

**WELCOME
TO
MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY
BHOPAL**



**PROSPECTUS AND ORDINANCE
UNDERGRADUATE PROGRAMMES
(B.Tech., B.Arch., B.Plan)
(2013-2014)**

MANIT, Bhopal 462 003

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1. INTRODUCTION

The Maulana Azad National Institute of Technology, Bhopal, Madhya Pradesh, one of the first eight Regional Engineering Colleges started in the country, was inaugurated on 4th September 1960. The institute has been named after Maulana Abul Kalam Azad, a renowned educationist, scholar and academician of India.

The Government of India and Govt. of Madhya Pradesh had jointly sponsored this institute for the purpose of attracting bright students from all over the country and imparting quality training to them in various branches of Engineering and Technology. From August 1966 the institute has been conducting industrially oriented M.Tech. Courses-under U.N. special Fund Assistance Programme the institute has got the status of academic autonomy from the academic session 1997-98.

The Government of India, Ministry of Human Resources Development, New Delhi has upgraded the institute as Maulana Azad National Institute of Technology (MANIT) along with a status of Deemed University with effect from 26th June 2002. Now, the Institute becomes the Institute of national Importance by the parliament act in the year 2007.

Setting and Environment

Bhopal, the capital of Madhya Pradesh, is centrally situated and is connected by rail, road and air with many big cities of the country. It is at an altitude of 550 m. The climate is also moderate with the temperature ranging from 10°C to 45°C.

Campus

The Government of Madhya Pradesh has made available for the institute a site of 265 hectares (650 acres) on a plateau commanding a magnificent view of the new township of Tatya Tope Nagar, adjacent hill and the Secretariat building on one side and the Habibganj Railway Station and Bharat Heavy Electrical Ltd. Township on the other side.

The foundation of the institute building was laid by the late Prime Minister Pandit Jawaharlal Nehru on 23rd April, 1961. The campus has been provided with Central Institutional buildings, Workshop, Energy Centre, Central Computer Centre, library, Hostel buildings for about 3000 students, girls hostel, staff quarters, hospital, shopping centre, guest house, students' activity centre etc.

As recommended in the Master plan for the institute, the entire campus with its administrative and instructional buildings, residential and recreational accommodation for students, staff and other general amenities like Post-Office, Bank, Shopping centre, School for children, Hospital, Auditorium and Play grounds in a fairly large and self contained campus.

1.1 Management of Organization

The institute which has a status of “Institute of national importance” is governed by a Board of Governors consisting of 10 members including nominees, Ministry of Human Resource Department of Technical Education and Faculty of the institute and a secretary, the name of the members of the Board of Governors are given Below.

BOARD OF GOVERNORS

- | | | | |
|----|---|----|---|
| 1) | Chairman
(An Eminent Technologist/
Engineer/Industrialist/
Educationist to be nominated
By the Central Government | 1. | Prof.G.K.Mehta
Honorary Professor, IIT, Kanpur,
Former VC, University of Allahabad. |
|----|---|----|---|

MEMBERS

- | | | | |
|----|---|----|---|
| 2) | Ex-Officio Member | 2. | Dr. Appu Kuttan KK
Director
Maulana Azad National Institute of
Technology
Bhopal |
| 3) | Nominee of the Ministry of
Human Resource
Development, Government of
India | 3 | Shri. Ashok Thakur
Secretary (Higher education)
Government of India Ministry of
Human Resource Development.
Dept. of Secondary &. Higher
Education
Shastri Bhavan, New Delhi-110001 |
| 4) | Financial Adviser,
Department of Higher Education
Human Resource
Development, Government of
India | 4. | Shri. Navin Soi
Director (Finance)
Department of Higher Education
Human Resource
Development, Government of
India |
| 5) | Nominee of Department of Higher/
Technical Education, Govt. of Madhya
Pradesh
India | 5 | Dr.Navin Chandra
Advanced material &Research
Institute (AMPRI), Bhopal |

6)	Head of another Technical institution in the Region 'or an eminent technologist nominated by the Central Government	6	Shri P.T.Deo, Director Indian Power Management Academy Bhopal
7)	Director of Indian Institute of Technology [in the region] or His nominee.	5	Dr.Ritu Barhwal Professor and Head Department of Bio Technology IIT, Roorkee
8)	An alumnus of the Institute from amongst alumni in Education/ Industry to be Nominated by the B.O.G.	8	Dr.Puneet Tandon Professor Mechanical Engineering and Design IIITDM, Jabalpur
9)	One Professor Professor of the institute by Rotation	9.	Dr.Geetha Agnihotri Professor Department of Electrical Engineering MANIT, Bhopal
10)	One Assistant Professor Professor of the institute by Rotation	10.	Dr.Usha Chouhan Assistant Professor Department of Architecture MANIT, Bhopal
11)	Secretary	11	Registrar M.A.N.I.T., BHOPAL-462007

1.2 Finance of Institute

The establishment, development and maintenance of the institute are carried out with funds provided by the Government of India.

The government of India also provides for the non-recurring expenditure on buildings and equipment and all the funds for P.G. courses. The names of the finance committee are given below.

**FINANCE COMMITTEE
MEMBERS**

- | | | | |
|----|---|----|--|
| 1) | Chairman
(An Eminent Technologist/
Engineer/Industrialist/
Educationist to be nominated
By the Central | 1. | Prof.G.K.Mehta
Honorary Professor, IIT, Kanpur,
Former VC, University of Allahabad. |
| 2) | Ex-Officio Member | 2. | Dr. Appu Kuttan KK
Director
Maulana Azad National Institute of
Technology
Bhopal |
| 3) | Financial Adviser,
Department of Higher Education
Human Resource
Development, Government of
India | 3. | Shri. Navin Soi
Director (Finance)
Department of Higher Education
Human Resource
Development, Government of
India |
| 4) | Director NIT's,
Department of Higher Education
Human Resource
Development, Government of
India | 4. | Shri. Rajesh Singh
Director NIT's
Department of Higher Education
Human Resource
Development, Government of
India |
| 5) | Head of another Technical
institution in the Region 'or
an eminent technologist
nominated by the Central
Government | 5. | Shri P.T.Deo,
Director
Indian Power Management
Academy
Bhopal |
| 6) | One Professor
Professor of the institute by
Rotation | 6. | Dr.Geetha Agnihotri
Professor
Department of Electrical Engineering
MANIT, Bhopal |

7) Secretary

7 Registrar
M.A.N.I.T.,
BHOPAL-462007

2 DEPARTMENT OF TEACHING AND RESEARCH

There are five divisions and fifteen departments and three centers are under the divisions in the institute as mentioned below:

Machine Technology Division

1. Civil Engineering (CE)
2. Electrical Engineering (EE)
3. Mechanical Engineering (ME)
4. Material Science and Metallurgical Engineering (MSM)

Soft Technology Division

1. Computer-Science and Engineering (CSE)
2. Electronics and Communication Engineering (E&E)
3. Chemical Engineering (CE)
4. Biological science and Engineering (BSE)

Architecture and Planning Division

1. Architecture (AR)
2. Planning (PLA)

Science Division

1. Chemistry (CH)
2. Physics, (PHY)
3. Mathematics, Computer Application, and Bio-informatics (MTH, MCA, BI)

Humanities and management Division

1. Humanities (HUM)
2. Management studies (MAN)

Centers

1. Energy center (ENE)
2. Remote sensing, GIS and GPS center (REM)
3. Nano Science and Engineering center (NSE)

All the engineering and science departments have well equipped Modern Laboratories for under graduate practical work and post graduate research. A fully equipped and well staffed workshop caters to the under graduate training and post graduate research needs of all the departments.

