examples, Serial communication Devices, Parallel Device ports, Networked Embedded systems, Serial Bus communication protocols.

Text Books:
1. Embedded Systems - Architecture Programming and Design – Raj Kamal, 2nd ed., 2008, TMH.
2. Embedded C Programming and the Microchip PIC-Richard Barnett, O" Cull, Cox, 2009, Cengage Learning.

Reference Books:
1. Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes Cole, 1999, Thomas Learning

MICROCONTROLLERS AND INTERFACING LAB
LIST OF EXPERIMENTS

Cycle - I: The following Programs are to be written in Embedded C and Compile them using RIDE and Top view Simulator

1. Study of I/O Ports of 89c51 Microcontroller
2. Interfacing of 7 – Segment displays to 89c51
3. Interfacing of 2 – line 16 – character LCD display
4. Generation of PWM signal as are of the portliness
5. Study of Timer / Counters of 89c51
6. Study of External Interrupts of 89c51
7. Study of Serial Port of 89c51
8. Interfacing of Keyboard & 7 – Segment display to 89c51

Cycle – II: The following Experiments are to be executed on 8051 Target system by writing programs in Assembly Language and using cross assembler.

9. Interfacing of Stepper Motor
10. Interfacing of DC Motor
11. Interfacing of Multichannel A/D Converter

Cycle-III: The following Experiments are to be executed on AT89S52 Target system by writing programs in Embedded-C

12. To Establish a Serial Communication Between Host and Target Board(AT 89S52) Using RS-232 Protocol
13. To Interface EEPROM to AT89S52 Using IIC Protocol.

NOTE: Minimum Ten Experiments to be done

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) First Semester 2012-2013

Course No. : 12-EM502
Course Title : REAL TIME CONCEPTS FOR EMBEDDED SYSTEMS
Course Structure : 3-1-0
SYLLABUS

UNIT I
Introduction: Examples of Embedded Systems, Definition of Embedded Systems, Architecture of Embedded Systems, Real- Time Embedded Systems , Design Issues and Current Trends for Embedded Systems
Hard versus soft Real- Time Systems: Jobs and Processes, Release Times, Deadlines and Timing Constraints, Hard and Soft Timing Constraints, Hard Real Time Systems, Soft Real Time Systems

UNIT II
A Reference Model of Real – Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters- preemptivity of jobs, criticality of jobs, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy- Scheduler and Schedules, Feasibility, Optimality and Performance Measures.

Classification of Real Time Scheduling Approaches: Clock- Driven Approach, Weighted Round- Robin Approach, Priority- Driven Approach, Dynamic versus Static Systems, Effective Release Times and Deadlines, optimality of the EDF and LST algorithms, Non optimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority –driven systems Off-line versus On-line Scheduling

UNIT III:
Clock-Driven Scheduling : Notations and Assumptions, Static, Timer -Driven Scheduler, General Structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of Aperiodic Jobs, Scheduling Sporadic Jobs-Acceptance test ,EDF Scheduling of accepted jobs and implementation, Pros and Cons of Clock Driven Scheduling,

UNIT IV:
Priority-Driven Scheduling of Periodic Tasks: Static Assumption, Fixed Priority v/s Dynamic Priority Algorithms, schedulability test for the EDF algorithm, a schedulability test for fixed priority tasks with short response times-time demand analysis, schedulability test for fixed priority tasks with arbitrary response times: busy intervals, general schedulability test, sufficient schedulability conditions for RM & DM algorithms: schedulable utilization of the RM algorithm for tasks with Di=pi, schedulable utilization of fixed priority tasks with arbitrary relative deadlines
Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers- Operations of Deferrable Servers, Constant utilization server Scheduling of sporadic jobs-a simple acceptance test in deadline driven systems, a simple acceptance test in fixed- priority driven systems

UNIT V:

Resources and Resource Access control: Assumptions on Resources and Their Usage, Effects of Resource Contention and Resource Access Control, Non-preemptive Critical Sections, Basic Priority Inheritance Protocol, Basic Priority Ceiling Protocol- Definition, computation of blocking time, Controlling accesses to Multiple Unit Resources

Real-Time Operating Systems: Overview- Threads and Tasks, The Kernel, Time Services and Scheduling Mechanisms- Time Services, Scheduling Mechanisms, Other Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt, Memory Management, I/O and Networking

TEXT BOOKS:

1. Real Time Systems – By Jane W.S.Liu -Low Price Edition , Pearson Education Asia
2. Real-Time Concepts for Embedded Systems - Qing Li with Caroline Yao
   published by CMP Books

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) First Semester 2012-2013

Course No. : **12-EM503**
Course Title : **VLSI Technology & Design**
Course Structure : **3-1-2**
SYLLABUS:

UNIT – I:
Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology.
Basic Electrical Properties of MOS, CMOS &BiCMOS Circuits: Ids-Vds relationships, Threshold Voltage Vt, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT – II:
Layout Design and Tools: Transistor structures, Wires and Bias, Scalable Design rules, Layout Design and Tools.
Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

UNIT – III:
Combinational Circuit Design: Delay Estimation, Logical Effort and Transistor Sizing , Power Dissipation, Circuit Families, Circuit Pitfalls, Low-power Logic Design, Comparison of Circuit Families, Silicon-on-Insulator Circuit Design

UNIT –IV:
Sequential Circuit Design : Introduction, Sequencing Static Circuits, Circuit Design of Latches and Flip-flops: Conventional CMOS Latches and Flip-Flops, Pulsed Latches, Resettable Latches and Flip-Flops, Enabled Latches and Flip-flops. Static Sequencing Element Methodology: Choice of Elements, Low-power Sequential Design. Synchronizers: A simple synchronizer, arbiter.

UNIT – V:
Floor Planning and System Design: Floor planning methods, Global interconnect, Floor Plan design, off-chip connections, Register Transfer Design, Pipelining

Text Books:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian. D, A.Pucknell, 2005, PHI.
2. Modern VLSI Design - Wayne Wolf, fourth edition, Pearson Education.
3. CMOS VLSI Design A Circuits and systems perspective Third Edition Neil H.E.Weste

References:

1. Introduction to VLSI systems – A Logic, Circuit and System Perspective- Ming Bo, Liu, CRC Press, 1st Edition 2011.
2. Principals of CMOS VLSI Design – N.H.E Weste, K.Eshraghian, 2nd ed., Adisson Wesley.

HDL and FPGA LAB
LIST OF EXPERIMENTS

The following Programs are to be written in HDL (VHDL/Verilog) Verify the functionality in FPGAs(Spartan 3e)
Cycle-I

1. Design of full adder, Subtractor in data flow, Behavioral and Strucral Modeling's.
2. Design of Multiplexers (4:1, 8:1) and Demultiplexers (1:4, 1:8).
3. Design of Encoders (with priority and without priority) and Decoders
4. Design of Comparators (1-bit, 2-bit, 4-bit) .
5. Design of Code converters:
   (a) Binary to Gray
   (b) Gray to Binary
   (c) BCD to Seven Segment
6. Design of Ripple carry, Carry Select Adders.

Cycle-II

7. Design of Flip Flops (SR,JK,T,D)
8. Design of Synchronous and Asynchronous Counters
9. Design of Barrel Shifter and 8-bit ALU
10. Design of Shift Registers (SISO, SIPO, PISO, PIPO).
11. Design of Finite State Machines (Moore and Mealy).
12.Design of Memories(ROM,RAM)

NOTE: After completion of these experiments any one application are to be Develop by Group

Tools Required : Xilinx 11.1i, Modelsim 5.7f, Digilent

Hardware Required: Spartan 3e FPGA Boards

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – II

Course No. **: 12-EM504**
Course Title **:Wireless Communications & Networks**
Course Structure **: 3-1-0**
SYLLABUS:

UNIT I

Introduction to Mobile and Wireless Landscape: Definition of Mobile and Wireless, Components of Wireless Environment, Challenges, Applications, Overview of Wireless Networks, Categories of Wireless Networks, open Research topics.
Wireless LAN :Infra redVs radio transmission, Infrastructure and Ad-hoc Network,
IEEE 802.11: System architecture, Protocol architecture. **Bluetooth:** User scenarios, Architecture.

UNIT II:

Global System for Mobile Communications(GSM): Introduction, Mobile services, System architecture, Radio interface, Localization and calling, Handover, Security.
(Wireless) Medium Access Control : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

UNIT III:

Mobile Network Layer:
Mobile IP: Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).
Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms.

UNIT IV

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT V

Broadcast Systems: Overview, Cyclical repetition of data, Digital audio broadcasting: Multimedia object transfer protocol, Digital video broadcasting: DVB data broadcasting, DVB for high-speed internet access, Convergence of broadcasting and mobile communications.

Text Book:

1. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2009.

REFERENCE BOOKS:

1.MartynMallick, "Mobile and Wireless Design Essentials", Wiley, 2008.
2.Asoke K Talukder, et al, "Mobile Computing", Tata McGraw Hill, 2008.
3.Mobile Computing, Raj Kamal,Oxford University Press.
4.William Stallings, " Wireless Communications & Networks", Person, Second Edition, 2007.
5.JimGeier, "Wireless Networks first-step", Pearson, 2005.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Second Semester 2012-2013

Course No. **: 11-EM601**
Course Title **: Advanced Embedded Processor Architecture**
Course Structure **: 3:1:2**
SYLLABUS:
UNIT I:
ARM Processor as System-on-Chip: Acorn RISC Machine – Architecture inheritance – ARM programming model. 3 and 5 stage pipeline ARM organization – ARM instruction execution and implementation – ARM Co-processor interface

UNIT II:
ARM Assembly Language Programming: ARM instruction types – data transfer, data processing and control flow instructions – ARM instruction set – Co-processor instructions, Thumb Instruction Set.

UNIT III: Architectural Support for System Development: Advanced Microcontroller bus architecture – ARM memory interface – ARM reference peripheral specification – Hardware system prototyping tools – ARMulator – Debug architecture.

UNIT IV:
ARM Processor Cores: ARM7TDMI, ARM8, ARM9TDMI, ARM10TDMI, The AMULET Asynchronous ARM Processors- AMULET1

UNIT V:
Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The OneC™ VWS22100 GSM chip, The Ericsson-VLSI, Bluetooth Baseband Controller, The ARM7500 and ARM7500FE.

Text Books:
1. ARM System on Chip Architecture – Steve Furber – 2nd ed., 2000, Addison Wesley
Professional.
2. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st ed., 2004, Springer
References:
1. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded
Technology) – Jason Andrews – Newnes, BK and CDROM
2. System on Chip Verification – Methodologies and Techniques –PrakashRashinkar, Peter
Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

ADVANCED EMBEDDED PROCESSOR LAB

LIST OF EXPERIMENTS

Basic Experiments

1. Interfacing of LEDS to P1.16 to P1.23
2. Interfacing Switches to P1.24 to P1.31
3. Interfacing Buzzer and Relay
4. Interfacing of stepper motor
5. Establishing a communication Link between kit and PC using Serial Port
6. Study of External Interrupts
7. Interfacing of 2 line 16 character LCD display
8. Study of Timer/Counter feature of LPC 2148

Design Experiments

1. Interfacing of temperature sensor LM 35 using on chip ADC
2. Interfacing 7 Segment Display using I2C interface
3. Controlling Speed of DC motor using On Chip PWM module
4. Interfacing a serial EEPROM using ARM7 Internal I2C Bus
5. Interfacing of GLCD
6. Interfacing RTC using I2C Bus

Note: Students have to complete at least six Basic experiments and one Design Experiment.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Second Semester 2012-2013

Course No. **: 11-EM602**
Course Title **: Digital Signal Processors and Architectures**
Course Structure **: 3-1-0**
SYLLABUS:

UNIT I

Introduction To Digital Signal Processing: Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. DiscreteFourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters,Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

Computational Accuracy In DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of errorin DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors,Compensating filter.

UNIT II

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, DataAddressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues,Features for External interfacing.

UNIT III

Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XXprocessors, Pipeline Operation of TMS320C54XX Processors.

UNIT IV

Implementations Of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, AdaptiveFilters, 2-D Signal Processing.

Implementation Of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed indexgeneration, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT V

Interfacing Memory And I/O Peripherals To Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface,Programmed I/O, Interrupts and I/O, Direct memory access (DMA).A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODECprogramming, A CODEC-DSP interface example

Text Books

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.

References

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and
M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Second Semester 2012-2013

Course No. **: 11-EM603**
Course Title **: Hardware Software Co -Design**
Course Structure **: 3-1-0**
SYLLABUS:
UNIT –I
Co- Design Issues
Co- Design Models, Architectures, Languages, A Generic Co-design Methodology.
Co- Synthesis Algorithms:
Hardware software synthesis algorithms: hardware – software partitioning distributed system co-synthesis.

UNIT –II
Prototyping and Emulation:
Prototyping and emulation techniques, prototyping and emulation environments, future developments in emulation and prototyping
Target Architectures:
Architecture Specialization techniques, System Communication infrastructure, Target Architecture and Application System classes, Architecture for control dominated systems (8051-Architectures for High performance control), Architecture for Data dominated systems (ADSP21060, TMS320C60), Mixed Systems.

UNIT – III
Compilation Techniques and Tools for Embedded Processor Architectures:
Modern embedded architectures, embedded software development needs, compilation technologies practical consideration in a compiler development environment.

UNIT – IV
Design Specification and Verification:
Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, design verification, implementation verification, verification tools, interface verification

UNIT – V
Languages for System – Level Specification and Design-I
System – level specification, design representation for system level synthesis, system level specification languages.
Languages for System – Level Specification and Design-II
Heterogeneous specifications and multi-language co-simulation the cosyma system and lycos system.

Text Books:
1. Hardware / software co- design Principles and Practice – Jorgen Staunstrup, Wayne Wolf – 2009, Springer.
2. Hardware / software co- design Principles and Practice, 2002, kluwer academic publishers

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Second Semester

Course No. : 12-EM604
Course Title : Linux System Concepts
Course Structure : 3-1-2
SYLLABUS:

UNIT1

Introduction: Structure of a computer system, looking at OS as a System Programming.

Development tools: Compilation tools and its functionalities, Debugging applications, Using Make, Source code Control Tools, Creating Libraries and Implementing System Calls.

Processes & Inter Process Communication: Pipes and FIFO's, Asynchronous I/O, Signals & its importance, Sockets, Threads, POSIX Threads, Multi-threading using POSIX Threads.

UNIT – II

Operating Systems Concepts: Structure of Linux Operating System, Process Management, Memory Management, File System Management, I/O Management, Networking Subsystem, Storage Management.

UNIT – III

Linux Kernel: Making partitions, Linux installation, Compilation of open sources, Configuration & Compilation of kernel sources, working with Modules.

UNIT – IV

Linux Kernel APIs: Kernel Features, Interrupts and Exceptions, Debugging, Timers, Synchronization techniques, ioctl's, The proc file system, Unified Device Model and sysfs, Memory Management and Allocation, User and Kernel Space communication, Sleep and Wait Queues, Interrupt Handling.

UNIT – V:

Linux Device drivers: Skeleton of device drivers, Block Drivers, PCI, Direct Memory Access, Network Drivers, USB Drivers, MTD, Asynchronous I/O, I/O Scheduling

Text Books:

1. Linux Kernel Development, Robert Love, 2nd Edition, 2006, Pearson Education.
2. Advanced Programming in UNIX Environment– Richard Stevens, Addison-Wesley, 1992.