3 INSTITUTE LIBRARY

The institute library has a collection of more than 1,03,764 Books and back volume Journals of Technical, scientific and general subjects and these are computerized on modern line. More than 67 current National & International Journals are subscribed. Good numbers of back

volume journals in hard copies and online are available. The Library remains open from 10.00 a.m. to 6.00 p.m. on all working days.

The library has reprography section to provide the facility to its readers. A separate Book Bank has been set up for SC & ST and general category student consisting of 19,248 and 6217 books respectively, through which textbooks are provided on long term loan basis to the poor and needy students.

An Audio-Visual section having 384 Educational video cassettes (now converted into CD's) on Engineering subject & have 2 T.V. monitors and 2 VCR respectively. Arrangement for Resource sharing among various NITs, online journals through optical LAN and VSAT have been made. The library has been connected with Internet there is a collection of 522 CD's on engineering & science streams.

INDEST Consortium

The ministry of Human Resource Development (MHRD) has set up a “Consortia-based Subscription to Electronic Resources for Technical Education System in India”. The consortium is named as the “Indian National Digital library in Science and Technology (INDEST) Consortium MANIT, Bhopal is member of INDEST Consortia.

At MANIT, Bhopal, Institute able to access the following online resources

S. No.	Electronic Resources	URL
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Full – text – E - Resources

1.	ACM Digital Library	http://portal.acm.org/portal.cfm
2.	ASCE Journal	http://www.pubs.asce.org/journals/jrns.html
3.	ASME Journal	http://www.asme.org/pubs/journals/
4.	IEL Online	http://ieeexplore.ieee.org/
5.	Indian standards	Intranet Version
6.	Nature	http://www.nature.com
7.	ProQuest Science	http://il.proquest.com/pqdauto
8.	Springer Verlag's Link	http://www.springerlink.com/

Bibliographic Database		
9.	J-Gate Customs Content for Consortia	http://jeee-indest.informindia.co.in

All the above mentioned journals can be accessible online from any computer connected to Internet through institute internet.

REGULATIONS, COURSE STRUCTURE AND COURSE CONTENT

These Rules/Regulations may be called “MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY (BHOPAL) REGULATIONS for Undergraduate programmes.

Definitions

- “Institute “/”NITB”/MANIT” means, Maulana Azad National Institute of Technology, Bhopal.
- “BOG”/”Board” means, the Board of Governors (BOG) of the Institute
- “MHRD” means, the Ministry of human resource development, GOI.
- “Chairman” means, the Chairman of the Board,
- “Director” means, the Director of the Institute,
- “Registrar” means, the Registrar of the Institute,
- “AIEEE ” means, All India Engineering Entrance Examination.
- “Senate” means, the senate of the Institute
- “BOS” means, the board of studies of the Institute
- “Finance Committee” means the Finance Committee of the Institute.
- “Building and Works Committee” means the Building and Works Committee of the Institute.
- “Authorities”, “Officers” and “Professors” respectively mean , the authorities
- “Regulations” means, the Regulations of the Institute.
- “Dean (AA)” means, the Dean (Academic Affairs)
- “Dean (SW)” means, Dean (Students welfare)
- “HOD” means, the Head of the department.
- “Course coordinator” means, a faculty in charge of and academic programme
- “Course” means, a specific subject usually identified by its course number followed by course title with a specified course description, references, taught by subject coordinator to a specific class (Group of students) during a specific academic session/Semester.
- “DUPC” means, the departmental under graduate programme committee
- “Regulations” means, the set of academic Regulations of the programme.

UNDERGRADUATE PROGRAMMES REGULATIONS

The Institute provides courses of 4 years duration leading to Bachelor degree in Technology (B.Tech.) in Civil Engineering, Mechanical Engineering, Electrical Engineering, Material Science and Metallurgy, Chemical Engineering, Electronics and Communication engineering, Electrical and Electronic Engineering, Computer Science and Engineering. Four year course also provided for Bachelor degree in planning (B.Plan) under Architecture and planning department. In addition, Institute also offer 5 years degree course in bachelor degree in architecture (B.Arch.)

4 STAFF

The staff is well qualified and experienced and opportunities are provided to them from time to time to improved their qualification and professional experiences. Most of the professors are Ph.D degree holders and professionally competent in their field.

5 ADMISSION TO INSTITUTE

Admission is open to students of both sex without any distinction of caste, creed or color. However, those candidates against whom disciplinary action has been taken in the past or those with moral turpitude will not be granted admission to any class/course conducted in this institute. Similarly, the students who are expelled from this or any other institute/school will not be granted admission under any circumstance to any class/course conducted in this institute. Foreign student nominated by the Government of India, against the seats reserved for them are also admitted. In case they are admitted they will be required to pay in amount of Rs.2000/- as security deposit as per uniform policy for all.

Admission to bachelor degree courses is on the basis of merit secured in AIEEE examination conducted by CBSE, New Delhi. The Institute has provision to admit a total of 937 students in first year out of which 120 students are admitted to architecture and planning department offering B.Arch. (80 students) and B.Plan (40 students). The rest 817 students are admitted to engineering stream with branch wise allocations Civil-92, Mechanical-170, Electrical-108, Material Science and Metallurgy-62, Chemical engineering-62, Computer science and Engineering-184, Electronics and Communication-139, Fifty percentage of the total seat both for engineering and architecture and planning are reserved for candidates belonging to house state of Mandaya Pradesh and remaining is allotted for other states. This admission will be done as per MHRD rule book approved by the Government of India (MHRD). The reservation of SC/ST/OBC/PH is as per AIEEE rules.

The institute does not accept any foreign students directly for admission; however admission is given to foreign students through DASA as per the directive of Govt. of India.

Verification of documents/ cancellation of admission

Selected candidates will be admitted to the institute only when their records, certificates, marks etc. are verified from original documents on personal appearance before the admission committee and also after they are declared medically fit at the medical examination conducted by the institute, Medical Officer, and after deposition the necessary fees.

If it is found that the candidate has succeeded in getting admission to the institute on the basis of false/ incorrect information or with holding relevant facts or if any time after admission it is found that the admission was given to the candidate due to some mistake or over sight, admission granted to the candidate shall be liable to cancellation, without any notice, at any time during the course of his/ her studies.

Admission to higher classes

Students seeking admission to a higher semester on promotion from the lower semester will be required to furnish their latest particulars in the prescribed application form obtained from the institute academic section. Their names would be enrolled only after submission of this form and obtaining no dues regarding institute/ Hostel/ Mess etc. Fresh admission will be sought by the students in each semester. The admission in each semester should be taken within 15 days of commencement of classes after which a late fee 100/- per week will be charged. In no case admission will be granted after 30 days of commencement of classes. They will also seek fresh admission to the hostel by submitting application form to the Chairman, Council of Wardens. All the students have to register for the subjects including the project work in the beginning of each semester.

6 ACADEMIC CALENDER

The normal duration of the course leading to B.Tech/B.Plan degree will be eight semester and B.Arch degree will be ten semesters. Each academic year shall be divided into two semesters . The academic session in each semester shall provide for at least 90 Teaching Days with 30 to 35 hours of teaching contact periods in a five days session per week. The semester that is typically from July to December is called the odd semester and the one that is from January to June is called the even semester. The exact date for the important academic events scheduled during the academic session shall be specified in the academic calendar. In particular, the dates for following events shall be specified: Registration, late registration, commencement of classes, examinations, submission of sessional/ tutorials, vacation, convocation, extra-curricular activities etc. The academic calendar must be strictly adhered to, and all other activities including co-curricular and /or extra-curricular activities must be scheduled so as not to interface with the curricular activities as stipulated in the academic calendar. Under any circumstances when any of the teaching days gets declared as a Holiday or otherwise when the classes get suspended,

irrespective of whatsoever be the reasons, appropriate makeup for such loss shall be made by having the class/ laboratory/teaching sessions conducted on the suitable Saturday by following the particular class time table of that teaching day which was so lost.

7 REGISTRATION

Before the commencement of each semester, every student, unless otherwise exempted by the senate, shall register for the prescribed course to be pursued during the semester on the registration date as specified in the academic calendar. Payment of prescribed semester fees, and all other dues outstanding against the name of the student to the Institute, the Hostels or any other recognized organ of the institute shall ordinarily be a precondition for registration. Students who do not register on the day announced for the purpose may be permitted late registration up to notified day in academic calendar on payment of late fee. Registration in Absentia will be allowed only in exceptional cases with the approval of the Dean (AA) after the recommendation of DUGC through the authorized representation of the student. The registration also include the course registration in prescribed form in each semester. Course registration form contains student copy, Course Instructor copy and Dean (AA)/ Controller of examination copy. A student will be permitted to register in the next semester only if he fulfills the following conditions:

- i) Satisfied all the academic requirements to continue with the programme of studies without termination
- ii) Cleared all institute, hostel and library dues and fines (if any) of the previous semester.
- iii) Paid all required advances payments of the Institute and hostels for the current semester.
- iv) Not debarred from registration on the specific ground by the institute.

8 TEACHING AND EVALUATION SYSTEM

8.1 Teaching

The medium of instructions/ evaluation/ etc. shall be in English. Every course comprises of specific Lecture-Tutorial- Practical (L-T-P) schedule. For lectures of one period (55 minutes duration) is assigned one credit where as tutorial and Practical has only 0.5 credit per period. Usually three lectures are assigned for one theory subjects and most of the practical classes are two period duration. Each course, along with its weightage in terms of units, shall require approval of the Board of Studies and approval from the senate. Only approved courses can be offered during any semester. The theory courses are in three category, namely, departmental core subject, departmental electives and open electives. The registration of open electives can be opted any branch of students with the consultation of the student advisor. Each approved course,

whenever offered in any semester, shall be conducted by the assigned faculty in charge with the assistance of the required number of faculty/tutors. The faculty in charge shall be responsible for conducting the course, holding the examinations, evaluating the performance of the student and awarding the grades at the end of the semester.

8.2 Evaluation process for B.Tech, B.Arch and B.Plan

In each semester, there shall be normally one mid term examination and one end examination. As far as possible, all the examinations shall be conducted during the announced examination periods in the academic calendar. Each student, registered for a course, shall be awarded marks by the concerned faculty in charge. The marks awarded to a student depend upon his performance in various examinations Laboratory works/ innovative works/ assignment etc. The marks to be used to award their relative letter grades and grade index.

Evaluation process for B.Tech

Theory paper

End term examination (180 minutes duration) Maximum mark	Mid term Continuous Evaluation			Total Marks (Theory)
	Distribution		Total	
60	Mid term examination (90 minute duration)	20	40	100
	Quiz /Mini test	10		
	Innovative work/ Assignment	10		

Practical

End Term examination (120 minutes duration) Maximum mark	Continuous Evaluation (Practical)			Total Marks (Practical)
	Distribution		Total	
60	Laboratory/ workshop	20	40	100
	Work/			
	Mid term examination Submission & viva	20		

Evaluation process for B.Plan/ B.Arch

End term examination (180 minutes duration) Maximum mark (Theory)	Mid term Continuous Evaluation			Total Marks (Theory)
	Distribution		Total	
40	Mid term examination (90 minute duration) Studio, Viva & Assignment	20 40	60	100

Architectural Design is seen as the central discipline of the B. Arch/B.Plan program. The-studio is the arena where the student applies his knowledge and develops design skills while testing out the theories and methods learnt in other courses of the Humanities, Technological and Professional streams. The students will endeavor to acquire an understanding of the determinants of the built form such as social imperatives, Environmental concerns and the craft of building. They will review experiences from their own immediate and personal environment as well as the values and perceptions of other people involved in the process of design viz. the user, the client and the public at large. Derivation of concepts and strategies will then lead to a deliberate response in the shape of a specific design proposal with the help of organizational and communicative skills.

The study of Architectural Design is seen as a cumulative process where the experience of the previous year is used as a base for increasing the depth and breadth of knowledge and development of skills in the following year. The range of design problems shall include projects of progressively increasing complexity from a simple rural habitat to multiple use urban mega structures.

Each Architectural Design course shall include both minor problem (Time problems or sketch schemes) and major problems (fully developed schemes). A six-hour Design test on a topic unrelated to the major problem, but of a similar level of understanding will also be taken. This is to encourage students to hone their skills and invigorate their creative faculties to come up with quick. Intuitive responses to difficult situations, as happens in the real world minor problems will be allocated to the development of a particular aspect of design, such as structures, services, historicism, economics, management etc as theoretically dealt with in the other concurrent courses. The internal assessment in this subject shall be on basis of the following distribution of marks:

1. 60% of the marks for internal assessment shall be allotted to the major Design problem.
2. 20% marks shall be allotted to minor problems.
3. 20% marks shall be allotted to the Design test.

At every stage, topics concerned with the design problem, shall be dealt with in lectures, group discussions and library research so as to provide the necessary philosophical and attitudinal background to a rational Design approach. The studio program of various design problems shall be set well in advanced of the commencement of the term by the design coordinator in close consultation with the other subject teachers. It would be ensured that exercises in other subjects are directly relevant to the studio problem wherever the scope for such integration exists.

The test in Architectural Design shall be of six (6) hours duration in two sessions of three hours each. The intent of this examination is, to test the candidates' ability to address, the problem, with conceptual or thematic solutions in a limited response time, and communicate them effectively.

Continuous evaluation system has been adopted along with credit and grading system as per the prevalent practice in various IIT's and other institutes of higher studies

8.3 Credits, Grades, Semester and Cumulative Grade Performance Average

To clear a particular subject the required grade and grade point for **B.Tech, B.Arch and B.Plan** is D (4.0) . For promotion in next higher class, required Cumulative Grade point average (CGPA) at the end of even semester is 4.0 and final Grade point average, CGPA for completion of course is also 4.0.

To qualify the four year B.Tech degree courses, minimum 174 credits a student has to complete where as for four year B.Plan degree course minimum requirement is 184 credits and for five year B.Arch degree course minimum requirement is 230 credits.

(i) In each course a student is registered, he/she earns certain approved credits and is awarded a letter grade indicating his/her overall performance in that course. There are seven letter grades: A⁺, A, B⁺, B, C, D and F. The minimum passing grade in a subject is D. Their equivalent numeric values are given in the following table.

Letter Grades	Grade Points	Description of Performance
A⁺	9.0 to 10	Outstanding
A	8.0 to 8.99	Excellent
B⁺	7.0 to 7.99	Very Good
B	6.0 to 6.99	Good
C	5.0 to 5.99	Average
D	4.0 to 4.99	Satisfactory
F	< 4.0	Fail

(ii) F grade are treated as Fail grade. Any student getting these grades will have to appear in the examination again whenever it is scheduled by the institute. A student can not be allowed to have F grades in more than two subjects in one semester. Also he/she has to improve these grades in maximum two consecutive attempts.