Reference Books:

1. Understanding the Linux Kernel, Third Edition Daniel P. Bovet , Marco Cesati, 3rd edition, Orally Publications
2. Linux Device Drivers, 3rd edition, Linux Device Drivers, 3rd Edition Jonathan Corbet, Alessandro Rubini , Greg Kroah-Hartman, Orally Publications

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Group-A 2012-2013

Course No. : 11-EM-E30
Course Title : CPLD and FPGA Architecture and Applications
Course Structure : 3-0-0

UNIT – I

Programmable Logic: Read Only Memory (ROM), PROM, Programmable Logic Array (PLA)/Programmable Array Logic (PAL). Combinational circuit realization using ROM, PROM

UNIT – II

CPLDs : Sequential PLDs. PGAs – Features, Programming and applications using CPLDs,- Altera series – Max 5000/7000 Series and ALTERA FLEX Logic – 10000 Series CPLDs. AMD's – CPLD (Mach 1 to 5);

UNIT - III

FPGAs: Logic blocks, routing architecture, Design flow, Technology Mapping for FPGAs, Case studies – Xilinx XC4000 & ALTERA's FLEX 8000/10000 FPGAs

UNIT - IV

Design Techniques, Rules, and Verification: Objectives, Hardware Description Languages, Top-Down Design, Synchronous Design, Floating Nodes, Bus Connection, Design for Test, and Testing Redundant Logic, What is Verification? Simulation, Static Timing Analysis, Assertion Languages & Formal Verification.

UNIT - V

Electronic Design Automation Tools: Objectives, Simulation Software, Test Bench Generators, In situ Tools, Synthesis Software, Automatic Test Pattern Generation (ATPG). Scan Insertion Software, Built-In Self-Test (BIST) Generators, Static Timing Analysis Software, Formal Verification Software, Place and Routing Software, Programming Tools.

Text Books:

1. Michael D.Celetti **"Advanced Digital Design with the Verilog HDL"** Prentice Hall, 2009
2. John F Wakerly **"Digital Design Principles & Practices"** Prentice Hall, 2001.
3. Bob Zeidman **"Designing with FPGAs & CPLDs"** Focal Press, 2002
4. S.Trimberger, Edr., **Field Programmable Gate Array Technology**, Kluwer Academic Publicatgions, 1994

Reference Books:

1. Ian Grout **"Digital Systems Design with FPGA's and CPLD's"** ELSEVIER
2. Stephen Brown **"Fundamentals of Digital Logic with VHDL Design"** MCH 2008
3. Dueck **"Digital Design with CPLD Applications and VHDL"** Thomson
4. P.K.Chan & S. Mourad, **"Digital Design Using Field Programmable Gate Array",** jPrentice Hall (Pte), 1994.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – I

Course No. **: 11-EM-E31**
Course Title **: Network Security & Cryptography**
Course Structure **: 3-0-0**
SYLLABUS:

UNIT-I

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetworksecurity. Classical Techniques: Conventional Encryption model, Steganography, Classical EncryptionTechniques.

UNIT-II

Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.
Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.
Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.
Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT-III

Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing forprimality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.
Message authentication and Hash functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT-IV

Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, and HMAC. **Digital signatures and Authentication protocols**:Digital signatures, Authentication Protocols, Digital signature standards. **Authentication Applications**:Kerberos, X.509 directory Authentication service. Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT-V

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations,Key Management.**:Web Security**
Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. **Intruders, Viruses and Worms :**Intruders, Viruses and Related threats. **Fire Walls :**Fire wall Design Principles, Trusted systems.

Text Book:

1. Cryptography and Network Security: Principles and Practice - William Stallings, 2000, PE.

References:

1. Principles of Network and Systems Administration, Mark Burgess,JohnWiel

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – I

Course No. **: 11-EM-E32**
Course Title **: Advanced Digital signal processing**
Course Structure **: 3-0-0**
SYLLABUS:

UNIT I

Review of DFT, FFT, IIR Filters, and FIR Filters, **Multirate Signal Processing:** Introduction, Decimation by a factor D, Interpolation by a factor I, and Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion, Applications of Multirate Signal Processing

UNIT II

Non-Parametric methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman &Tukey methods, Comparison of all Non-Parametric methods

UNIT III

Parametric Methods of Power Spectrum Estimation: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Waker& Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT –IV

Linear Prediction : Forward and Backward Linear Prediction – Forward Linear Prediction, Backward Linear Prediction, Optimum reflection coefficients for the Lattice Forward and Backward Predictors. Solution of the Normal Equations: Levinson Durbin Algorithm, Schur Algorithm. Properties of Linear Prediction Filters

UNIT V

Finite Word Length Effects: Analysis of finite word length effects in Fixed-point DSP systems – Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

Textbooks:

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis& D.G.Manolokis, 4th ed., PHI.
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.
3. DSP – A Pratical Approach – Emmanuel C.Ifeacher, Barrie. W. Jervis, 2 ed., Pearson
Education.

References:

1. Modern spectral Estimation : Theory & Application – S. M .Kay, 1988, PHI.
2. Multirate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – I

Course No. **: 11-EM-E33**
Course Title **:Ad-hoc Wireless & Sensor Networks**
Course Structure **: 3-0-0**

SYLLABUS:

UNIT I

Introduction to Ad Hoc Networks: Characteristics of MANETs, Applications of MANETs and challenges of MANETs - **Routing in MANETs:** Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, Other routing algorithms.

UNIT II

Data Transmission: Broadcast storm problem, Broadcasting, Multicasting and Geocasting - **TCP over Ad Hoc:** TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT III

Basics of Wireless Sensors and Applications: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT IV

Data Retrieval in Sensor Networks: Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots - **Security:** Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

UNIT V

Sensor Network Platforms and Tools: Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms - **Operating System:** TinyOS - **Imperative Language:** nesC, Dataflow style language: TinyGALS, Node-Level Simulators, ns-2 and its sensor network extension, TOSSIM

TEXT BOOKS:

1.Ad Hoc and Sensor Networks – Theory and Applications, *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2.Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – I

Course No. **: 11-EM-E34**
Course Title **:Robotics**
Course Structure **: 3-0-0**
SYLLABUS:
Unit – I :
Introduction & Basic Definitions: Introduction, Control Programs for Robots, Industry Applications of Robots, Pick and Place, Gantry and Armtype Robots in typical set-ups like Automobile Industry
Coordinate Systems : Cartesian, Cylindrical, Polar, and Revolute systems: Robot Positioning: Robot Arms; Axes, their ranges, offset and In-line Wrist: Roll, Pitch and Yaw, their meaning in Robotics

Unit-II :
Mechanical Aspects: Kinematics, Inverse Kinematics, Motion planning and Mobile Mechanisms

Unit-III :
Sensors and Applications: Range and Use of Sensors, Micro switches, Resistance Transducers, Piezo-electric, Infrared and Lasers. Applications of Sensors : Reed Switches, Ultrasonic, Barcode Readers and RFID

Unit-IV
Robot Systems: Hydraulic and Electrical Systems including pumps, valves, solenoids, cylinders, stepper motors, Encoders andAC Motors

Unit-V
Programming of Robots: Programming of Robots such as Lego Robots, Programming environment, Example Applications, Safetyconsiderations

Text Books:
1. Introduction to Robotics – P.J.Mckerrow, ISBN : 0201182408
2. Introduction to Robotics – S.Nikv, 2001, Prentice Hall,
3. Mechatronics and Robotics: Design & Applications – A.Mutanbara, 1999,CRC Press.

References:
1. Robotics – K.S.Fu, R.C.Gonzalez and C.S.G.Lee, 2008, TMH.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Group-B

Course No. :11-EM-E40
Course Title : Embedded Linux
Course Structure : 3-0-0
SYLLABUS:

UNIT – I:

Introduction: History of Embedded Linux, Embedded Linux versus Desktop Linux, Embedded Linux Distributions, Architecture of Embedded Linux, Linux Kernel Architecture, Linux Start-Up Sequence, GNU Cross-p\Platform Tool chain.

UNIT – II:

Board Support Package: Inserting BSP in Kernel Build Procedure, Boot Loader Interface, Memory Map, Interrupt Management, PCI Subsystem, Timers, UART, and Power Management.

Embedded Storage: Flash Map, MTD—Memory Technology Device, MTD Architecture, Flash-Mapping Drivers, MTD Block and Character devices, Embedded File systems, Optimizing Storage Space.

UNIT – III:

Embedded Drivers: Linux Serial Driver, Ethernet Driver, I2C subsystem on Linux, USB Gadgets, Watchdog Timer, and Kernel Modules.

UNIT-IV:

Porting Applications: Architectural Comparison, Application Porting Road Map, Programming with Pthreads, Operating System Porting Layer (OSPL), Kernel API Driver.

Unit-V:

Real-Time Linux: Linux and Real-Time, Real-Time Programming in Linux, Hard Real-Time Linux.

Text Books:

1. Embedded Linux System Design and Development, P.Raghavan, Amol Lad, SriramNeelakandan, 2006, Auerbach Publications

Reference Books:

1. Embedded Linux – Hardware, Software and Interfacing

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Third Semester

Course No. **: 12-EM-E41**
Course Title **: System On – Chip Architecture**
Course Structure **: 3-0-0**

SYLLABUS:

UNIT-I Introduction ,Design Methodology for Logic cores : SoC Design flow, General guide lines for design reuse, design process for soft, firm and hard cores, system integration.

UNIT-II Design Methodology for Memory Cores and Analog cores: Design methodology for embedded memories, specifications of analog circuits Design Validation: core level validation, core interface verification SoC design validation.

UNIT-III On-chip communication Architectures: A quick overlook, Basic concepts of bus based communication Architectures: Terminology, characteristics of Bus based communication architectures, data transfer modes, Bus topology types.

UNIT-IV On chip Communication Architecture Standard : standard on chip bus based communication architectures, socket based on chip interface standards.

UNIT-V Verification and security Issues in On chip communication Architectures: verification of on chip communication protocols, compliance verification for IP block integration, basic concepts for SoC security, security support in standard bus protocols Networks on chip: network topology, switching strategies, routing algorithms, flow control, clocking schemes, NOC architectures.

Text Books :

1. System On a Chip Design and Test? by Rochit Rajsuman, Library of Congress Cataloging-in-Publication Data,2000.

2. On chip communication Architectures? by Sudeep Pasricha and Nikil Dutt , Morgan Kaufmann Publishers,2008

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – II

Course No. **: 11-EM-E42**
Course Title **: Advanced Computer Networks**
Course Structure **: 3-0-0**
SYLLABUS:

Unit -I:

Congestion and Quality of Service (QoS): Data traffic, Congestion, Congestion Control, Open loop and Closed Loop Congestion Control in TCP andFrame Relay, Quality of Service, Flow Characterization, Flow Classes, Need For QoS, Resource Allocation,Best Effort Service Features, Techniques to Improve QoS.

Queue Management: Passive, Active (RED), and Fair (BRED, Choke) Queue Management Schemes, Scheduling, Traffic Shaping, Resource Reservation and Admission Control Scheduling, Integrated and Differential Services.

Unit-II:

Wireless Local Area Networks: Introduction, Wireless LAN Topologies, Wireless LAN Requirements, the Physical Layer, the Medium Access Control (MAC) Layer, Latest Developments.

Wireless Personal Area Networks (WPANs): Introduction to PAN Technology and Applications, Commercial Alternatives- Bluetooth, Home RF.

Wireless Wide Area Networks and MANS: The Cellular Concept, Cellular Architecture, The First-Generation Cellular Systems, The Second- Generation Cellular Systems, The Third- Generation Cellular Systems, Wireless in Local Loop, Wireless ATM, IEEE 802.16 Standard.

Unit-III:

Cellular Systems and Infrastructure- Based Wireless Networks: Cellular Systems Fundamentals, Channel Reuse, SIR and User Capacity, Interference Reduction Techniques, Dynamic Resource Allocation, Fundamental Rate Limits.

Virtual Private Network (VPN): Types of VPN, VPN General Architecture, Disadvantages, VPN Security Issues, VPN Standards.

Unit-IV:

ATM Protocol Reference Model: Introduction, Transmission Convergence (TC) Sub-layer, Physical Medium Dependent (PMD) Sub-layer, Physical Layer Standards for ATM.

ATM Layer: ATM Cell Header Structure at UNI, ATM Cell Header Structure at NNI, ATM Layer Functions.

ATM Adaptation Layer: Service Classes and ATM Adaptation Layer, ATM Adaptation Layer 1 (AAL1), ATM Adaptation Layer 2 (AAL2), ATM Adaptation Layer 3/4 (AAL3/4), ATM Adaptation Layer 5 (AAL5).

ATM Traffic and Service Parameterization: ATM Traffic Parameters, ATM Service Parameters, Factors Affecting QoS Parameters, ATM Service Categories, QoS and QoS Classes.

Unit-V:

Interconnection Networks: Introduction, Banyan Networks- Properties, Crossbar Switch, Three Stage Class Networks, Rearrangeable Networks, Folding Algorithm, Benes Networks, Looping Algorithm, Bit- Allocation Algorithm.

SONET/SDH: SONET/SDH Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks.

Text Books:

1. Wireless Communications - Andrea Goldsmith, 2005, Cambridge University Press.
2. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj,
2004, PHI.
3. Data Communication and Networking - B. A.Forouzan, 2nd updating, 2004,TMH

References:

1. Introduction to Broadband Communication Systems- Sadiku, Mathew N.O., Akujuobi,
Cajetan.M, PHI
2. Wireless Networks- P. Nicopolitidis, A. S. Pomportsis, G. I. Papadimitriou, M. S. Obaidat,
2003, JohnWiley& Sons
3. High Performance TCP / IP Networking – Mahaboob Hassan, Jain Raj, PHI.
4. Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John
Wiley & Sons, 2004.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – II

Course No. : 11-EM-E43
Course Title :Image and Video Processing
Course Structure : 3-0-0
SYLLABUS:

UNIT I

Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System Sampling and Quantization of an image – Basic relationship betweenpixelsImage Transforms: 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet Transforms:Continuous Wavelet Transform, Discrete Wavelet Transforms.

UNIT II

Image Processing Techniques:

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters,Sharpening spatial filters.Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening,Selective filtering.

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region Based segmentation.

UNIT III

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compressionmodels: Lossy& Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards.

UNIT IV

Basic steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models,Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT V 2-D

Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, and Mesh basedMotion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd ed., Pearson.
2. Video processing and communication – Yao Wang, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.

References :

1. Digital Video Processing – M. Tekalp, Prentice Hall International

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – II

Course No. : 12-EM-E44
Course Title : Real Time Operating Systems
Course Structure : 3-1-0
SYLLABUS:
UNIT-I
Review of Operating Systems: Basic Principles, Operating System structures, System Calls, Files, Processes, Design and Implementation of processes, Communication between processes, Introduction to Distributed operating system, Distributed scheduling.
UNIT-II
Overview of RTOS: RTOS Task and Task state, Process Synchronisation- Message queues, Mail boxes, pipes, Critical section, Semaphores, Classical synchronisation problem, Deadlocks
UNIT-III
REAL TIME MODELS AND LANGUAGES: Event Based – Process Based and Graph based Models, Real Time Languages, RTOS Tasks, RT scheduling, Interrupt processing, Synchronization, Control Blocks, Memory Requirements.
UNIT IV
REAL TIME KERNEL: Principles, Design issues, Polled Loop Systems, RTOS Porting to a Target, Comparison and study of various RTOS like QNX, VX works, PSOS, C Executive- Case studies.
UNIT V
RTOS APPLICATION DOMAINS: RTOS for Image Processing, Embedded RTOS for voice over IP, RTOS for fault Tolerant Applications, RTOS for Control Systems.