(iii) If a student does not complete all the requirements including the mid-terms and end term for a course for a genuine reason, the course instructor may award grade I (Incomplete). An I grade must be converted by the instructor to a regular letter grade by conducting the re-examination for such candidate by the last date for the submission of the grades specified in the Academic Calendar, failing which it is automatically converted to an F grade.

(iv) A student getting D grade in a course may be allowed to repeat it, provided his/her CGPA is less than the prescribed minimum and the students are allowed to continue in the programme.

(v) In addition, a FA grade is awarded for the students who fail in the subject due to shortage of attendance. Such students has to repeat the subject.

(vi) Mandatory learning courses will be graded as satisfactory (S) or unsatisfactory (U) and will carry zero credit.

8.4 Computation of the Semester Grade Performance Average (SGPA) and Cumulative Grade Performance Average (CGPA)

The SGPA is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. If the grades index awarded to a student are $G_1, G_2 \dots G_n$ etc in courses with corresponding credits $C_1, C_2 \dots C_n$ etc, the SGPA is given by:

$$SGPA = \frac{C_1 G_1 + C_2 G_2 + \dots + C_n G_n}{C_1 + C_2 + \dots + C_n}$$

Similarly, the CGPA indicates the cumulative academic performance in all the courses/subjects taken during the entire stay in the institute. If the SGPA awarded to a student in each semester are S_1, S_2, \dots, S_n , the CGPA is given by:

$$CGPA = \frac{S_1 G_1 + S_2 G_2 + \dots + S_n G_n}{C_1 + C_2 + \dots + C_n}$$

The course credits and thesis/project credits will be shown separately in the final grade card with overall CGPA. In case a student is clearing any fail subject, the new grade obtained will replace the older one while calculating the overall CGPA.

The final grade index and grade shall be displayed in Institute web site and student can approach the concerned subject coordinator (s) for any clarifications within one week of the

announcement of the grades. The process of evaluation shall be transparent and the students shall be made aware of all the factors included in the evaluation. In case of any corrections, the subject coordinators (s) shall have to incorporate the same before finalizing the grade and printing the mark list.

For promotion in next higher classes (III/IV/V years), required Cumulative Grade point average (CGPA) at the end of even semester is 4.0, and CGPA for completion of course is also 4.0, further the student must complete the B.Tech and B.Plan programme in a maximum of 6 years and B. Arch. in 7 years.

9 DISCIPLINARY/GRIEVANCE COMMITTEE

An academic grievance committee is constituted for the smooth functioning of all the under graduate programs of the institute and it consists of the following members:

Dean (Academic Affairs)	Convener
Dean (Student Affairs)	Member
Concern HOD	Member
Controller of Examination	Member
Associate Dean (UG)	Member

The above committee will be dealing with all the UG student's academic matters/grievances related to attendance, academics etc. problems in the UG program. The committee will meet as and when necessary and send the recommendations to the Chairman senate for final approval and action.

(ii) Although all UG students residing in the hostels or out side hostels are expected to maintain the decorum and harmony of the hostels and campus community to the best of their behavior, a disciplinary committee will be constituted for the smooth running of the hostels life of all UG students in the MANIT campus. This committee consists of the following members.

Dean (Student Affairs)	Convener
Dean (Academic Affairs)	Member
Concerned HOD	Member
Concerned Warden(s)	Member
Proctor(s)	Member

The above committee will be dealing with all the administrative/disciplinary matters related to the UG students leaving in and out of institute hostels. The committee will meet as and when necessary and send the recommendation to the director of the institute for final approval and action.

10 PROCEDURE TO CLEAR BACKLOG

When the subject is offered in any semester the candidate can register for the credit and may appear in both in-semester (continuous evaluation) and End term exam. There is supplementary examination for the failed students. In odd semesters, there will be supplementary examination for even semester subjects after the regular odd semester examination. However, supplementary examination for odd semester has to write along with regular examination. Similarly, for even semester, there will be supplementary examinations for odd semester subjects after regular even semester examinations..

Attendance and progress of the students of all years will be constantly under observation right through the session. Regularity and punctuality in attendance and performance at lectures, tutorials, practical work in laboratories, drawing class, workshop, oral and written test constitute the day to day assessment of progress. A certain portion of the marks is reserved for class work and progress of students during the year, as students is expected to working regularly all through the year. A student whose attendance is less than 75% is liable, under the institute rules, to be detained from appearing in the Examination.

The parents while accompanying their wards for admission or while visiting the institute on other occasions are advised to contact the Professor Training and Placement and Students Welfare/ Chairman, Council of Wardens and express their views/ difficulties if any. The parents should also see the results of their wards and watch their progress regularly. They should also clear the dues of their wards from time to time.

The institute lays particular emphasis on Educational tours and practical training of students in industrial organization works. These tours and training are arranged periodically during the session as per Academic Calendar and are subsidized to a limited extent. The expenditure has to be borne mainly by the students.

The attendance of students on last day before any vacation begins and on the first day after the vacation is over is compulsory. Students absent on these days will be penalized as per rules.

10.1 Leave of absence

If the period of leave is more than two days and less than two weeks, prior application for leave shall have to be submitted to the HOD concerned, with the recommendation of the subject coordinator stating fully the reasons for the leave requested, along with supporting documents.

If the period of leave is two or more, prior applications for leave shall have to be made to the Dean (AA) with the recommendation of the subject coordinator, HOD concerned stating fully the reason for the leave requested, along with supporting documents. The Dean (AA), on receipt of such application may grant leave, or also decide whether the student be asked to withdraw from the course for that particular semester because of long absence. It will be responsibility of the student to intimate the course coordinator, and also the Dean (Students Welfare) as well as the chief Warden of the hostel, regarding his absence before availing leave.

10.2 Absence during Mid term examination

A student who has been absent from a Mid term examination due to illness and other contingencies may give a request for make up examination within two weeks after the Mid-term examination to the HOD with necessary supporting documents and certifications from authorized personal. The HOD may consider such request depending on the merits of the case, and after consultation with the course instructor, may permit the make up Mid-term examination for the concerned student. Unauthorized absence (i.e. absence without due permission) may result in termination of the student's programme by the senate in addition to loss of financial assistance for the entire period of such unauthorized absence (s) or part thereof. Students are expected to complete their programme without any break. However, for bonofide reason students may be granted leave of absence from the programme. But such absence (s) shall ordinarily not exceed two semesters with or without break.

11 UNFAIR MEANS (UFM) RULE

Use or attempt to use Unfair Means and disorderly conduct at an examination by a candidate After considering the report of centre superintendent, invigilators, examiners, statement of accused candidate and relevant papers, the UFM committee constituted for the purpose will categorise the act and recommends the punishment as per details given below:

Category	UFM-Type	Punishment
A	During the course of Examination, if any book or written paper connected with question paper is found under possession of the candidate, whether candidate was copying or not will be put into Category.	Examination of that theory papers will be cancelled in which candidate has been found doing so.
B	If a candidate leaves the examination hall finally without handing over answer book to invigilator or smuggles in an answer book or takes out for arranging it to send out or replaces continuation sheet during or after examination will be put in this category.	Present full examination (Theory) will be cancelled.