REFERENCES:
1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
2. Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 1997.
3. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill 1997.
4. Krishna.C.M, Kang, Shin.G, "Real Time Systems", McGraw Hill, 1997.
5. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999.
6. Mukesh Sighal and Shi.N.G "Advanced Concepts in Operating System", McGraw Hill 2000.

KL University
Department of Electronics & Computer Engineering
M.Tech (ES) Elective – II 2011-2012

Course No. **: 12-EM-E45**
Course Title **: Object Oriented Analysis & Design**
Course Structure **: 3-0-0**
SYLLABUS:

UNIT I:

Methodology, Modeling: Object-oriented Methodologies; Rumbaugh et al.'s Object Modeling Technique; The Booch Methodology; The Jacobson et al. Methodologies; Patterns; Frameworks; The Unified Approach.

UNIT II:

Unified Modeling Language: Introduction; Static and Dynamic Models; Modeling ; Introduction to the Unified Modeling Language; UML Diagrams; UML Class Diagram; Use-Case Diagram; UML Dynamic Modeling; Model Management: Packages and Model Organization; UML Extensibility; UML Meta-Model.

UNIT III:

Object-Oriented Analysis: Use-Case Driven: Object-Oriented Analysis Process: Identifying use cases: Introduction; Why Analysis is a Difficult Activity; Business Object Analysis: Understanding the Business Layer; Use-Case Driven Object-Oriented Analysis: The Unified Approach; Business Process Modeling; Use-Case Model; Developing Effective Documentation; Case-Study: Analyzing the Via Net Bank ATM-The Use-Case Driven Process. **Classification:** Introduction; classifications Theory; Approaches for Identifying Classes; Noun Phrase Approach; Common Class Patterns Approach; Use-Case Driven Approach: Identifying Classes and Their Behaviors through Sequence/Collaboration Modeling; Classes, Responsibilities, and Collaborators.

UNIT IV:

Identifying Object Relationships, Attributes, And Methods: Introduction; Associations; Super-Sub Class Relationships; A-Part-of Relationships-Aggregation; Case Study: Relationship Analysis for the Via Net Bank ATM System; Class Responsibility: Identifying Attributes and Methods; Class Responsibility: Defining Attributes by Analyzing Use Cases and Other UML Diagrams; Defining Attributes for Via Net Bank Objects; Object Responsibility: Methods and Messages; Defining Methods for Via Net Bank Objects. **The Object-Oriented Design Process And Design Axioms:** Introduction; The Object-Oriented Design Process; Object-Oriented Design Axioms; Corollaries.

UNIT V:

Designing Classes: Introduction; The Object-Oriented Design Philosophy; UML Object Constraint Language; Designing Classes: The Process; Class Visibility: Designing Well-Defined Public, Private, and Protected Protocols; Designing Classes: Refining Attributes; Refining Attributes for the Via Net Bank Objects; Designing Methods and Protocols; Designing Methods for the Via Net Bank Objects; Packages and Managing Classes. **View Layer:** Designing Interface Objects: Introduction; User Interface Design as a Creative Process; Designing View Layer Classes;

Macro-Level Process: Identifying View Classes by Analyzing Use Cases; Micro-Level Process.

Text Books:

(1) Object Oriented Systems Development by Ali Bahrami Tata McGraw Hill International Editions, Computer Science Series.

Reference Books:

(1) Unified Modeling Language Reference Manual, James Rumbaugh, Jacobson, Booch, PHI.
(2) The Unified Software Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh, Pearson Education.

M. TECH (PED)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

		M.Tech 2012 Batch(PED)		
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	11-EE511	POWER ELECTRONIC CIRCUITS - I	3-1-2	5
2	11-EE512	ELECTRICAL MACHINE MODELING AND ANALYSIS	3-1-0	4
3	11-EE503	OPTIMIZATION TECHNIQUES	3-1-0	4
4	11-EE504	MODERN CONTROL THEORY	3-1-0	4
5		ELECTIVE-1	3-0-0	3
6		ELECTIVE-2	3-0-0	3
7	11-EE509	SEMINAR	0-0-4	2
		TOTAL CREDITS		25
Semester -2				
1	11-EE513	POWER ELECTRONICS CIRCUITS II	3-1-2	5
2	11-EE506	MICRO CONTROLLERS AND EMBEDDED SYSTEMS	3-1-0	4
3	11-EE514	POWER ELECTRONIC CONTROL OF DRIVES	3-1-0	4
4	11-EE515	INTELLIGENT CONTROL OF ELECTRICAL DRIVES	3-1-0	4
5		ELECTIVE-3	3-0-0	3
6		ELECTIVE-4	3-0-0	3
7	11-EE509	TERM PAPER	0-0-4	2
		TOTAL CREDITS		25
Semester -3&4				
1	KLUC505	THESIS		36
Odd Semester Electives				
1	11-EE541	INSTRUMENTATION & CONTROL	3-0-0	3
2	11-EE532	VLSI	3-0-0	3
3	11-EE533	DIGITAL SIGNAL PROCESSING	3-0-0	3
4	11-EE540	SPECIAL MACHINES	3-0-0	3
5	11-EE534	NON CONVENTIONAL ENERGY RESOURCES	3-0-0	3
Even Semester Electives				
1	11-EE535	FACTS	3-0-0	3
2	11-EE544	ELECTRICAL VEHICLES	3-0-0	3
3	11-EE536	STATE ESTIMATION & ADAPTIVE CONTROL	3-0-0	3
4	11-EE542	EMBEDDED CONTROL OF ELECTRIC DRIVES	3-0-0	3
5	11-EE543	AL TECHNIOQUES IN POWER ELECTRONICS & DRIVES	3-0-0	3

POWER ELECTRONICS CIRCUITS – I

Course Code : 11 EE511 **L-T-P : 3-1-2**

Credits : 5

Syllabus:

Unit I : POWER ELECTRONICS DEVICES:

power electronic devices – SCR, Theory of operation of SCR, Two transistor model of SCR, Characteristics and ratings, SCR turn on and turn off methods, Firing circuits, DIAC, TRIAC, IGBT, MOSFET and their characteristics , MTO,ETO , IGCTs , MOS-controlled thyristors(MCTs) – Static Induction Thyristors (SITHs) – Power integrated circuits (PICs) – symbol, structure and equivalent circuit – comparison of their features.

Unit II : NATURAL COMMUTATED CONVERTERS:

AC to DC Converter- single phase controlled rectifier bridge type - with R load- RL load- with and without FWD- analysis & wave forms- three phase controlled rectifier bridge type with R, RL loads with & without FEWD- analysis & waveforms – performance factors of natural commutated converters - advantages- applications - power factor improvements.

Unit III : AC VOLTAGE CONTROLLERS:

Single phase Ac voltage controllers- with R & RL loads- Analysis & waveforms- three phase AC voltage controllers- analysis& wave forms – AC synchronous tap changers - Matrix converters, cyclo converters

Unit IV : PWM INVERTERS (single phase)

Bridge type- Single phase Inverters. MC Murray- Bedford inverter- and their analysis & waveforms – Bridge type three phase Inverters with different modes. CSI-some applications- comparison of VSI & CSI. Simple problems. PWM and their methods, Advanced modulation techniques for improved performance, stepped, harmonic injection and delta modulation, Advantages, application

Unit V : D.C - D.C. Converters.

Analysis of step-down and step-up dc to dc converters with resistive and Resistive-inductive loads – Switched mode regulators – Analysis of Buck Regulators - Boost regulators – buck and boost regulators – Cuk regulators – Condition for continuous inductor current and capacitor voltage – comparison of regulators –Multiouput boost converters – advantages – applications – Numerical problems.

Text books:

1. Power Electronics – Mohammed H. Rashid – Pearson Education –Third Edition – First Indian reprint 2004.
2. . Power Electronics – Ned Mohan, Tore M. Undeland and William P. Robbins – John Wiley AND Sons – Second Edition

Reference Books:

1. Power Electronics by W.Launder
2. Industrial Electronics & Robotics by Shaler & C.Menamee

ELECTRICAL MACHINE MODELING AND ANALYSIS

Course Code : 11 EE512 **L-T-P : 3-1-0**

Credits : 4

Syllabus:

Unit I: Basic concepts of Modeling

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine - voltage, current and Torque equations.

DC Machine Modeling

Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations

Unit II: Reference frame theory

Real time model of a two phase induction machine- Transformation to obtain constant matrices-three phase to two phase transformation-Power equivalence-

Dynamic modeling of three phase Induction Machine

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-Equations in flux linkages-per unit model

Unit III: **Small Signal Modeling of Three Phase Induction Machine**

Small signal equations of Induction machine-derivation-DQ flux linkage model derivation-control principle of Induction machine.

Symmetrical and Unsymmetrical 2 phase Induction Machine

Analysis of symmetrical 2 phase induction machine-voltage and torque equations for unsymmetrical 2 phase induction machine-voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine-analysis of steady state operation of unsymmetrical 2 phase induction machine- single phase induction motor - Cross field theory of single-phase induction machine.

Unit IV: Modeling of Synchronous Machine

Synchronous machine inductances –voltage equations in the rotor's dq0 reference frame-electromagnetic torque-current in terms of flux linkages-simulation of three phase synchronous machine- modeling of PM Synchronous motor.

Unit V: Dynamic Analysis of Synchronous Machine

Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria

Text Books:

1. R. Krishnan, "Electric Motor Drives - Modeling, Analysis& control", Pearson Publications, 1st edition, 2002.

2. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drive systems", IEEE Press, Second Edition.

Reference Books:

1. P.S.Bimbra, "Generalized Theory of Electrical Machines" Khanna publications, 5th edition-1995

2. Dynamic simulation of Electric machinery using Matlab / Simulink –Chee Mun Ong-Prentice Hall.

OPTIMIZATION TECHNIQUES (PED & PS)

Course Code :11 EE503 **L-T-P : 3-1-0**
Credits : 4

Syllabus:

UNIT I: Linear Programming

Standard form of linear programming problem; Simplex method two phase simplex method; revised simplex method. Duality in Linear programming. Some simple numerical problems.

UNIT II: Non-Linear Programming

Fibonacci method, Golden section method, Powell's method, Newton's method, Kuhn-Tucker conditions. Some simple numerical problems.

UNIT III: Transportation Problem

Definition of transportation problem, transportation algorithm, North-West corner method, Vogel approximation method, Least cost method, Hungarian method for assignment. Some simple numerical problems.

UNIT IV: Project planning through Networks

Arrow diagram representation; Rules for constructing an arrow diagram. PERT and CPM, critical path calculations, Earliest start and latest completion times; Determination of floats. Some simple numerical problems.

UNIT V: Dynamic Programming

Multistage decision processes; Types of multistage decision problems, concept of sub-optimization and the principle of sub-optimality computational procedure in dynamic programming. Some simple numerical problems.

Text Books:

1. Engineering optimization theory and practice by S.S. Rao New Age International publications.
2. Operations Research, An introduction by Hamdy A. Taha. PHI learning private Ltd. New Delhi.

Reference Books:

1. Operations Research by S.D. Sharma, Kedarnath & Ramnath Publishers, Delhi.
2. Introduction to operations research Hiller and Liberman.

MODERN CONTROL THEORY (PED & PS)

Course Code : 11 EE504 **L-T-P : 3-1-0**

Credits : 4

Syllabus:

UNIT–I: DIGITAL CONTROL SYSTMES

Introduction, Signal Reconstruction, Difference Equation, Z Transfor Function, Response of Linear Discrete Systems, Z Transform Analysis of Discrete data Control Systems, Z and S Domain Relation ship, Stability of Discrete systems.

UNIT- II: STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS

Introduction, State Descriptions of Digital Processors, State Description of sampled continuous time plants, Solution of State difference equations, Controllability and Observability

UNIT-III : NONLINEAR SYSTEMS

Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions

.UNIT-IV: STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method– Direct method of Lyapunov – Generation of Lyapunov functions – Variable gradient and Krasoviskii's methods – estimation of transients using Lyapunov functions.

UNIT- V : OPTIMAL CONTROL

Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functionals, variation of functionals – fundamental theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator

TEXT BOOKS:

1.M.Gopal – Digital Control and state variable methods, Tata Mcgraw'Hill, 2nd eddition
2.M.Gopal - Modern Control System Theory - New Age International (P.Ltd,) 2nd eddition,1984

REFERENCE BOOKS:

1. Stafani etal , "Design of Feedback control Systems" – Oxford Press, 4th eddition.
2. Ogata K, "Modern Control Engineering," Prentice Hall, 4th eddition.
3. Nagarath IJ and M. Gopal, " Control Systems Engineering"- New Age International Publishers, 5th eddition.

POWER ELECTRONICS CIRICUITS – II

Course Code : 11 EE513 **L-T-P : 3-1-2**
Credits : 5

Syllabus:

UNIT I

Resonant pulse inverters – series resonant inverters – series resonant inverters with unidirectional switches – series resonant inverters with bidirectional Switches – analysis of half bridge resonant inverter – evaluation of currents and Voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – numerical problems.

UNIT II

Frequency response of series resonant inverters – for series loaded inverter – for parallel loaded inverter – For series and parallel loaded inverters – parallel resonant inverters – Voltage control of resonant inverters – class E resonant inverter – class E resonant rectifier – evaluation of values of C's and L's for class E inverter and Class E rectifier – numerical problems.

UNIT II

Multilevel concept – Types of multilevel inverters – Diode clamped multilevel inverter –Improved diode clamped inverter – Flying capacitors multilevel inverter – Cascaded multilevel inverter – Hexagram inverter - Principle & Operations – Switching device currents – DC link capacitor voltage balancing – Features of multilevel inverters – Comparison of multilevel inverters - Applications – numerical problems.

UNIT IV

Resonant converters – zero current switching resonant converters – L type ZCS resonant converter – M type ZCS resonant converter – zero voltage Switching resonant converters – comparison between ZCS and ZVS resonant Converters – Two quadrant ZVS resonant converters – resonant dc-link Inverters – evaluation of L and C for a zero current switching inverter – Numerical problems.

UNIT V

Power supplies - DC power supplies – classification - switched mode dc power supplies – flyback Converter – forward converter – push-pull converter – half bridge converter – Full bridge converter – Resonant d c power supplies – bidirectional power Supplies – Applications - AC power supplies – classification – switched mode ac power supplies – power line disturbances – power conditioners – uninterruptible Power supplies – Renewable uninterruptible Power supplies – applications

TEXT BOOKS:

1. Mohammed H. Rashid , "Power Electronics", Pearson Education, 3rd Edition.
2. Bimal K. Bose, "Modern Power Electronics", PHI publications.