C	Getting impersonated by any other person in examination or candidate refuses to hand over the materials used for copying or destroys the proof or refuses to sign on UFM proforma all such candidates will be put under this category.	Present examination will be cancelled in full and student will be debarred from appearing in next examination and therefore candidate can not be admitted in next coming semester exam.
D	If a candidate tries to disrupt or actually disrupts the examination or tries to forcefully obstructs the others not to appear in the examination will be grouped in this category.	Present Examination will be cancelled in full and the candidate will be debarred for next two examinations.
E	A candidate misbehaves or uses abusive language or beats or fights or threatens to harm or tries to bribe or actually bribes an invigilator, examination superintendent or a person appointed for examination work at the centre or carries any weapon in examination centre or takes any dog or other animal or birds in the exam hall will be grouped under this category.	Cancellation or present full examination and debarred for appearing in next four examination and FIR will be sent to police for criminal proceeding on the candidate.
F	Keeping /using mobile at the time of examination	Cancellation of paper

Depending on seriousness of UFM case, the UFM committee will give recommendations for punishment for approval of Director. The committee may use its discretion for points not covered in above category.

12 STUDENTS LIFE

12.1 Housing

The institute is residential institution with limited accommodation available in the hostels for boys and girls. There are six boys' hostels in the campus; each hostel has its own kitchen, dining room and common room block. Hostel messes are run on co-operative basis. Students are required to work honorary in various capacities in the organization of Co-operative messes.

In addition to the above, girl's hostel is also functioning on the campus for residence of girls. However, the number of seats is limited and only double/ triples

- (i) Seated rooms are available. No girl student will be allowed single seated accommodation.
- (ii) Some hostels are located about a Kilometer away from the main institute building. The students are advised to possess a bicycle for their conveyance and to avoid loss of study time.

12.2 Procedure for Admission to Hostel

For the new entrants as well as the students already on the roles, the procedure for admission to hostel is as follows:

- a) All the students seeking admission to the hostel should fill up the hostel admission form.
- b) For fresh entrants, the hostel allotment will be made along with the declaration of admission. For fresh entrants in first year the allotment will be made in three seated rooms based on the availability of seats.
- c) All hostel allotments will be done by the Chairman, Council of Wardens.
- d) Allotment of rooms in a hostel will be done on merit basis. For this purpose, branch wise merit list of the students would be prepared (performance in the previous year i.e. marks of odd and even semester) and seats would be allocated accordingly. Branch wise merit list will also include the reservation for SC and ST, as per norms of the institution.
- e) Only those students who register themselves in the institute would be eligible for hostel accommodation.
- f) Once rooms are allotted, no mutual inter-change of rooms would be permitted.
- g) Under graduate students of pre final and final B. Tech./ B. Arch./B.Plan And post graduate will normally be allotted single seated accommodation and others will be allotted accommodation in hostels with two or three seated rooms depending on the availability of accommodation. If a three seated room is converted into two seated or single seated, the students residing in the rooms will be charged depending upon the number of students in the room.

12.3 Hostel rules

Every student residing in the hostel must join the co-operative mess attached to that hostel. Individual cooking and messing outside is not permitted.

- a) The cost of the food including the pay of mess servants is to be met by the students themselves. The responsibility for clearing the mess/ advances in time lies with the parent/ guardian of the student. An undertaking to this effect will have to be given by the parent/ guardian of the student at the time of admission.
- b) Every inmate of the hostel is required to perform the honorary duties in the co-operative mess of the hostel as 'Duty Student' or as member of the 'Purchase-cum-Advisory committee' whenever required. These duties are assigned by rotation to inmates of the hostel.

The co-operative mess of each hostel is run under the hostel Committee consisting of the students of the Concerned hostel and constituted by the institute from time to time. To assist in

the purchase and maintenance of mess account, the institute provides mess supervisors and Assistant mess Supervisors to attend the work. The students are responsible to watch and keep a check on the mess Accounts.

- a) Students are advised not to keep valuables in the rooms. They are advised to deposit extra cash in a Bank or in the Post Office.
- b) Each student shall use only one electric bulb not exceeding 60 watts. For use of other
- c) electric appliances prior permission of the Wardens is necessary. The tariff for use of such electrical appliances will be fixed by the Warden. Use of all unauthorized electric appliances is strictly prohibited and these will be confiscated. Lights must be switched off when the students leave their rooms or when they retire to bed.
- d) Students shall not remain absent from their hostels during the night between 10:00 PM
- e) and 5:00 A.M. without the prior permission of the warden. Corresponding timing for Girls hostel will be 8:00 p.m. and 7:00 a.m.
- f) Visitors are not permitted to stay in the hostel after 8:00 p.m. and the guests of the students are not allowed to stay in the hostel except with the prior permission of the Warden and under no circumstances for more than two days.
- g) Students shall not leave the head quarter without prior permission of the Warden.
- h) Hostel prefects will be selected on merit from amongst the hostel students to assist the Warden in the supervision of the hostels and in enforcing discipline.
- i) The room of any student can be inspected at any time by the Parents, Warden or any member of the institute staff.
- j) Students are expected to share the duties involved in keeping the hostel and campus clean and tidy and in running their messes.
- k) Room furniture electric fitting etc. are required to be maintained by the students in good condition. At the time of allotment of seat and leaving the hostel for the summer vacation every student must take over and hand over the hostel property.
- l) Students should invariably vacate hostel during summer vacation for white wash, repair of electric fittings etc. if they want to leave any belonging in the hostel during this period, then it should be deposited with the hostel caretaker.
- m) Damaged / stolen items of furniture, fitting, utensils, mess crockery etc. will be replaced at the cost of student.
- n) No outsider can be invited by any hostel without prior permission of the Chairman Council of Warden/ Proctorial Board.
- o) No magazine or souvenir will be published from any of the hostels without prior permission of the Council of Wardens/ Proctorial board.
- p) Notices from hostel will not be displayed on Institute/ Hostel Notice Board without the counter signature of Warden/ Sr. Wardens.
- q) Duration of the hostel function should be about 2 days preferably on week ends/ holidays.
- r) New clubs will not be formed without permission of the Director.
- s) Letter concerning institute/ Hostel should not be sent to any outsider without prior permission and counter signature of Sr. warden.
- t) Collection should not be made from outside.

- u) Maximum expenditure on hostel functions be limited to Rs. 3000/- plus dinner of hostel inmates duly approved by Sr. warden.
- v) Guest of the students in function could only be invited with the prior permission of the Chairman Council of Wardens/ Proctorial Board.
- w) As far as possible cultural night must be organized in student Activity Centre where full facilities are available.

In all above cases for seeking prior permission of Chairman Council of wardens/ proctorial Board, a written request/ application be invariably submitted 10 days in advance to the Sr. Warden.

13 GENERAL INFORMATION

Health Services

The institute has two full-time Medical Officers and its staff staying in institute campus. The institute also maintains a dispensary situated in the hostel sector. Medical aid is thus available to all students of the institute as and when required. Besides it is compulsory for each student on the rolls of the institute to present himself for a medical examination before the institute Medical Officer for a periodical checkup on such dates as may be fixed by the Medical Officer. Cases which deserve special attention will be referred by the institute Medical Officer to specialists in the local Government Hospitals. Generally medicines will be available at institute dispensary free of cost, but patent medicines will have to be purchased by the student. Students advised not to seek treatment from unregistered medical practitioners.

Tutor Guardian Scheme

The tutor Guardian scheme, introduced in the institute, benefits all the students. Under this scheme a group of students from particular year and department are placed under care of one of the teaching staff who acts as tutor guardians for these students and look after their needs and difficulties. The tutor guardian meets the students individually and in groups as frequently as possible and assists them in every manner. By this, the institute aims to develop the qualities of good citizenship in them. The attendance of the students in the meetings called by their tutor guardian is compulsory.