REFERENCE BOOKS:

1. C.V.Lander, "Power Electronics", Mc Graw Hills, International Edition.
2. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics", John Wiley and Sons, 2nd Edition.
3.G.K. Roy, "Non Conventional Energy Sources" Khanna Publicatoins, 1st Edition – 2004.

MICRO CONTROLLERS & EMBEDDED SYSTEMS

Course Code :11 EE506 **L-T-P : 3-1-0**
Credits : 4

Syllabus:

UNIT – I

MICRO CONTROLLERS:

Introduction to Micro controllers - Micro controller families - Features of 8051 Micro controller - 8051 Architecture - Block diagram of 8051 Micro controller - Register organization - Addressing modes - Instruction set - Distinction between CISC and RISC - Assembler directives – Architecture of 16 bit micro controller.

UNIT – II

INTRODUCTION TO EMBEDDED SYSTEMS:

An Embedded System - Embedded System Classification – Components of an Embedded System Hardware - Overview of Processors in the System - Other hardware units - Software embedded into the system - Exemplary Embedded Systems - Embedded System on a Chip (SOC) and the use of VLSI design circuit – Structural units in Processor

UNIT – III

DEVICE NETWORK AND EMBEDDED PROGRAMMING:

Input/output devices – Device I/O types and Examples – Synchronous, Iso-synchronous and Asynchronous communication from Serial Devices – Timer and Counting devices - Programming in Assembly language (ALP) versus High Level Language - C program elements - Macros and functions - Multiple function calls in a cyclic order in the main Function - C Program compiler and Cross compiler

UNIT – IV

REAL TIME OPERATING SYSTEMS:

Operating System services – Goals of an operating system – Process management – Memory management - Device management - File System Organization and Implementation - I/O Subsystem – IEEE Standard POSIX functions for Standardization of RTOS and inter-task communication functions – Inter-Process Communication and Synchronization - OS Security Issues – Mobile OS

UNIT – V

Hardware Software Co-design in an Embedded System:

Embedded System Project management – Embedded System design and Co-Design issues in System development Process – Design cycle in the development phase for an Embedded System – Uses of a Target System or its Emulator and In-Circuit Emulator – Use of software tools for development of an Embedded System – Use of Scopes and logic analyzers for system hardware tests.

Text Books

1. Mazidi & Mc Kinley, " The 8051 Micro controller and Embedded Systems using Assembly and c", 2nd edition.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", TATA McGraw-Hill Publications.

Reference Books

1. Dr.K.V.K.K.Prasad, "Embedded/Real-time Operating System", Dreamtech Press.

POWER ELECTRONIC CONTROL OF DRIVES

Course Code : 11 EE514 **L-T-P : 3-1-0**
Credits : 4

Syllabus:

Unit-I
Control of induction motor, Review of steady-state operation of Induction motor, Equivalent circuit analysis, torque-speed characteristics. Voltage Source Inverter Fed Induction motor drives &Current Source Inverter Fed Induction motor drives. control of induction by Slip power recovery schemes.

Unit-II
Vector control of Induction Motor : Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation.

Unit-III

Control of Synchronous motor drives : Synchronous motor and its characteristics-Control strategies-Constant torque angle control- power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams. PMSM and BLDC control of Drives, control of Variable Reluctance Motor Drive

Unit-IV

Speed control of dc Motors-Different types of speed control techniques by using single phase& three phase ac systems Closed loop control of phase controlled DC motor Drives. Open loop Transfer function of DC Motor drive- Closed loop Transfer function of DC Motor drive –Phase-Locked loop control.

Unit- V

Closed loop control of chopper fed DC motor Drives, Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller – modeling of current controller – design of current controller

Text Books:

1. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications-
2. Electric Motor Drives- R.Krishanan- Prentice Hall, Indian Edition.

REFERENCES:

1. Power Electronics and Motor Control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press
2. Power Electronic Circuits, Devices and Applications – M. H. Rashid – PHI.
3. Fundamentals of Electrical Drives by GK Dubey, Narosa Publishers.

INTELLIGENT CONTROL OF ELECTRIC DRIVES

Course Code : 11 EE515 **L-T-P : 3-1-0**
Credits : 4

Syllabus:

UNIT I
Introduction and motivation. Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.
Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network.

UNIT II
Data Pre-Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Networks: Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox.

UNIT III
Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm.
Concept on some other than GA search techniques like tabu search and ant-colony search techniques for solving optimization problems.

UNIT IV
Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to Fuzzy logic modeling and control of a system. Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases.
Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox.

Unit-V:
Fuzzy logic & Neural network applications to Drives
Fuzzy logic applications**:** Design of Fuzzy PI controller for speed control of DC motor- Flux programming efficiency improvement of three phase induction motor-Induction motor speed control-Slip gain tuning of indirect vector control of induction motor-stator resistance estimation.
Neural network applications**:**-PWM Controller-Selected harmonic elimination PWM-Space vector PWM-Vector controlled drive-feedback signal estimation-speed estimation and flux estimation of induction motor

Text Books:

1. Neural Networks: A comprehensive Foundation – Simon Haykins, Pearson Edition, 2003.
2. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
3. Genetic Algorithms- David E Goldberg.

Reference Books:

1. Principles of Neurocomputing for science and Engineering,- Fredric M.Ham and Ivica Kostanic, McGraw Hill, 2001.
2. Neural Network Fundamentals with Graphs, Algorithms and Applications, N.K. Bose and P.Liang, Mc-Graw Hill, Inc. 1996.
3. Fuzzy logic Intelligence, Control, and Information- John Yen and Reza Langari, Pearson Education, Indian Edition, 2003.

SPECIAL MACHINES (ELECTIVE)

Course Code : 11 EE540 **L-T-P :3-0-0**

Credits : 3

Syllabus:

Unit-I:

Induction generators: self excitation requirements, steady state analysis, voltage regulation, different methods of voltage control, application to mini and micro hydel systems.

Doubly fed induction machines: control via static converter, power flow, voltage/frequency control (generation mode), application to grid connected wind and mini/micro hydel systems.

Unit-II

Brushless DC Machines: construction operation, performance, control and applications.

Micro Machines: principles of operation of various types. Sensors for control, e.g. Position sensor, etc. Recent developments in the area.

Unit-III

Linear Machines: Linear Induction Machines and Linear Synchronous Machines.

Construction, operation, performance, control and applications. PMDC and PM Synchronous Machine, control and applications. Recent developments in electrical machines

Unit-IV

Stepper Motors: Various types, principle of operation, operating characteristics, application. Servo Motors. Servo amplifier and control. Special types of permanent magnet motors for servo application. Various types of specialized actuators. Switched Reluctance Motor: Construction, operating performance, control and applications.

Unit-V: Synchronous And Special Machines

Construction of synchronous machines-types - Induced emf - Voltage regulation; emf and mmf methods - Brushless alternators - Reluctance motor - Hysteresis motor - Stepper motor.

Text Books:

1. P.C Sen, ‘Principles of Electrical Machines and Power Electronics’, Wisley Edition, Second edition, 1997.
2. Gopal K Dubey, ‘Fundamentals of Electrical Drives’ Narosa Publications, Second edition, 2008.
3. J Gnanvadivel, N.Rathina prabha et.el, ‘ELECTRICAL MACHINES’, Anuradha publications.

Reference books:

1. Bimal K. Bose, ‘Modern Power Electronics And AC Drives’, Low Price Edition, First edition.
2. R.K Rajput, ’Electrical Machines’, Laxmi Publications Pvt Ltd, Fifth Edition.

INSTRUMENTATION AND CONTROL (ELECTIVE)

Course Code :11 EE541 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics –sources of error, Classification and elimination of error.open and closed systems Servomechanisms–Examples with block diagrams– Temperature, speed & position control systems.

UNIT II:

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures,measurement of temperature - Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

UNIT – III

MEASUREMENT OF PRESSURE : Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleodpressuregauge.

UNIT – IV

MEASUREMENT OF LEVEL : Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubler level indicators,flow measurement : Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

UNIT – V

MEASUREMENT OF SPEED : Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer Measurement of Acceleration and Vibration Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

TEXT BOOKS :

1. D.S Kumar "Mechanical Measurement Control" 3rd edition, Metropolitan Publishers, 2004.
2. Mechanical Measurements / BeckWith, Marangoni, Linehard, PHI / PE

REFERENCES :

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh/ TMH
2. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.

VLSI DESIGN.(ELECTIVE)

Course Code : 11 EE 532 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

UNIT-I:

Introduction to CMOS circuits: MOS transistors, MOS switches, CMOS logic: Inverter, combinational logic, NAND, NOR gates, compound gates, Multiplexers. Memory: Latches and registers. Circuit and system representations: Behavioral, structural and physical representations

UNIT-II

MOS transistor theory: NMOS, PMOS enhanment mode transistors, Threshold voltage, body effect, MOS device design equations: basic DC equations, second order effects, sub threshold region, channel-length modulation, mobility variation, impact ionization-hot electrons

UNIT-III

MOS models, small signal AC characteristics, CMOS inverter DC characteristics, static load MOS inverters, bipolar devices, CMOS processing technology: An overview of silicon semiconductor technology:

UNIT-IV

basic CMOS technology, CMOS process enhancement, layout design rules, Latch up, technology related CAD issues . CMOS circuit and logic design: CMOS logic gate design: fan in, fan-out, typical CMOS NAND and NOR Delays, transistor sizing.

UNIT-V

Basic physical design of simple logic gates. CMOS logic structures. Clocking strategies: single phase memory structures, PLL techniques, single phase logic structures, two phase clocking, memory structures, And logic structures, I/O Structures: out put pads, input pads.

TEXT BOOK

1. Weste, Eshragian, Principles of CMOS VLSI design, Addison Wesley, 2001.

REFERENCE BOOKS:

1. Douglas A Pucknell and Kamaran Eshragian, Basic VLSI design, 3rd edition, 2001.
2. J.S.Smith, Application Specific Integrated Circuits, Addison Wesley, 2004

DIGITAL SIGNAL PROCESSING (ELECTIVE)

Course Code : 11 EE533 **L-T-P : 3-0-0**
redits : 3

Syllabus:

UNIT-I: Digital Filter Structures:

Introduction- Structure for realization of Discrete systems, Structures for FIR systems, Cascaded and Lattice filter, Structures for IIR Filters- Cascaded and Lattice filters, State space analysis of structures- Solution to state equations.

UNIT-II: Implementation of DTS:

Representation of Numbers- fixed binary, floating, Error in rounding, Trunk - Quantization of Filter coefficients, quantization coefficients in FIR, Round off effects in Filters-Limit cycle oscillations, Scaling to prevent overflow.

UNIT-III: Digital filter design:

General considerations- Design of FIR filter using windows- Design of IIR digital filters-Using Bilinear transformations of IIR filters- FIR filter Design-based on Least Square Method - Design of FIR digital filters with least Square –Inverse(Wiener Filter)- design of IIR digital filters in Frequency domain.

UNIT-IV: Analysis of finite Word length effects:

The Quantization process and errors- Reduction of Product round-off errors using feedback –Quantization of fixed point and floating point Numbers- Analysis of coefficient Quantization effects – Dynamic range scaling- overflow oscillations.

UNIT V: Power Spectrum Estimation:

Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum estimation-Walsh methods-Blackman & Tukey method. – Parametric method for power spectrum Estimation - Minimum variance spectral estimation.

Text Books:

1. Digital Signal Processing principles, Algorithms and Applications – John G. Proakis -PHI –3rd edition-2002.
2. Discrete Time Signal Processing – Alan V. Oppenheim, Ronald W. Shafer - PHI- 1996 1st edition-9th reprint.

Reference Books:

1. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C. Gnanapriya – TMH - 2nd reprint-2001
2. Digital Filter Analysis and Design - Auntonian -TMH

NON CONVENTIONAL ENERGY RESOURCES (ELECTIVE)

Course Code : 11 EE534 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

UNIT I : SOLAR RADIATION

Extraterrestrial solar radiation, terrestrial solar radiation, solar thermal conversion, solar ponds, solar heating/cooling technique, solar distillation, photovoltaic energy conversion, solar cells – 4 models.

UNIT II:WIND ENERGY

Planetary and local winds, vertical axis and horizontal axis wind mills, principles of wind power, maximum power, actual power, wind turbine operation.

UNIT III: ENERGY FROM OCEANS

Ocean temperature differences, principles of OTEC plant operations, wave energy, devices for energy extraction, tides, simple single pool tidal system.

UNIT IV: GEOTHERMAL ENERGY

Origin and types, Bio fuels, classification, direct combustion for heat and electricity generator, anaerobic digestion for biogas, biogas digester, power generation.

UNIT V: MICRO- HYDEL ELECTRIC SYSTEMS:

Power potential –scheme layout-generation efficiency and turbine part flow-geothermal energy extraction.

TEXT BOOKS:

1. Godfrey Boyle "Renewable Energy", Oxford Publications, Second edition.
2. G. D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, First edition.

REFERENCE BOOKS:

1. Roger H.Charlier, Charles W. " Ocean Energy- Tide and Tidal Power"ISBN: Library of Congress Control Number: 2008929624_c Springer-Verlag Brerlin Heidelberg 2009.
2. John Twidell & Toney Weir: E&F.N. Spon, "Renewable Energy Sources", Taylor & Francis New York, 2nd edition.
3. John F.Walker & N.Jenkins, "Wind Energy Technology", John Willey and Sons Chichester, U.K – 1997.

FLEXIBLE AC TRANSMISSION SYSTEMS (ELECTIVE)

Course Code : 11 EE535 **L-T-P : 3-0-0**

Credits : 3

Syllabus:

UNIT – 1 FACTS Concept and General System Considerations

Introduction to Facts devices, Power Flow in AC system, Dynamic stability Considerations and the importance of the controllable parameters, Definitions on FACTS, Basic types of FACTS Controllers, Basic concept of voltage source converters, Single phase, there phase full wave bridge converters operation, Transformer connections for 12 pulse, 24 and 48 pulse operation.

UNIT II CONVERTERS

Three level voltage source converter, pulse width modulation converter, Design of pwm converter to reduce the harmonics, basic concept of current source Converters, Comparison of current source converters with voltage source converters.

UNIT-III Static shunt Compensators

SVC and STATCOM Operation & characteristics and Control of TSC,TSR, STATCOM, Comparison between SVC and STATCOM – STATCOM for transient and dynamic stability enhancement.

UNIT – IV Static Series Compensation

GCSC, TSSC, TCSC and SSSC Operation and Control External system Control for series Compensator SSR and its damping – Static Voltage and Phase angle Regulators - TCVR and TCPAR –Operation and Control.

UNIT –V UPFC and IPFC

The unified power flow Controller – Operation –Comparison with other FACTS devices – control of P and Q – dynamic performance – special Purpose FACTS controllers – Interline Power flow Controller – Operation and Control.

Text Books :

1. N.G Hingorani & L.Gyugyi " Understanding FACTS: Concepts and Technol;ogy of Flexible AC
Transmission System" , IEEE Press,2000
2. K.R.Padiyar "FACTS Controller in power Transmission and Distribution" New Age Int Publisher,2007

Reference Books:

1. Ned Mohan e.al "Power Electronics" John wiley & Sons
2. T.J.E Millor, "Reactive power control in electric Systems" John wiley & sons

ELECTRIC VEHICLES (ELECTIVE)

Course Code : 11 EE544 **L-T-P : 3-0-0**

Credits : 3

Syllabus:

UNIT-I: Introduction to Alternate Propulsion Systems: History and working principle of hybrid vehicles, configurations of hybrid vehicles, case studies of hybrid vehicles, fuel oil reserves and depletion, the need for alternate propulsion devices, introduction to electric vehicle, introduction to hybrid vehicle.