Students Council

The student's council is a pivot around which the co-curricular/extra curricular activities of the institute revolve and plays significant role in the institute life of the student. The student's council serves as an important adjunct to course work also, since it sponsors lectures by eminent engineers, debate contests, general knowledge tests, essay competitions and various other programs and in general stimulates interest in the diverse spheres of student's life including games and sports. It provides ample opportunities for the students to develop their abilities in fine arts by conducting music contest, dramatics etc. This encourages emotional integration among students to a very great extent.

Main aims and objectives of the student's council are as follows:

- (a) To promote discipline and incorporate, intellectual, civic and cultural life amongst students.
- (b) To foster activities to bring out the creative talents of the students.
- (c) To promote the study and discussion of subject of national and international importance.
- (d) To encourage amongst students awareness of the responsibilities of an individual in a democratic society.
- (e) To promote social service activities.

With the idea of keeping students informed about the latest development in their field of study, the following technical society/association are also functioning under the students council.

- (a) Civil Engineering Association.
- (b) Mechanical Engineering Association.
- (c) Electrical Engineering Association.
- (d) Architecture & Planning Association
- (e) Society of Theoretical and Applied Mechanics.
- (f) Applied Sciences Society.
- (g) Electronics Engineering Association.
- (h) Computer Science Association
- (i) Information Technology Society.

The following clubs/ societies are also functioning under the student's council.

- | | |
|----------------|----------------------|
| a. Auto Club | b. Art Club |
| c. Cine Club | d. Music Club |
| e. Nature Club | f. Photographic Club |
| g. Socio Club | h. Rotract Club |

MANIT ALUMNI Association

The Maulana Azad National Institute of Technology Alumni Association was founded in June 1989. Membership of the Association is open to graduates, postgraduate and teaching staff of the institute. Membership is also open to visiting professors and other participants in the institute's summer programmes. Membership is also possible for the persons whose names are recommended by the executive committee.

The association seeks to provide a common meeting ground for the alumni of the institute. A major activity of the Association is to arrange alumni conferences which bring together the alumni and teaching staff to discuss among themselves topics of interest which are useful to the profession. There is a Annual Silver Jubilee alumni meet in every year in the month of December and also there is bi-annual global alumni convention.

Students Activity Centre

A state of the auditorium artistically designed with a seating capacity of one thousand has been constructed for organizing dramas, music, debate and lectures by eminent personalities.

Open air Auditorium

An open air Auditorium has been constructed in the Sector by 'Shramdan' of the students, faculty and other members of the staff. This auditorium is best suited for organizing cultural functions, picture shows etc.

Co-operative Store

The Co-operative store situated in the main building provides all type of stationary items, Drawing instruments, Blazer cloth, Monograms and Ties at reasonable rates. (No Loss No-profit basis). Every first year student is expected to possess the institute Blazer, the cloth for which is available at the co-operative-store.

Games and Sports

In addition to adequate indoor facilities, extensive and well laid out playgrounds are made available for Tennis, Badminton, Hockey, Football, Cricket, Basketball, Kabaddi, Kho-kho, Gymnastics and other games. One of the state of art gymnastics and billiard are also available for the students.

Banking and Postal Facilities

There is a branch of State Bank of India and a branch of Post Office in the institute building. Students are advised to have savings account at the Bank. They should not keep much cash with them in the hostel. ATM facility is also available in the institute campus. Through which the fee etc. can also be deposited by SBI ATM's from any where in country.

N.C.C. & N.S.S.

NCC/ NSS training is for boys and girls of the first two years at the institute except foreign students. There is a technical unit of NCC in the institute known as: M.P. Composite Technical Regiment. NCC comprises of two companies namely Engineers EME and EME and 4 MP Girls Battalion for girls. Students are required to attend NCC parades and NCC annual camps as prescribed by University and NCC authorities. During training students are expected to qualify for the 'B certificate examination of NCC. Students can qualify for certificate 'C examination of NCC in their third year of NCC training.

A unit of National Services Scheme (an alternative to NCC) has also been opened in the institute since 1973. the students of 1st year who are not joining NCC can join NSS unit of the institute.

Value Education Cell

Aim of any Educational institute is not just to give academic knowledge to the students, but also to develop their all round personality which includes, apart from other things, development and enhancement of human values and commitment to society and nation. For this purpose, a value education cell functions in the institute which comprises of faculty members associated with cultural, spiritual, sports, NCC and NSS activities. Programs like lectures of eminent personalities on various aspects of human values and our rich cultural heritage, Yoga-Meditation camp. Study of various languages and cultures, student participation activities like

debate, essay competition, visits to various sections of society (Villages, slums) to cultivate social awareness and social responsibility, social service programs etc are organized by this cell.

instruments and Equipment

Students are expected to possess the following equipment:

- a) One good drawing instruments Box.
- b) Drawing Board (imperial size) and T-square/ Mini-drafter.
- c) Transparent set squares and protector.
- d) One set of Transparent French Curves
- e) Electronic pocket calculator
- f) Draftsman's scale
- g) Standard Drawing pencils and erasers

This equipment is available at the institute co-operative store.

Apart from these, students of Architecture course requires colour boxes, painting brush etc. detailed instructions regarding this will be given on admission by Department of Architecture. Students of Electrical and Electronics branches should possess a tester, plier and soldering iron also.

Identity Card

Students are issued identity cards on appropriate payment and the students must carry the identity cards with them all the time in the institute and in the town. The cards have to be produced on demand by any member of the staff. The identity card should be returned to the institute when the students finally leave the institute.

Students discipline

At the time of admission to 1st year an undertaking will be required from the parents stating that their ward will abide by all the rules and regulations of the institute and any modifications made therein from time to time.

Ragging of Junior Students:

As per the decision of the Hon'ble Supreme Court vide Writ Petition (Civil) No. 656 of 1998, 'Ragging is an undesirable Social Offence which is totally banned in the Institute' Broadly speaking ragging is :

'Any disorderly conduct whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness any other student, indulging in rowdy or undisciplined activities which causes or is likely to cause annoyance, hardship or psychological harm or to raise fear or apprehension thereof in a fresher or junior student or asking the student to do any act or perform something which such student will not do in the ordinary course and which has the effect of causing or generating a sense of shame or embarrassment so as to adversely affect the physique or psyche of a fresher or a junior student.'

The following could be possible punishments as per the decision of the Hon'ble Supreme Court.

- (i) Cancellation of admission.
- (ii) Suspension from attending classes.
- (iii) Withholding/ withdrawing scholarship/ fellowship or other benefits.
- (iv) Debarring from appearing in test/ examination or other evaluation process.
- (v) Withholding results.
- (vi) Debarring from representing the institution in any national or international meet, tournament, youth festival etc.
- (vii) Suspension/expulsion from the hostel.
- (viii) Rustication from the institution for periods varying from 1 to 4 semesters.
- (ix) Expulsion from the institution and consequent debarring from admission to any other institution.
- (x) Fine up to Rs.25,000/-
- (xi) Rigorous imprisonment up to three years.

Disregard of institute hostel rules, order and notices.

- a) Disregard of orders and instructions of the members of the institute staff.
- b) Noisy, boisterous, disorderly and obnoxious behavior.
- c) Irregular attendance and unauthorized absence from classes and hostels.
- d) Lack of punctuality in attendance, non payment of institute dues, in other matters where dates and time for any duty, functioning or obligation are prescribed.
- e) Persistent neglect of studies including mass absenteeism and inciting the mass absenteeism.
- f) Recourse to unfair means in test and examination.
- g) Negligence, use of false, fraudulent statement or acts.
- h) Taking part in strikes.
- i) Failure to produce identity card on demand by member of staff, warden, prefect etc. at any time and place within the institute, hostel and town.
- j) Non-sportsman like behavior during indoor/outdoors games.

In addition, the student shall observe the following

- a) Student during training in industry must confirm to industrial discipline and follow factory rules in regard to attendance, holiday, timings, code etc.
- b) Student shall be responsible for all books, apparatus tools, instruments, material etc. issued to them.
- c) Student shall observe all safety precautions. The institute is not responsible for accidents in the institute, hostel, workshop, laboratory and playground.
- d) No society, association or club shall formed by the student without prior permission of the director.
- e) No meeting shall be convened and no person shall be invited to address any meeting in the institute premises without the prior permission of the Director.

- f) A student who is found to have committed any act of indiscipline is liable to any one or more of the following punishments. (i) Warning (ii) Censure (iii) Fine (iv) Reduction/Cancellation of scholarship/stipend/Fellowship (v) Recovery in part or full of losses or damages to the institute property or property of others caused by the delinquent student (vi) Suspension from availing of any other caused by the delinquent student (vii) Suspension from availing of any of the Institute amenities and services or from class (viii) Removal, rustication or expulsion from the institute or hostel (ix) withholding of character certificate. Ragging of juniors students will invariably lead to expulsion from the institute.

No post in student council/association/Hostel committees, No privilege for MALI, Value Education etc. No permission for attending conferences, No recommendations, No option to revise grades, review and debarring from campus interviews, deduction of marks of innovates works/General Proficiency, informing prospective employers, debarring from attending convocation. The students will have opportunity through NCC/NSS/Sports to improve their behavior/discipline. The punishments are liable to be inflicted at the discretion of Director whose decision shall be final.

- g) Students are required to attend not less than 75% of lectures and tutorials etc. in each subject and to complete 75% of practical work in practical subjects in order to qualify for appearing at the End Term Examination.
- h) Students who wish to take leave must send application in writing duly countersigned by their parents or their tutor guardians or Hostel Warden to the institute office; at least two days before the date on which they wish to proceed on leave, except in case of emergency.
- i) The Railway concessions are issued to the students in accordance with the prescribed rules of Railways.

Training, Placement and Students Welfare

The institute has a professor incharge and training and placement officer looking after the training and placement of students as well as their welfare. This cell makes arrangement for vocational training of students in various engineering department and industries in the country. It helps the students in securing suitable placement while in final year and even after they pass out from the institute and also looks after welfare of students in general.

Proctorial Committee

A Proctorial committee is constituted to supervise and maintain overall welfare and discipline of the students. All cases of students indiscipline will be looked into by this committee and suitable reformatory action to be taken in the matter.

Council of Wardens

Council of wardens constituted to co-ordinate the smooth functioning of hostels.

The function of the council of wardens is to look to the common problems of all hostels such as:

- a) Organize and encourage healthy activities for the general development.
- b) Overall discipline of the students in the hostels.

- c) Regularize collection of mess dues and enforce mess rules.
- d) Arrange for auditing of hostel mess accounts.
- e) Provide facilities like developing hostel gardens, games, sports and general cleanliness in the hostel.

14 INDO-UK RECS PROJECT-ENERGY THEME

To strengthen the technical education system in RECs, the Govt. of India, Ministry of HRD and govt. of U.K. the Overseas Development Administration (ODA-UK) signed an agreement in the month of January, 1994. Under this agreement the selected 8 RECs' out of 17 in India have collaborated with 12 important Universities of Northern Consortium of U.K. Focus is on the 4 identified thrust themes, developed as multidisciplinary topics across several department, each theme covering 2 institutes namely Design at Allahabad & Jaipur, Energy at Bhopal & Trichi, Information Technology at Surathkal and Warangal, and Material Engineering and Nagpur & Rourkela.

It is a matter of pride that MACT is one amongst the 8 RECs selected for this UK-REGs project, and that it is the nodal center for 'Energy Theme because of its infrastructure, programmes and development in energy related areas and because of its close collaboration with giant industry such as BHEL, Bhopal producing energy related equipment.

The INDO-UK made available £ 6.207 million as aid to 8 RECs over the 4 years in support of the project towards 104 UK to India Consultancies (UK Experts), 46 study visits by senior faculty, laboratory refurbishment and information support, books/journals, software etc. Govt. of India provide about Rs.200 millions towards locally procured equipment, long term maintenance support, new laboratory building space, recruitment of nominal additional staff, local cost of UK Consultancies, travel grant to REC staff to participate in local workshops/ conferences, enhancement of information support services to provide an effective network of Libraries in 8 RECs.

15 CENTRES

Energy center

The Energy Centre with a built up area of 3000 sq. m. has been establishment under this project over a site of 5400 sq. m. at MANIT and it is engaged in R & D activities in the field of. Non-conventional Energy. The building design is based on the energy efficiency through orientation and design solution, the open yard is used for placing solar Collectors, Wind turbine Generator, Solar Pumps, Bio-gas plant, Automatic weather station 'and other field activities. There are about 11 laboratories, conference hall and other administration and service areas, Each laboratory facilities R & D activities related to each area of Non-conventional energy and utilization such as photo-voltaics, Wind Energy, Bio Energy, Mini Micro Hydro, Active Passive

Solar Energy, Energy conservation and Energy management, Energy efficient material etc. Computer facilities are extended to each laboratory. Number of research and consultancy projects is taken up. MANIT has recognized it as centre for energy studies and sanctioned post graduate fellowship. A large number of conferences seminars workshops. Training program continuing education programs are regularly organized in various areas of energy.

Energy centre provides substantial support for number of M.Tech Students and Ph.D students for the purpose of their thesis work.

Nano science and Engineering center

Physics department has started a PG course on Nano-technology in 2007. Three batches has already come out and well placed in India and Abroad. Now, center for Nano-Science and Engineering is started recently. Number students are working for their M.Tech project works and lot of research and development works are carried out in this center.

Remote Sensing, GIS and GPS Center

Remote sensing, GIS and GPS center started at MANI, Bhopal recently with funding from TEQIP II for center of excellence. One M.tech course on Geo-informatics is running under the center. Large number of Ph.D students and M.Tech students are working in the new emerging area of research. Number of consultancy works are carried out by the faculty sponsored by Government of India organization such as DRDO, BARC, ISRO etc.

16 TEQIP

The institute has been selected as lead institute under TEQIP (Technical Education Quality Improvement Programme) of Govt. of India in Feb. 2003. this shall facilities the enhancement of various laboratory facilities and infrastructure development along with training of faculty and staff of the participating institute.

Under this programmes SGSITS (Indore) S.V. Polytechnic (Bhopal) and UIT (Bhopal) are associated with MANIT as the networking institutes. TEQIP phase 2 also started in the Institute. This scheme will enhance the research and development activities of all the associated institutes.

17 SPONSORED GOLD MEDALS FOR MANIT STUDENTS

Institute is awarding gold medal and silver medal for the toppers of each department for both UG and PG programmes.