UNIT-II: Motors and Drives: Electromagnetic force, torque production from electromagnets, working principle of DC motor, variants of DC motors, torque-speed characteristics of DC motors, speed control of DC motors, merits and limitations of DC motors, Introduction to AC motors, Induction, permanent magnet and switched reluctance motors: working principle, torque-speed characteristics and control.

UNIT-III: Battery Technology: Energy density of various energy sources and storage devices, basics of battery, working principle, construction, of lead-acid, nickel cadmium, nickel metal hydride and lithium ion batteries, high voltage battery, various configurations of battery, maintenance free and low maintenance battery, recombination battery, AGM and valve regulated battery, battery capacity, current and voltage characteristics during charging and discharging, battery modeling, Peukart Capacity and discharging, battery failure modes, good practices of battery maintenance.

UNIT-IV: Energy Storage Devices for Hybrid Vehicles: Super capacitor, ultra capacitor, fly wheel technology, Vehicle dynamics, tractive effort, aerodynamic resistance, maximum tractive effort limited by ground adhesion, acceleration performance, gradeability, maximum speed of a vehicle, Working principle of fuel cell, various types of fuel cells and details, performance and efficiency of fuel cells, fuel cell voltage pattern, fuel cell vehicles, supply and storage of hydrogen.

UNIT-V: Design of Plug-in Electric Vehicle (EV): Requirement of drive train of EV, various configurations of drive train in EV, transmissions systems, motor sizing for EV, tractive effort and transmission requirement, general EV configuration, Energy consumption pattern in EV, driving pattern in EV, control of EV,Case studies of series and parallel hybrid vehicle design practices.

TEXT BOOKS:

1. Jefferson, C.M., Barnard and R.H., *Hybrid Vehicle Propulsion*, WIT Press, Boston, 2002
2. Husain and Iqbal, *Electric and Hybrid Vehicles : Design Fundamentals*, CRC Press, London, 2003

REFERENCE BOOKS:

1. International Journal of Electric and Hybrid Vehicle, Inderscience Publications.
2. International Journal of Alternate Propulsion, Inderscience Publications.
3. Erjavec, Jack, Arias and Jeff Hybrid, *Electric and Fuel-Cell Vehicles*, Thomson, Australia, 2007

EMBEDDED CONTROL OF ELECTRIC DRIVES (ELECTIVE)

Course Code : 11 EE542 **L-T-P : 3-0-0**

Credits : 3

Syllabus:

UNIT I: MC68HC11 MICROCONTROLLER

Architecture memory organization – Addressing modes – Instruction set – Programming techniques – simple programs

UNIT II: PERIPHERALS OF MC68HC11

I/O ports – handshaking techniques – reset and interrupts – serial communication interface – serial peripheral interface – programmable timer – analog / digital interfacing – cache memory

UNIT III: PIC 16C7X MICROCONTROLLER

Architecture – memory organization – addressing modes – instruction set – programming techniques – simple operation.

UNIT IV: PERIPHERAL OF PIC 16C7X MICROCONTROLLER

Timers – interrupts – I/O ports – I^2C bus for peripheral chip access – A/D converter – VART

UNIT V: SYSTEM DESIGN USING MICROCONTROLLERS

Interfacing LCD display – Keypad interfacing – AC load control – PID control of DC motor – stepper motor control – brush less DC motor control.

TEXT BOOKS:

1. B. Peatman , 'Design with PIC Microcontrollers,' Pearson Education, Asia 2004
2. Michael Khevi, 'The M68HC11 Microcontroller Applications in control, Instrumentation and communication', Prentice Hall, New Jersey, 1997.

REFERENCE BOOK:

1. John B. Peatman, 'Design with Microcontrollers', Mc-Graw Hill

STATE ESTIMATION AND ADAPTIVE CONTROL (ELECTIVE)

Course Code : 11 EE536 **L-T-P : 3-0-0**

Credits : 3

Syllabus:

UNIT I : Elements of Probability Theory

Introduction, Random variables, Probability functions, Expected value, Characteristic function, Independence, Correlation Gaussian distribution, Elements of theory of stochastic processes.

UNIT II : Least Squares Estimation

Least squares and Regression models, Estimation of parameters, Simulation of Recursive estimation, Wiener filtering, General filter optimization.

UNIT III : Optimal Prediction And Filtering For Discrete Systems

Optimal prediction for discrete linear systems, optimal estimation for discrete systems, Kalman filter for discrete linear systems.

UNIT IV : Model Reference Adaptive Schemes

Introduction, MIT Rule, Determination of the adaptation gain, Lyapunov theory, Design of MRAS using Lyapunov theory, Applications of adaptive control.

UNIT V : Robust And Self Oscillating Systems

Robust high gain feedback control, Self oscillating adaptive systems, Variable structure systems, practical issues and implementation.

BOOKS:

1.Stochastic optimal linear estimation and control by J.S. Meditch, McGraw Hill book company
2.Adaptive control by Karl J. Astrom and Bjorn Witten Mark second edition, Pearson Education; 2006

AI TECHNIQUES IN POWER ELECTRONICS & DRIVES (ELECTIVE)

Course Code :11 EE543 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

UNIT-I : ARTIFICIAL NEURAL NETWORK

Fundamentals of artificial neural networks – Basic concepts of neural networks - Biological Prototype - Artificial neuron – Basic models of artificial neural networks – connections – learning - Activation functions - Important terminologies of ANN - Neural Network Architecture - Single layer artificial neuron networks - Multilayer artificial neuron networks – Recurrent networks.

UNIT-II : SUPERVISED LEARNING NETWORK

Perceptron Network – Perceptron learning rule - Architecture- Perceptron training algorithms – Adaline – Architecture – Madaline - Architecture – Training Algorithms - Architecture of Back Propagation Network- Back Propagation Learning – Back Propagation Algorithms.

UNIT-III : FUZZY LOGIC

Introduction – Fuzzy sets - basic Fuzzy set operations – Properties of Fuzzy sets - Membership function - features of membership function - Fuzzy Inference Systems - Methods of FIS – defuzzification methods – centroid method – weighted average method

UNIT-IV: GENETIC ALGORITHMS

Introduction- Characteristics of Genetic algorithms- Basic operators and Terminologies in GAs - search space – Effects of Genetic operators - Traditional Algorithm Vs Genetic Algorithm -Simple GA - General Genetic Algorithm

UNIT-V: APPLICATIONS OF POWER ELECTRONICS & DRIVES

Neural network based Control: Neural network based Control of DC Motor Drive, Neural network based Control of Induction Motor, Neural network based Control of Stepper Motor - Fuzzy Logic Control: Fuzzy Logic Control of DC Motor Drive, Fuzzy Logic Control of Induction Motor, Fuzzy Logic Control of Stepper Motor

TEXT BOOKS

1. S.N.Sivanandam & S.N.Deepa, “Principles of Soft Computing”, Wiley India (P) Ltd., 1st Indian Edition 2008
2. Alok Jain, ‘Power Electronics & its Applications”, Penram international Publishing, Second Edition

REFERENCE BOOK

1. J.S.R. Jang, C.T. Sun and E. Mizutani “Neuro Fuzzy and Soft Computing”, Pearson Education.

M. TECH (POWER SYSTEMS)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

		M.Tech 2012 Batch(PS)		
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	11-EE501	POWER SYSTEM ANALYSIS AND DYNAMICS	3-1-2	5
2	11-EE502	EHVAC AND HVDC TRANSMISSION	3-1-0	4
3	11-EE503	OPTIMIZATION TECHNIQUES	3-1-0	4
4	11-EE504	MODERN CONTROL THEORY	3-1-0	4
5		ELECTIVE-1	3-0-0	3
6		ELECTIVE-2	3-0-0	3
7	11-EE509	SEMINAR	0-0-4	2
		TOTAL CREDITS		25
Semester -2				
1	11-EE505	REAL TIME CONTROL OF POWER SYSTEMS	3-1-2	5
2	11-EE506	MICRO CONTROLLERS AND EMBEDDED SYSTEMS	3-1-0	4
3	11-EE507	POWER SYSTEMS PROTECTION	3-1-0	4
4	11-EE508	POWER QUALITY	3-1-0	4
5		ELECTIVE-3	3-0-0	3
6		ELECTIVE-4	3-0-0	3
7	11-EE509	TERM PAPER	0-0-4	2
		TOTAL CREDITS		25
Semester -3&4				
1	KLUC505	THESIS		36
Odd Semester Electives				
1	11-EE530	REACTIVE POWER COMPENSATION & MANAGEMENT	3-0-0	3
2	11-EE532	VLSI	3-0-0	3
3	11-EE531	DISTRIBUTION SYSTEM PLANNING & AUTOMATION	3-0-0	3
4	11-EE534	NON CONVENTIONAL ENERGY RESOURCES	3-0-0	3
5	11-EE533	DIGITAL SIGNAL PROCESSING	3-0-0	3
Even Semeter Electives				
1	11-EE536	STATE ESTIMATION & ADAPTIVE CONTROL	3-0-0	3
2	11-EE535	FACTS	3-0-0	3
3	11-EE539	AL TECHNIQUES IN POWER SYSTEMS	3-0-0	3
4	11-EE537	POWER SYSTEM RESTRUCTURING & DEREGULATION	3-0-0	3
5	11-EE538	ENERGY CONSERVATION & AUDIT	3-0-0	3

POWER SYSTEM ANALYSIS AND DYNAMICS

Course Code : 11 EE501 **L-T-P : 3-1-2**

Credits : 5

Syllabus:

UNIT-I: POWER SYSTEM STABILITY

Basic definitions, statement of the problem, elementary model, Swing equations, power angle equations, Natural frequencies of oscillations, and single-machine-infinite bus system-Equal area criterion-classical model of a multi machines systems.

UNIT-II: RESPONSE TO SMALL DISTURBANCES

The unregulated synchronous machine, Modes of oscillations of an unregulated multi machine system, regenerated synchronous machine, Distribution of power impacts.

UNIT-III: SYNCHRONOUS MACHINE

Reactance and Time constants of a synchronous machine- Basic notions and relation to short circuit oscillogram. Circuit equations of Synchronous machine and parks Transformations, Vector diagrams in steady state and transient state, Power angle curves of a salient pole machine, a procedure for multi machines systems, effect of saturation, effect of damper windings as stability, damper action explained by theory of induction - motor.

UNIT-IV: EXCITATION SYSTEMS

Typical Excitations configurations and excitation, (Automatic) Voltage regulators, Exciter Build- up, excitation system response and computer representations of excitations systems (types 1, 2, 3 and 4).

UNIT-V: EFFECT OF EXCITATION ON STABILITY

Effect on (a) Power limits, (b) Transient stability, (c) Dynamic stability, approximate excitation system representation, supplementary stabilizing signals.

Text Books:

1. P.M.Anderson and A.A.Foud, "Power System Control and Stability", The IOWA state university press: AMES, IOWA, USA-GALGOTIA Publications (Indian English Language Edn.1981).
2. Edward Wilson Kim bark, "Power System Stability: Synchronous Machines", Volume 3 Dover publications Inc., New York(1961)

Reference Books:

1. M. Powella & P. G. Murthy, "Transient Stability of Power Systems - Theory & Practice", John Wiley Publications.(1994).

EHVAC & HVDC TRANSMISSION

Course Code : 11 EE502 **L-T-P : 3-1-0**

Credits : 4

Syllabus:

UNIT-I: Introduction:

Need of EHV transmission, Limitations, Comparison of EHV-AC & HVDC transmission, Interconnected Network and Role of Interconnecting Transmission Lines.

UNIT-II : EHV-AC Transmission:

Parameters of EHV line, over-voltages due to switching, Ferro resonance, line insulator and clearance, corona, long distance transmission with series & shunt compensations, principle of half wave transmission, flexible ac transmission.

UNIT-III: HV DC Transmission

Types of dc links, terminal equipments & their operations, HVDC system control, reactive power control, harmonics, multiterminal dc (MTDC) system, ac/dc system analysis, protection of terminal equipments.

UNIT-IV: Insulation Requirement of EHV-AC and HVDC

Classification, Insulation design aspect, Difference between Insulation Coordination-EHV-AC and HVDC, Insulation Coordination, Surge arrester protection in HVDC and EHV-AC Substation, Clearance for HVDC and EHV-AC.

UNIT-V: Towers for (EHV-AC and HVDC)

Types and configuration of self supporting and flexible towers, Foundation of towers, mechanical design of towers Tower design based on switching surges and lightning strokes.

TEXT BOOKS:

1. K. R. Padiyar, HVDC Power Transmission System, Wiley Eastern Limited.
2. EHV-AC, HVDC Transmission and Distribution Engineering, S. Rao, Khanna Publications.

REFERENCE BOOKS:

1. Rakesh Das Begmudre, Extra High Voltage AC Transmission Engineering, Wiley Eastern Limited
2. E.W.Kimbark, EHV-AC and HVDC Transmission Engineering &Practice, Khanna Publishers.

OPTIMIZATION TECHNIQUES (PED & PS)

Course Code :11 EE503 **L-T-P : 3-1-0**

Credits : 4

Syllabus:

UNIT I: Linear Programming

Standard form of linear programming problem; Simplex method two phase simplex method; revised simplex method. Duality in Linear programming. Some simple numerical problems.

UNIT II: Non-Linear Programming

Fibonacci method, Golden section method, Powell's method, Newton's method, Kuhn-Tucker conditions. Some simple numerical problems.

UNIT III: Transportation Problem

Definition of transportation problem, transportation algorithm, North-West corner method, Vogel approximation method, Least cost method, Hungarian method for assignment. Some simple numerical problems.

UNIT IV: Project planning through Networks

Arrow diagram representation; Rules for constructing an arrow diagram. PERT and CPM, critical path calculations, Earliest start and latest completion times; Determination of floats. Some simple numerical problems.

UNIT V: Dynamic Programming

Multistage decision processes; Types of multistage decision problems, concept of sub-optimization and the principle of sub-optimality computational procedure in dynamic programming. Some simple numerical problems.

Text Books:

1. Engineering optimization theory and practice by S.S. Rao New Age International publications.
2. Operations Research, An introduction by Hamdy A. Taha. PHI learning private Ltd. New Delhi.

Reference Books:

1. Operations Research by S.D. Sharma, Kedarnath & Ramnath Publishers, Delhi.
2. Introduction to operations research Hiller and Liberman.

MODERN CONTROL THEORY (PED & PS)

Course Code : 11 EE504 **L-T-P : 3-1-0**
Credits : 4

Syllabus:
UNIT–I:

DIGITALCONTROLSYSTMES
Introduction, Signal Reconstruction, Difference Equation, Z Transfor Function, Response of Linear Discrete Systems, Z Transform Analysis of Discrete data Control Systems, Z and S Domain Relation ship, Stability of Discrete systems.

UNIT- II: STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS

Introduction, State Descriptions of Digital Processors, State Description of sampled continuous time plants, Solution of State difference equations, Controllability and Observability

UNIT-III : NONLINEAR SYSTEMS

Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions

UNIT-IV: STABILITY ANALYSIS
Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method– Direct method of Lyapunov – Generation of Lyapunov functions – Variable gradient and Krasoviskii's methods – estimation of transients using Lyapunov functions.

UNIT- V : OPTIMAL CONTROL

Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functionals, variation of functionals – fundamental theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator

TEXT BOOKS:
1.M.Gopal – Digital Control and state variable methods, Tata Mcgraw'Hill, 2nd eddition
2.M.Gopal - Modern Control System Theory - New Age International (P.Ltd,) 2nd eddition,1984

REFERENCE BOOKS:
1. Stafani etal , "Design of Feedback control Systems" – Oxford Press, 4th eddition.
2. Ogata K, "Modern Control Engineering," Prentice Hall, 4th eddition.
3. Nagarath IJ and M. Gopal, " Control Systems Engineering"- New Age International Publishers, 5th eddition.

REAL TIME CONTROL OF POWER SYSTEM

Course Code : 11 EE505 **L-T-P : 3-1-2**
Credits : 5

Syllabus:

UNIT – I
Unit Commitment Problem: Introductions to UCP, thermal & Hydral constraints in Unit commitment-Economic Dispatch: Economic importance -characteristics of thermal, nuclear and hydro-generator units - Economic dispatch problem –Thermal system dispatch with network losses – line loss formula –The Lambda iteration method – first order gradient method – base point and participation factors – Economic dispatch Vs unit commitment.

UNIT – II
Load frequency control-I: Definition of control area – single area control – Block diagram representation – steady state analysis – dynamic response – proportional plus integral control of single area block diagrams – AGC multi area system –static and dynamic response – tie line bias control – Inter connected systems- Automatic voltage control

UNIT – III
Load Frequency Control-II: Load frequency control of 2-area system -uncontrolled case and controlled case- tie-time bias control.

UNIT – IV
Computer control of power systems: Energy control centre – various levels – SCADA system – computer configuration functions – monitoring – data acquisition and controls – EMS system – expert system applications for power system operation. Communication protocol IEC61850
Security control: Security analysis and monitoring – system operating states by security control functions – generator and line outages by linear sensitivity factors.

UNIT – V
State estimation: Power system state estimation – Weighted least square state estimation – state estimation of AC network. Treatment of bad data – network observability and pseudo measurements.

Text Books

1. Allen J. Wood and Bruce F. Wollenberg "Power Generation, Operation & Control" 2nd edition, John Wiley and Sons.
2. I.J. Nagarath & D. P. Kothari , "Modern power system analysis" 3rd Edition, TMH

Reference Books

1. I. Elgard , "Electric Energy Systems Theory – An Introduction" TMH.
2. Abhijit Chakrabarti & Sunita Halder " Power System Analysis operation and Control " 1st edition, PHI
3. Mahalanabis A.K., Kothari D.P. and Ahson S.I., "Computer aided power system analysis and control", TMH

POWER SYSTEM PROTECTION

Course Code : 11 EE507 **L-T-P : 4-0-0**
Credits : 4

Syllabus:

UNIT-I
Need for protection systems: Nature and causes of faults, types of faults, effects of faults, fault statistics, evolution of protective relays, zones of protection, primary & back up protection, essential qualities of protection, classification of protective relays and schemes, CT, PT, summation transformer, phase-sequence current segregating network.

UNIT-II
Protection of Power System Equipment - Generator, Transformer, Generator-Transformer Units, Transmission Systems, Bus-bars, Motors.

UNIT-III
Pilot wire and Carrier Current Schemes; Use of optical fibers for protection schemes. System grounding –ground faults and protection; Load shedding and frequency relaying; Out of step relaying; Re-closing and synchronizing

UNIT-IV
Static Relays: Advantages of static relays, working principles of static impedance, static reactance using phase comparator, static distance, static over current, static differential relay using amplitude comparator, use of sampling comparator.

UNIT-V
Microprocessor based protection relays – Working principles of μP based over current, impedance, reactance directional, reactance (distance) & mho relays – digital relaying algorithms, various transform techniques employed like discrete Fourier, Walsh-Hadamard, Haar, microprocessor implementation of digital distance relaying algorithms – protection of lines against lightning & traveling waves.

TEXT BOOKS:

1. T.S. Madhava Rao, "Power System Protection: Static Relays With Microprocessor Applications", Tata McGraw-Hill, 2nd edition.
2. Badri Ram & DN Viswakarma, "Power System Protection & Switch Gear", McGraw Hill

REFERENCE BOOKS:

1. A.R. Van C. Washington, "Protective Relays Their Theory & Practice", Vol.I & II, John Wiley & Sons.
2. Singh L.P ,Digital Protection, Protective Relaying from Electromechanical to Microprocessor, John Wiley & Sons, 1994
3. D. Robertson, "Power System Protection – Reference Manual", Oriel Press, London, 1982.
4. C.R. Mason, "The art and science of protective relaying", John Wiley &sons.
5. S. Sunil Rao, "Switch Gear & Protection", Khanna Publisher's, Delhi.

POWER QUALITY

Course Code : 11 EE508 **L-T-P : 4-0-0**

Credits : 4

Syllabus:

Unit I: Introduction

Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring

Unit II: Long Interruptions

Interruptions – Definition – Difference between failure, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – Short interruptions

Unit III: Short Interruptions

Definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

Unit IV: Voltage sag – characterization – Single phase

Voltage sag – definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration - Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

Unit V: Mitigation of Interruptions and Voltage Sags

Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Text books:

1. Math H J Bollen, "Understanding Power Quality Problems: voltage sags and interruptions", Wiley-IEEE Press, 1999.
2. Roger C Dugan, Surya Santoso, Mark F. McGranaghan, H. Wayne Beaty, "Electrical power systems quality", Second edition, 2002.

Reference Book:

1. Angelo Baggini, "Hand book of power quality", wiley publications, 2008.

REACTIVE POWER COMPENSATION AND MANAGEMENT (ELECTIVE-1)

Course Code : 11 EE530 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

LOAD COMPENSATION: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- example.: Steady – state reactive power compensation in transmission system: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples. **TRANSIENT STATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEMS:** Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers –**:** Reactive power coordination: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences. **DEMAND SIDE MANAGEMENT:** Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels**:** Distribution side Reactive power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks . **USER SIDE REACTIVE POWER MANAGEMENT:** KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations. **REACTIVE POWER MANAGEMENT IN ELECTRIC TRACTION SYSTEMS AND ARC FURNACES:** Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations-furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

TEXT BOOKS:

1. T.J.E.Miller, “Reactive power control in Electric power systems”, John Wiley and sons, 1982.
2. D. M. Tagare, “Reactive power Management”, Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Hong Chen, “Practices of reactive power management and compensation”, PJM Interconnection, Norristown, PA;
2. T E Miller, “Reactive Power Control in Power Systems”, John Wiley, 1982.

DISTRIBUTION SYSTEM PLANNING & AUTOMATION (ELECTIVE)

Course Code : 11 EE531 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

Unit-I: Distribution system planning and load characteristics:
Planning and forecasting techniques, present and future role of computer, load characteristics, load forecasting, methods of forecasting, regression analysis, correlation analysis and time series analysis, load management, tariff, diversified demand method, and metering of energy.

Unit-II: Distribution transformers:
Types, Regulation and Efficiency, use of monograms for obtaining efficiency, distribution factors, KW-KVA-Method of determining regulation.
Design of sub transmission lines and distribution substation: Introduction, sub transmission systems, distribution substation, substation bus schemes, description and comparison of switching schemes, substation location and rating, application of network flow techniques in rural distribution networks to determine optimum location of substation.

Unit-III: Design considerations on primary systems:
Introduction, types of feeders, voltage levels, radial type feeders, feeders with uniformly distributed load and non-uniformly distributed loads.
Design considerations of secondary systems: Introduction, secondary voltage levels, secondary banking existing systems improvement.

Unit-IV: Capacitors in distribution systems and distribution system protection:
Effects of series and shunt capacitors, justification of capacitors, procedure to determine optimum capacitor size and location, basic definition and types of over current protection device, objective of distribution system protection, coordination of protective devices.

Unit-V: Distribution system automation:
Reforms in power sector, methods of improvement, reconfiguration, reinforcement, automation, communication systems, sensors, automation systems architecture, software and open architecture, RTU and data communication, SCADA requirement and application functions, GIS/GPS based mapping of distribution network, communication protocol for distribution systems, integrated substation, metering systems, revenue improvement, issuing multiyear tariff and availability based tariff, Grounding system: earth and safety, nature and size of earth electrodes, design of earthing schemes.

Text Books:

1. Electrical Power Distribution Engineering by Turan Gonen, McGraw Hill.

Reference Books:

1. Electrical Power Distribution by A. S. Pabla, TMH, 5th Ed., 2004.

NON CONVENTIONAL ENERGY RESOURCES (PED & PS)

Course Code : 11 EE534 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

UNIT I : SOLAR RADIATION
Extraterrestrial solar radiation, terrestrial solar radiation, solar thermal conversion, solar ponds, solar heating/cooling technique, solar distillation, photovoltaic energy conversion, solar cells – 4 models.

UNIT II:WIND ENERGY
Planetary and local winds, vertical axis and horizontal axis wind mills, principles of wind power, maximum power, actual power, wind turbine operation.

UNIT III: ENERGY FROM OCEANS
Ocean temperature differences, principles of OTEC plant operations, wave energy, devices for energy extraction, tides, simple single pool tidal system.

UNIT IV: GEOTHERMAL ENERGY
Origin and types, Bio fuels, classification, direct combustion for heat and electricity generator, anaerobic digestion for biogas, biogas digester, power generation.

UNIT V: MICRO- HYDEL ELECTRIC SYSTEMS:
Power potential –scheme layout-generation efficiency and turbine part flow-geothermal energy extraction.

Text books:

1.Godfrey Boyle "Renewable Energy", Oxford Publications, Second edition.
2.G. D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, First edition.

Reference books:

1.Roger H.Charlier, Charles W. " Ocean Energy- Tide and Tidal Power"ISBN: Library of Congress Control Number: 2008929624_c Springer-Verlag Brerlin Heidelberg 2009.
2.John Twidell & Toney Weir: E&F.N. Spon, "Renewable Energy Sources", Taylor & Francis New York, 2nd edition.
3.John F.Walker & N.Jenkins, "Wind Energy Technology", John Willey and Sons Chichester, U.K – 1997.

VLSI DESIGN.(ELECTIVE)

Course Code : 11 EE 532 **L-T-P : 0-0-3**

Credits : 3

Syllabus:

UNIT-I:

Introduction to CMOS circuits: MOS transistors, MOS switches, CMOS logic: Inverter, combinational logic, NAND, NOR gates, compound gates, Multiplexers. Memory: Latches and registers. Circuit and system representations: Behavioral, structural and physical representations

UNIT-II

MOS transistor theory: NMOS, PMOS enhanment mode transistors, Threshold voltage, body effect, MOS device design equations: basic DC equations, second order effects, sub threshold region, channel-length modulation, mobility variation, impact ionization-hot electrons

UNIT-III

MOS models, small signal AC characteristics, CMOS inverter DC characteristics, static load MOS inverters, bipolar devices, CMOS processing technology: An overview of silicon semiconductor technology:

UNIT-IV

basic CMOS technology, CMOS process enhancement, layout design rules, Latch up, technology related CAD issues . CMOS circuit and logic design: CMOS logic gate design: fan in, fan-out, typical CMOS NAND and NOR Delays, transistor sizing.

UNIT-V

Basic physical design of simple logic gates. CMOS logic structures. Clocking strategies: single phase memory structures, PLL techniques, single phase logic structures, two phase clocking, memory structures, And logic structures, I/O Structures: out put pads, input pads.

TEXT BOOK

1.Weste, Eshragian, Principles of CMOS VLSI design, Addison Wesley, 2001.

REFERENCE BOOKS:

1. Douglas A Pucknell and Kamaran Eshragian, Basic VLSI design, 3rd edition, 2001.

2. J.S.Smith, Application Specific Integrated Circuits, Addison Wesley, 2004

DIGITAL SIGNAL PROCESSING (ELECTIVE)

Course Code : 11 EE533 **L-T-P : 0-0-3**
Credits : 3

Syllabus:

UNIT-I: Digital Filter Structures:

Introduction- Structure for realization of Discrete systems, Structures for FIR systems, Cascaded and Lattice filter, Structures for IIR Filters- Cascaded and Lattice filters, State space analysis of structures- Solution to state equations.

UNIT-II: Implementation of DTS:

Representation of Numbers- fixed binary, floating, Error in rounding, Trunk - Quantization of Filter coefficients, quantization coefficients in FIR, Round off effects in Filters-Limit cycle oscillations, Scaling to prevent overflow.

UNIT-III: Digital filter design:

General considerations- Design of FIR filter using windows- Design of IIR digital filters-Using Bilinear transformations of IIR filters- FIR filter Design-based on Least Square Method - Design of FIR digital filters with least Square –Inverse(Wiener Filter)- design of IIR digital filters in Frequency domain.

UNIT-IV: Analysis of finite Word length effects:

The Quantization process and errors- Reduction of Product round-off errors using feedback –Quantization of fixed point and floating point Numbers- Analysis of coefficient Quantization effects – Dynamic range scaling- overflow oscillations.

UNIT V: Power Spectrum Estimation:

Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum estimation-Walsh methods-Blackman & Tukey method. – Parametric method for power spectrum Estimation - Minimum variance spectral estimation.

Text Books:

1.Digital Signal Processing principles, Algorithms and Applications – John G. Proakis -PHI –3rd edition-2002.

2. Discrete Time Signal Processing – Alan V. Oppenheim, Ronald W. Shafer - PHI-1996 1st edition-9th reprint.

Reference Books:

3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C. Gnanapriya – TMH - 2nd reprint-2001

4. Digital Filter Analysis and Design - Auntonian -TMH

AI TECHNIQUES IN POWER SYSTEMS

Course Code : 11 EE539 **L-T-P : 3-0-0**
Credits : 3

SYLLABUS:

UNIT-I

ARTIFICIAL NEURAL NETWORK: Fundamentals of artificial neural networks – Basic concepts of neural networks - Biological Prototype - Artificial neuron – Basic models of artificial neural networks - connections– learning - Activation functions - Important terminologies of ANN - Neural Network Architecture - Single layer artificial neuron networks - Multilayer artificial neuron networks – Recurrent networks.

UNIT-II

SUPERVISED LEARNING NETWORK: Perceptron Network – Perceptron learning rule - Architecture- Perceptron training algorithms – Adaline – Architecture –Madaline - Architecture – Training Algorithms - Architecture of Back Propagation Network- Back Propagation Learning– Input layer computation– Hidden layer computation – Output layer computation– Back Propagation Algorithms.

UNIT-III

FUZZY LOGIC: Introduction – Fuzzy sets- basic Fuzzy set operations – Properties of Fuzzy sets - Membership function- features of membership function - Fuzzy Inference Systems - Methods of FIS – defuzzification methods – centroid method – weighted average method.

UNIT-IV

GENETIC ALGORITHMS: Introduction- Characteristics of Genetic algorithms- Basic operators and Terminologies in Gas - search space – Effects of Genetic operators - Traditional Algorithm Vs Genetic Algorithm -Simple GA - General Genetic Algorithm.

UNIT-V

APPLICATION TO ELECTRICAL SYSTEMS: ANN based Short Term Load Forecasting - load flow studies - Fuzzy Logic based Unit Commitment and Genetic Algorithm based Economic Dispatch.

Text Books:

1. S.N.Sivanandam & S.N.Deepa, "Principles of Soft Computing", Wiley India (P) Ltd., 1st Indian Edition 2008.
2. J.S.R. Jang, C.T. Sun, E. Mizutani "Neuro Fuzzy and Soft Computing", Pearson education.

Reference Books:

1. D.E Goldberg," Genetic Algorithms", Addison – Wisley 1999.
2. Bast kosko, "Neural networks &Fuzzy systems", Prentice Hall.

STATE ESTIMATION & ADAPTIVE CONTROL (ELECTIVE-4)

(Common to Both PED & PS)

Course Code : 11 EE536 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

Elements of probability theory: definition of probability and random variable, probability functions, expected value, mean and covariance, independence and correlation, Gaussian distribution and its properties.

Stochastic processes and system models: Elements of the theory of stochastic processes, mean value function and covariance kernel, independent and correlated stochastic processes, stationery and non sequence model, Gaussian white process.

Non parametric methods & parametric methods: Nonparametric methods: Transient analysis-frequency analysis-Correlation analysis-Spectral analysis. Liner Regression: The Lease square estimate-best liner unbiased estimation under linear constraints-Prediction error methods: Description of Prediction error methods-Optimal Prediction –relationships between Prediction error methods and other identification methods theoretical analysis.

Adaptive control schemes Introduction – users- Definitions-auto tuning-types of adaptive control-gain scheduling controller-model reference adaptive control schemes – self tuning controller. MRAC and STC: Approaches – The Gradient approach – Lyapunov functions – Passivity theory – pole placement method Minimum variance control – Predictive control.

Adaptive control and application: Stability – Convergence – Robustness – Application of adaptive control, direct model reference adaptive control. Introduction: Basic approaches to adaptive control. Applications of adaptive control. Identification: Error formulations linear in the parameters. Direct adaptive control: Linear error equations with dynamics. Gradient and pseudo-gradient algorithms. Strictly positive real transfer functions. Kalman-Yacubovitch-Popov lemma. Passivity theory.

TEXT BOOKS:

1. Dan Simon, “Optimal State Estimation”, Wiley Intersience, 2006.
2. S. Sastry and M. Bodson, Adaptive Control: Stability, Convergence, and Robustness, Prentice-Hall, 1989.

REFERENCE BOOKS:

1. K.J. Astrom and B. Wittenmark, Adaptive Control, Addison-Wesley, 2nd edition, 1995.
2. I.D. Landau, R. Lozano, and M. M'Saad, Adaptive Control, Springer Verlag, London, 1998.
3. Meditch, “Stochastic Optimal Linear Estimation and Control” Mc-Graw Hill Company, 1969.
4. K.S. Narendra and A.M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989.

FLEXIBLE AC TRANSMISSION SYSTEMS (Common for PS & PED)

Course Code : 11 EE535 **L-T-P : 3-0-0**

Credits : 3

Syllabus:

UNIT – I

FACTS and CONVERTER Concepts

Introduction to FACTS devices, Power Flow in AC system , Dynamic stability Consideration and the importance of the controllable parameter , Definition of FACTS , Basic types of FACTS Controllers, Basic concepts on voltage source converters, basic concepts of current source Converter, Comparison of current converters with voltage source converters, concepts on PWM technique and Three level voltage Source converter

UNIT – II

Static Shunt Compensators

SVC and STATCOM Operation & Characteristics and Control of TSC, TSR, STATCOM, comparison between SVC and STATCOM, STATCOM for transient and dynamic stability enhancement.

UNIT – III

Static series Compensators

GCSC,TSSC,TCSC and SSSC Operation and Control External system control for series Compensator SSR and its damping, Static Voltage and Phase angle Regulator, TCVR and TCPAR Operation and Control.

UNIT – IV

UPFC and IPFC

The Unified Power Flow Controller Operation, Comparison with other FACTS devices, control of P and Q, Dynamic Performance, Special purpose of FACTS Controllers, Interline Power Flow Controller Operation and Control.

UNIT –V

Custom Power devices

Introduction to custom power devices, Shunt active filter for power distribution system, Reactive power compensation by series connected compensator, Load Compensation & Distribution STATCOM, Application of STATCOM for reactive power compensation and voltage regulation, Concepts of DVR, UPQC.

Text Books:

1) N.G. Hingorani & L. Gyugyi " Understanding FACTS: Concepts and technology of Flexible AC Transmission System" , IEEE press, 2000
2) K.R. Padiyar, "FACTS Controllers In Power Transmission and Distribution" , New Age Int Publisher, 2007

Reference Books:

1) Ned Mohan et. al. "power Electronics" John Wiley & Sons
2) T.J.E. Miller, " Reactive Power Control in Electric Systems", John Wiley & Sons

ENERGY CONSERVATION & AUDIT

Course Code : 11 EE537 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

BASIC PRINCIPLES OF ENERGY AUDIT: Energy audit- definitions, concept, types of audit, energy index, cost index, pie-charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

ENERGY MANAGEMENT:
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting - Energy manger, Qualities and functions, language, Questionnaire - check list for top management. Demand side management.

ENERGY EFFICIENT MOTORS: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage van at ion-voltage unbalance- over motoring- motor energy audit.

POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS: Power factor - methods of improvement, location of capacitors, PF with non linear loads, effect of harmonics on PF , PF motor controllers - Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's.

ECONOMIC ASPECTS AND ANALYSIS: Economics Analysis - Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Energy efficient measures- calculation of simple payback method, net present worth method - Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

Text Books:

1. W.C.Turner, "Energy management hand book", John wiley and sons Energy management and good lighting practice: fuel efficiency- book let 12-EEO
2. W.K. Murphy, G- Mckay Butier worth, "Energy management", Heine mann publications, (20070.

Reference Books:

1. Paulo Callaghan, "Energy management", 1st edition, Mc-graw Hill Book company, (1998)
2. Giovanni and Petrecca, "Industrial Energy Management: Principles and Applications", The Kluwer international series-207 (1999)
3. Howard E.Jordan, "Energy-Efficient Electric Motors and their applications", Plenum pub corp; 2nd ed. (1994)

POWER SYSTEM RESTRUCTURING, DEREGULATION & POWER MARKETS

Course Code : 15 EE 538 **L-T-P : 3-0-0**
Credits : 3

Syllabus:

Key Issues in Electric Utilities Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion. Open Access Same-time Information System (OASIS) Structure of OASIS - Posting of Information – Transfer capability on OASIS.

Available Transfer Capability (ATC) Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow. **Electricity Pricing** Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

Power System Operation in Competitive Environment Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets Operational Planning Activities of a GENCO. **Market Power :** Introduction - Different types of market Power – Mitigation of Market Power - Examples.

Transmission Congestion Management : Introduction - Transmission Cost Allocation Methods : Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

Text Books:

1. Loi Lei Lai, "Power System Restructuring and Deregulation", John Wiley & Sons Ltd., England, (2001).
2. Kankar Bhattacharya, "Operation of Restructured Power System", Math H.J. Boller and Jaap E.Daalder Kulwer Academic Publishers, (2001).

Reference Books:

1. Mohammad Shahidehpour and Muwaffaq alomoush, "Restructured Electrical Power Systems", Marcel Dekker, Inc., (2001).
2. P. Venkatesh,B V Manikandan,S Charles Raja and A Srinivasa Rao, "Electric Power System Analysis, Security & Deregulation", PHI, (2012).

M.TECH IN THERMAL ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

MTECH IN THERMAL ENGINEERING

DEPARTMENT OF MECHANICAL				
S.No	**Course Code**	**Course Title**	**L-T-P**	**Credits**
Semester -1				
1	11ME501	ADVANCED ENGINEERING THERMODYNAMICS	3-1-2	5
2	11ME502	ADVANCED FLUID MECHANICS	3-1-0	4
3	11ME503	GAS TURBINES AND JET PROPULSION	3-1-2	5
4	11ME504	ENERGY CONSERVATION & MANAGEMENT	3-1-0	4
5	11ME530	RENEWABLE ENERGY SYSTEMS	3-0-0	3
6	11ME541	REFRIGERATION AND AIR CONDITIONING	3-0-0	3
7	11ME551	SEMINAR	0-0-4	2
8				
Semester -2				
1	MEC625	HEAT EXCHANGER ANALYSIS AND DESIGN	3-1-0	4
2	MEC626	COMPUTATIONAL METHODS IN THERMAL ENGINEERING	3-1-2	5
3	MEC627	DESIGN OF THERMAL SYSTEMS	3-1-0	4
4	MEC628	ANALYSIS OF THERMAL POWER CYCLES	3-1-0	4
5	MEC629	ADVANCED INTERNAL COMBUSTION ENGINES	3-0-0	3
6	MEC631	GAS DYNAMICS	3-0-0	3
7		TERM PAPER	0-0-4	2
8				
Semester -3,4				
1	TE	THESIS/PROJECT		36

I semester

Course Code : 11ME501

Course Title : Advanced Engineering Thermodynamics

Course Structure : 3 – 1 - 2

SYLLABUS:

UNIT I

Availability, Irreversibility and Second-Law Efficiency for a closed System and steady state Control Volume. Availability Analysis of Simple Cycles. Thermodynamic Potentials, Maxwell relations, Generalized relation for changes in Entropy, Internal Energy and Enthalpy, Generalized Relations for Cp and Cv Clausius Claypeyron Equation, Joule-Thomson Coefficient, Bridgman Tables for thermodynamic relations.

UNIT II

Different Equations of State, Fugacity, Compressibility, Principle of Corresponding States, Use of generalized charts for enthalpy and entropy departure, fugacity coefficient, Lee-Kesler generalized three parameter tables. Fundamental property relations for systems of variable composition, partial molar prosperities, Real gas mixtures, Ideal solution of real gases and liquids, Equilibrium in multi phase systems, Gibbs phase rule for non-reactive components.

UNIT III

Thermo chemistry, first Law analysis of reacting systems, Adiabatic Flame temperature, Entropy change of reacting systems, Second Law analysis of reacting systems, Criterion for reaction equilibrium composition.

UNIT IV

Microstates and Microstates, Thermodynamic probability, Degeneracy of energy levels, Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein Statistics, Microscopic Interpretation of heat and work, Evaluation of entropy, Partition function, Calculation of the Microscopic properties from partition functions. Collision Theory and Transport properties.

UNIT V

Conjugate Fluxes and Forces, Entropy Production, Onsager's Reciprocity relations, thermo-electric phenomena and formulations. Thermodynamics of High-Gas flow.

Text Books:

1. Holman, J.P., Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1998.
2. Sonntag, R.E., and Vann Wylen, G, Introduction to Thermodynamics, Classical and Statistical, third Edition, John Wiley and Sons, 1991.

References Books:

1. Kenneth Wark Jr., Advanced Thermodynamics for Engineers, McGraw-Hill Inc., 2001.
2. Rao, Y.V.C., Postulational and Statistical thermodynamics, Allied Publisher Limited, New Delhi, 1994.

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Course Code : 11ME502

Course Title : Advanced Fluid Mechanics

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

Concept of continuum and definition of a fluid. Body and surface forces, stress tensor, Scalar and vector fields, Eulerian and Lagrangian description of flow. Motion of fluid element - translation, rotation and vorticity; strain rate tensor, continuity equation, stream function and velocity potential.

UNIT II

Transport theorems, constitutive equations, derivation of Navier Stokes equations for compressible flow. Exact solutions of Navier Stokes equations: plane Poiseuille flow and Couette flow, Hagen-Poiseuille flow.

UNIT III

Flow between two concentric rotating cylinders, Stoke's first and second problem, Hiemenz flow, flow near a rotating disk, and flow in convergent- divergent channels. Slow viscous flow: Stokes and Oseen's approximation,

UNIT IV

Theory of hydrodynamic lubrication. Boundary layer: derivation, exact solutions, Blasius, Falkner Skan, series solution and numerical solutions. Approximate methods. Momentum integral method.

UNIT V

Two dimensional and axisymmetric jets. Description of turbulent flow, velocity correlations, Reynold's stresses, Prandtl's Mixing Length Theory, Karman's velocity defect law, universal velocity distribution.

Text Books:

1. Advanced Fluid Mechanics, Som and Biswas, Tata McGraw Hill Fluid Mechanics, A.K.Mohanty.

References Books:

1. Fundamentals of Fluid Mechanics, Schlitching.
2. Introduction to Fluid Mechanics, Shaughnessy, Oxford University Press.

Course Code : **11ME503**

Course Title : **Gas Turbines and Jet Propulsion**

Course Structure : **3 – 1 - 2**

SYLLABUS:

UNIT–I

Thermodynamic cycle analysis of gas turbines; Types of gas turbine, gas turbine v/s internal combustion engine (Diesel & Petrol Engines) gas turbine v/s steam engine / turbines, Gas turbine plant component, Application of gas turbine. Open and closed cycles.

UNIT–II

Axial flow turbines; blade diagrams and design of blading, performance characteristics. Centrifugal and axial flow compressors, blowers and fans. Theory and design of impellers and blading. Matching of turbines and compressors. Fuels and combustion, effect of combustion chamber design and exhaust on performance.

UNIT-III

Basic principles and methods of heat recovery. Thermodynamic cycle analysis and efficiencies of propulsive devices. Open cycle gas turbine with regeneration, re-heating and intercooling, effects of regeneration, re-heating and intercolling on efficiency,

UNIT–IV

Jet propulsion Introduction, theory of jet propulsion, types of jet engines, energy flow through jet engines, thrust, thrust power, and propulsive efficiency, turbo jet, turbo prop, turbo fan engines, pulse jet and ram jet engines, performance characteristics of these engines, thrust segmentation application of jet engines, concept of rocket propulsion.

UNIT-V

Thrust equation, classification and comparison of ram jets, turbojets, pulse jets and rockets. Performance of turbo-prop, turbo-jet and turbofan engines. Augmentation of thrust.

Text Books:

1) Gas turbine and propulsion system P.R.Khajuria.
2) Domkundwar, “Thermal Engineering”, Dhanpat Rai and Co Ltd. Delhi.

References Books:

1) P L Ballaney, “Thermal Engineering”. Khanna Publications, Delhi.
2) R K Rajput, “Thermal Engineering”, Laxmi Publication ltd. New Delhi.

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Course Code : 11ME504

Course Title : Energy Conservation and Management

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

General energy problem. Global and national energy scenario, primary energy sources, energy use patterns, Basic Principles, laws of Thermo dynamics. Irreversibility, entropy enthalpy, heat engine, refrigeration cycle, thermal efficiency and thermal exchange ratio. Critical and economic thickness of insulation. Optimum use of prime movers for power generation, techniques cogeneration technology. Energy conservation methods in power plants, conservation of energy in energy intensive industries.

UNIT II

Maintenance engineering friction, lubrication and tribological innovations, predictive and preventive maintenance, Energy audit, case studies.

UNIT III

Heating, lighting and Air conditioning of building and measures for conservation of electrical energy. Energy conservation in domestic gadgets. Industrial heating and energy conservation in electric and oil fired furnances. Measures for Reduction of losses in Transmission and distribution systems.

UNIT IV

Energy efficient electric drives, energy efficient motors, V.S.D. power factor improvement in power system. Energy conservation in transportation systems especially in electric vehicle.

UNIT V

Load curve analysis and load managements, DSM, Energy storage for power systems, (Mechanical, Thermal, electrical and Magnetic) Restructuring of electric tariff from energy conservation considerations, payback period.

Text Books:

1. Energy Technology:S.Rao,Dr.B.B.Purulekhar,Khanna Publishers.
2. Elect. Energy Utilization & Conservation: By - Dr. S.C.Tripathi, Tata Mc Graw Hill Publishers.

References Books:

1. Energy Efficiency Manual: for everyone who uses energy, pays for utilities, designs and builds, is interested in energy conservation and the environment.
2. Donald R. Wulfinghoff (Author) –Energy Institute Press,Maryland,U.S.A.
3. Title: Handbook of Energy Conservation, (Set 2 Volumes)
   ISBN: 9789810828288 (Set ISBN)- Alkem Company (S) Pte LtdAdd: 1, Penjuru Close Singapore 608617.

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Course Code : 11ME530

Course Title : Renewable Energy Systems

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT I

Energy scenario and renewable energy sources: global and Indian situation. Potential of non-conventional energy sources, economics. Solar Radiation: Solar thermal process, heat transfer devices, solar radiation measurement, estimation of average solar radiation. Solar energy storage: stratified storage, well mixed storage, comparison.

UNIT II

Hot water system, practical consideration, solar ponds, Non-convective solar pond, extraction of thermal energy and application of solar ponds. Wind energy: The nature of wind. Wind energy resources and modeling. Geothermal energy: Origin and types of geothermal energy and utilization.

UNIT III

OTEC Ocean temperature differences. OTEC systems. Recent OTEC developments. Wave energy: Fundamentals. Availability Wave-energy conversion systems. Tidal energy: Fundamentals. Availability Tidal-energy conversion systems. ; Energy from biomass: Photosynthesis; Biomass resource; Utilization of biomass.

UNIT-VI

Bio-Energy: Biomass and its uses, Classification of biomass, Biomass as a source of energy, Characteristics of biomass, Biomass conversion processes, Buiqueting of biomass, Gasification and combustion of biomass, Gasifies.

UNIT-V

Biogas as a rural energy source, Environmental significance, Biogas production mechanism, Biogas plant and its components, Types of biogas plants, Design and construction features.

Text Books:

1. S.P.Sukhatme, Solar Energy Principle of Thermal Collection and Storage', Tata.
2. McGraw Hill, 1990.G.L. Johnson, Wind energy systems, Prentice Hall Inc. New Jersey J.M.Kriender, Principles of Solar Engineering', McGraw Hill, 1987.

Reference Books:

1. V.S. Mangal, Solar Engineering', Tata McGraw Hill, 1992.
2. N.K.Bansal, Renewable Energy Source and Conversion Technology', Tata McGraw Hill, 1989.
3. P.J. Lunde.,Solar Thermal Engineering', John Willey & Sons, New York, 1988. J.A. Duffie, and W.A. Beckman, Solar Engineering of Thermal Processes', Wiley & Sons.

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Course Code : 11ME541
Course Title : Refrigeration & Air Conditioning
Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT-I

INTRODUCTION TO REFRIGERATION: Necessity and applications, unit of refrigeration and C.O.P, methods of refrigeration.

AIR REFRIGERATION: Reversed Carnot Cycle, Bell Coleman cycle, Advantages and disadvantages of air refrigeration, Open and Dense air systems, Actual air craft refrigeration system, types of systems, problems.

UNIT-II

REFRIGERANTS: Nomenclature, Desirable properties, common refrigerants used, Eco friendly refrigerants, ODP

VAPOUR COMPRESSION REFRIGERATION: Working principle, essential components of plant, simple vapour compression refrigeration cycle, Effect of condenser pressure , evaporator pressure, sub cooling and super heating. Multi pressure systems – multistage compression, multi evaporator system, use of p–h charts, problems.

UNIT-III

SYSTEM COMPONENTS: Compressors general classification, comparison, advantages and disadvantages, Condensers - classification, working, Evaporators - classification, working. Expansion devices - types, working.

VAPOUR ABSORPTION SYSTEM: Calculation of max COP, description and working of NH_3 - water system, Li - Br, H_2O system, principle of operation of three fluid absorption system and salient features.

UNIT-IV

PRODUCTION OF LOW TEMPERATURE: Cascade system, Production of Solid CO_2. **STEAM JET REFRIGERATION SYSTEM:** Principle of working, application, merits and demerits.

NON-CONVENTIONAL REFRIGERATION METHODS: Principle and operation of thermoelectric refrigerator (ii) Vortex tube or Hilsh tube (iii) Pulse Tube (iv) Cooling by adiabatic de magnetization.

UNIT-V

INTRODUCTION TO AIR CONDITIONING: Psychometric properties and processes, sensible and latent heat loads, SHF, need for ventilation, infiltration, concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning and requirements, air conditioning load calculations.

AIR CONDITIONING SYSTEMS: classification, concepts of RSHF, ASHF, ESHF & ADP, filters, grills and registers, deodorants, fans and blowers.

Text Books:

1. A course in refrigeration and air conditioning by S.C.Arrora & Domkundwar.
2. Principles of Refrigeration by Dossat.

References Books:

1. Refrigeration and air conditioning by Stocker.
2. Refrigeration and Air Conditioning, P.L.Balaney.

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II semester

Course Code : ME C625

Course Title : Heat Exchanger Analysis and Design

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

INTRODUCTION TYPES OF HEAT EXCHANGERS: Over all heat transfer co-efficient, LMTD of heat exchanger analysis (parallel flow, counter flow) simulation of heat exchangers.

UNIT II

WORKING OF HEAT PIPE: Different types of heat pipes, heat pipe components ,advantages of heat pipe, applications, analysis and design if heat pipe.

UNIT III

ANALOGY AND RECENT DEVELOPMENTS IN HEAT EXCHANGERS: Analogy between momentum and heat transfer. Recent developments in the design of compact heat exchangers, insulation-design and selection.

UNIT IV

PLATE HEAT EXCHANGER: Compact heat exchanger, Codes of mechanical design of heat exchanger. Computerized methods for design and analysis of heat exchanger. Performance enhancement of heat exchanger, fouling of heat exchanger. Testing, evaluation and maintenance of heat exchanger.

UNIT V

BASIC DESIGN METHODS FOR HEAT EXCHANGER: Design of shell and tube type heat exchanger, TEMA code. Furnaces, Radioactive heat exchangers, Regenerators, Principles of boiler design, recuperators, matrix heat exchanger and heat pipe exchanger.

Text Books:

1. J.P. Hallman, “Heat Transfer”, McGraw Hill, New York, 1968.

References Books:

1. J.G. Knudsen and D.L. Katz," Fluid Dynamics and Heat Transfer", McGraw Hill, New York, 1958.

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Course Code : ME C626

Course Title : Computational Methods in Thermal Engineering

Course Structure : 3-1-2

SYLLABUS:

UNIT-I

Review of basic fluid mechanics and the governing (Navier-Stokes) equations, Techniques for solutionof PDEs.

UNIT-II

FINITE DIFFERENCE METHOD (FD): finite element method and finite volume method. Finite volume (FV) method in one-dimension, Differencing schemes, steady and unsteady calculations.

UNIT-III

BOUNDARY CONDITIONS: FV discretizationin two and three dimensions, SIMPLE algorithm and flow field calculations, variants of SIMPLE, Introduction to Turbulence and turbulence modeling, illustrative flow computations.

UNIT-IV

INTRODUCTION TO COMMERCIAL SOFTWARE'S FLUENT AND CFX: grid generation, flow prediction and post-processing Application of FD methods for unsteady and steady heat conduction problems.

UNIT-V

GLOBAL MODELLING UNDER DYNAMIC CONDITIONS: numerical methods for integrating ordinary differential equations and systems of equations; use of EES software; applications to systems with thermal storage, mass storage, etc.

Text Books:

1. Computational fluid dynamics by Anderson.

References Books:

1. Stocker, Wilbert F; design o thermal systems.

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Course Code : **MEC627**

Course Title : **Design of Thermal Systems**

Course Structure : **3 – 1 - 0**

SYLLABUS:

UNIT I

Modeling of Thermal Systems: types of models, mathematical modeling, curve fitting, linear algebraic systems, numerical model for a system, system simulation, methods for numerical simulation.

UNIT II

Acceptable Design of a Thermal System: initial design, design strategies, design of systems from different application areas, additional considerations for large practical systems; Economic Considerations: calculation of interest, worth of money as a function of time, series of payments, raising capital, taxes, economic factor in design, application to thermal systems.

UNIT III

Problem Formulation for Optimization: optimization methods, optimization of thermal systems, practical aspects in optimal design, Lagrange multipliers, optimization of constrained and unconstrained problems, applicability to thermal systems; search methods: single-variable problem, multivariable constrained optimization, examples of thermal systems; geometric, linear, and dynamic programming and other methods for optimization, knowledge-based design and additional considerations, professional ethics.

UNIT-IV

Optimization, Objective function formulation, Constraint equations, Mathematical formulation, Calculas method, Dynamic programming, Geometric programming, linear programming methods, solution procedures.

UNIT-V

Equation fitting, Empirical equation, best fit method, method of least squares. Modeling of thermal equipments such as turbines, compressors, pumps, heat exchangers, evaporators and condensers

Text Books:

1.W.F. Stoecker, Design of Thermal Systems - McGraw-Hill, 1971.
2.N.V. Suryanarayana, Design & Simulation of Thermal Systems - MGH, 2002.

References Books:

1.Y. Jaluria, Design and Optimization of Thermal Systems –CRC Press, 2007.
2.Bejan, G. Tsatsaronis, M.J. Moran, Thermal Design and Optimization - Wiley,1996.
3.R. F. Boehm, Developments in the Design of Thermal Systems – Cambridge University Press, 1997.

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Course Code : MEC628

Course Title : Analysis of Thermal Power Cycles

Course Structure : 3 – 1 - 0

SYLLABUS:

UNIT I

STEAM POWER PLANTS CYCLE: Rankine cycle – Reheat cycle – Regenerative cycle with one and more feed heaters – Types of feed heaters – Open and closed types – Steam traps types.

UNIT II

COGENERATION: Condensing turbines – Combined heat and power – Combines cycles – Brayton cycle Ranking cycle combinations – Binary vapour cycle.

UNIT III

AIR STANDARD CYCLES: Cycles with variable specific heat – fuel air cycle – Deviation from actual cycle.

UNIT IV

BRAYTON CYCLE: Open cycle gas turbine – Closed cycle gas turbine – Regeneration – Inter cooling and reheating between stages.

UNIT V

REFRIGERATION CYCLES: Vapour compression cycles – Cascade system – Vapour absorption cycles – GAX Cycle.

Text Books:

1.Nag. P.K., Power Plant Engineering, 2nd Tata McGraw-Hill, 2002.
2.Nag. P.K., Engineering Thermodynamics, 3rd edition, Tata McGraw-Hill, 2005.

Reference Books:

1.Arora, C.P., Refrigeration and Air Conditioning, 2nd edition, Tata McGraw-Hill, 2004.
2.Culp R., Principles of Energy Conversion, McGraw-Hill, 2000.

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Course Code : MEC629

Course Title : Advanced Internal Combustion Engines

Course Structure : 3 – 0 - 0

SYLLABUS:

UNIT I

Thermodynamic Analysis of I.C.Engine Cycles. Effect of design and operating parameters on cycle efficiency. Modified fuel-air cycle considering heat losses and valve timing. Engine dynamics and torque analysis. Use of Combustion chart. Thermodynamic cycle with supercharging both S.I. and C.I. Engines. Limits of Supercharging.

UNIT II

Methods of Supercharging and Superchargers. Fuels and combustion in S.I. engines, knocking and fuel rating. Energy balance, volumetric efficiency, measurement of indicated and brake power.

UNIT-III

Advanced theory of carburetion. Fuel Injection Systems for S.I. and C.I. Engines. Cooling of engine and governing of engine. Ignition system: conventional and electronic.

UNIT IV

Variable compression ratio engine. Theoretical analysis, methods of obtaining variable compression ratio, Wankel rotary combustion engine, Stratified charged engine.

UNIT V

Methods of charge stratification, Dual fuel and Multifuel engines, Biofuels, Variable Valve timing engines, Exhaust emissions, its measurement and control. Fault diagnosis of S.I. Engines.

Text Books:

1. Fundamentals of I.C. Engines by H.B.Heywood, McGraw Hill I.C.Engine Theory and Practices, Vol.I & II C.F.Taylor, MIT Press .

References Books:

1. I.C.Engine, Mathur and Sharma, Dhanpat Rai and Sons Fundamentals of I.C.Engine by Ganeshan, Tata McGraw Hill.

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Course Code : MEC631

Course Title : Gas Dynamics
Course Structure : 3 – 0 – 0

SYLLABUS:

UNIT I

GAS DYNAMICS: Energy equation for flow process, Stagnation state, Velocity of sound, Critical states, Various regions of flow, Mach number, Critical Mach number, Mach cone, Crocco number, Effect of Mach number of compressibility. T-S and H-S diagrams showing nozzle and diffuser processes.

UNIT II

ISENTROPIC FLOW: Isentropic flow with variable area - Mach number variation, Hugoniot equation, Area ratio as a function of Mach number, Impulse function, Mass flow rate, flow through nozzles, Flow through diffusers.

UNIT III

FLOW THROUGH CONSTANT AREA DUCTS: Flow in constant area ducts with friction, Fanno curves and Fanno flow equation, Solution of Fanno flow equation, Variation of flow properties, Variation of Mach number with duct length, isothermal flow with friction. Flow in constant area ducts with Heat transfer, Rayleigh line, Rayleigh flow equation, Variation of flow properties, Maximum heat transfer.

UNIT IV

NORMAL SHOCK GAS DYNAMICS: Flow with normal shock waves, Governing equation, Prandtl - Meyer equation, Impossibility of rarefaction shock, Mach number in the downstream of the normal shock. Static pressure ratio, Temperature ratio, Density ratio and stagnation pressure ratio across the shock, Entropy change, Characteristic of flow through convergent and divergent nozzle with various backpressure. Normal shocks in Fanno and Rayleigh flow, Flow with oblique shock waves (Qualitative Treatment).

UNIT V

MEASUREMENTS IN COMPRESSIBLE FLOW: Introduction, Pressure measurements, Temperature measurements, Velocity and direction, density problems.

HIGH TEMPETATURE GAS DYNAMICS: Importance of High Temperature flows, Nature of High temperature flows.

Text Books:

1.Gas dynamics by E Radhakrishnan, PHI.
2.Fundamentals of compressible flow with Aircraft and Rocket propulsion by S.M.Yahya , Wiley Eastern. 2 ed.

Reference Books:

1. Gas dynamics through problems by Zoeb Hussain, New Age Int.
2. Introduction to gas Dynamics by Alan J. Chapman, William F. Walker, Holt, Rineharl and Winstion.
3. Gas dynamics and jet propulsion by S.L.Somasundaram.

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