18 CHANGE OF RULES

Although the rules and regulations mentioned in this ordinance are not variable but, the Senate, as the Supreme academic body of the institute, from time to time, may revise, amend or alter the regulations, courses of study, their credits and syllabus as and when found necessary. In case a rule needs urgent revision for smooth conduction of academic semester, the same can be done by Chairman Senate and will be ratified in the subsequent senate meeting. *If there is difference of opinions in understanding/interpretation of any rule/regulation given here, the decision of the Chairman senate shall be final.*

COURSE STRUCTURE

In the engineering discipline, four years courses, first year, the courses are common. Hence, merit students can get branch change depend upon the availability of the seats in other branches.

I semester Machine Technology Division/ II semester Soft Technology Division

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH111/ MTH121	Mathematics 1 / Mathematics 2	3	-	-	3
CE112	Basic Civil Engineering	3	-	-	3
PHY113	Physics	3	-	-	3
HUM114	Communication Skill	3	-	-	3
CSE115	Computer Programming	3	-	-	3
ME116	Engineering Graphics	2	2	-	3
CSE117	Computer Program Lab.	-	-	3	2
PHY118	Physics Lab.	-	-	3	2
Total credit 22					

I semester Soft Technology Division/ II semester machine Technology Division

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH121/ MTH111	Mathematics 2/Mathematics 1	3	-	-	3
CH 122	Engineering Chemistry	3	-	-	3
CE123	Environment Engineering and biology	3	-	-	3
EE124	Basic Electronics and Electrical Engineering	3	-	-	3
ME125	Basic Mechanical Engineering	3	-	-	3
CE126	Solid Mechanics	3	-	-	3

ME127	Workshop Practice	-	-	2	1
EE128	Electrical and Electronic Lab.	-	-	2	1
CH 129	Chemistry Lab.	-	-	3	2
Total credit					22

MACHINE TECHNOLOGY DIVISION

19 DEPARTMENT OF CIVIL ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH211A	Mathematics 3	3	-	-	3
CE212	Surveying 1	3	-	-	3
CE213	Fluid Mechanics 1	3	-	-	3
CE214	Engineering Geology	3	-	-	3
CE215	Building Planning and Drawing	3	-	-	3
CE216	Structural Analysis	3	-	-	3
CE217	Survey Lab. 1	-	-	3	2
CE218	Fluid Mechanics Lab. 1	-	-	2	1
CE219	Engineering & Geology Lab.	-	-	2	1
Total credit					22

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CE221	Survey 2	3	-	-	3
CE222	Fluid Mechanics 2	3	-	-	3
CE223	Transportation Engineering 1	3	-	-	3
CE224	Structural design and drawing1 (Concrete Structure)	3	-	-	3
CE225	Engineering hydrology	3	-	-	3
CE226	Geotechnical engineering 1	3	-	-	3
CE227	Survey Lab. 2	-	-	3	2

CE228	Fluid Mechanics Lab. 2	-	-	2	1
CE229	Geotechnical Engineering Lab.	-	-	2	1
Total credit 22					

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CE311	Geotechnical engineering 2	3	-	-	3
CE312	Structural Design & Drawing 2 (Steel Structure)	3	-	-	3
CE313	Transportation Engineering 2	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
CE315	Geotech Engg. Lab. 1	-	-	2	1
CE-316	Transportation Lab.	-	-	2	1
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CE321	Irrigation Engineering	3	-	-	3
CE322	Structural Analysis 2	3	-	-	3
CE323	Water Supply Engineering	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
CE325	Geotech Engg. Lab. 2	-	-	2	1
CE326	Water analysis. Lab.1	-	-	2	1
Total credit 23					

List of Departmental electives

CE331 Concrete technology	CE332 Air Quality Monitoring & Control
CE333 Applied Geology	CE334 Ground Water Hydrology
CE335 Geodesign and GNSS	CE336 Open Channel Hydraulics
CE337 Traffic engineering	
CE338 Computational Methods in civil Engineering,	
CE341 Solid waste management	CE342 High way geometric design

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CE411	Waste water Engineering	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
CE412	Waste water Analysis Lab.	-	-	2	1
CE413	Major Project/Seminar	-	3	3	3
CE414	Educational Tour & Training.	-	-	2	1
Total credit 20					

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HUM421	Project costing and Contract Management	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
CE422	Major project & Seminar	-	6	2	4
CE423	General Proficiency	-	-	2	1
Total credit 20					

List of Departmental electives

CE7431 Reinforced Earth and Geo-Synthetics engg. CE432 Modern Foundation
 CE433 Earthquake Resistance Design of structure
 CE434 Computational methods in civil engineering
 CE435 Advanced Reinforced concrete Design CE436 Hydro Power Engineering
 CE437 Sediment Transportation Engineering
 CE438 Analysis & Design of substructures CE 439 Airport planning and design
 CE 441 Industrial waste management
 CE442 Site Investigation & Ground Improvement
 CE443 Soil Dynamics & Machine Foundation CE 444 Hydraulic Structure
 CE445 Hazardous Waste Management and Risk Analysis
 CE446 Advanced Highway construction CE447 Pavement Design

20 DEPARTMENT OF MECHANICAL ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ME211	Engineering Thermodynamics	3	-	-	3
ME212	Mechanical engg.graphics	2	2	-	3
ME213	Materials science & engineering	3	-	-	3
ME214	Kinematics of machines	3	-	-	3
ME215	Manufacturing processes - 1	3	-	-	3
ME216	Mechanics of materials	3	-	-	3
ME217	Thermal Engineering Lab.	-	-	2	1
ME218	Computer aided graphics Lab.	-	-	2	1
ME219	Strength of materials Lab.	-	-	2	1
ME220	Manufacturing technique Lab.	-	-	2	1
Total credit					22

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH221	Mathematics - 3	3	-	-	3
ME222	Manufacturing processes -2	3	-	-	3
ME223	Dynamics of Machines	3	-	-	3
CE224	Fluid Mechanics & hydraulic Machines	3	-	-	3
ME225	Machine Design - 1	3	-	-	3
EE226	Electrical machines & Electronics	3	-	-	3
ME227	Dynamics of Machines lab	-	1	3	2
CE228	Fluid mechanics Lab.	-	-	2	1
EE229	Electrical Machines & Electronics Lab.	-	2	1	1
Total credit					22

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ME311	Mathematics 4	3	-	-	3
ME312	Internal combustion engines	3	-	-	3
ME313	Metrology	3	-	-	3
	Departmental elective 1	3	-	-	3
	Departmental elective 2	3	-	-	3
	Open elective	3	-	-	3
ME314	IC engines Lab.	-	1	3	2
ME315	Metrology Lab.	-	-	2	1
ME-316	Thermal engineering Lab. 2	-	1	3	2
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ME321	Heat transfer	3	-	-	3
ME322	Machine design 2	3	-	-	3
ME323	Industrial engineering	3	-	-	3
	Departmental elective 3	3	-	-	3
	Departmental elective 4	3	-	-	3
	Open elective	3	-	-	3
ME324	Heat transfer lab	-	-	2	1
ME325	Manufacturing technique laboratory -2	-	-	2	1
ME326	minor project	-	3	3	3
Total credit 23					

List of Departmental electives

ME331 Mechatronics

ME333 Material Handling

ME334 Production & Operations Management

ME336 Automobile Engineering

ME338 Supply Chain Management

ME332 Measurement techniques

ME335 Industrial tribology

ME337 Turbomachinery

ME339 Lean Manufacturing Engg.

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ME411	Refrigeration and air conditioning	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
ME412	Lab. (Environmental lab II)	-	-	2	1
ME413	Major Project/Seminar	-	4	2	3
ME414	Educational Tour & Trg.	-	-	2	1
Total credit					20

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HUM-421	Industrial management	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
ME428	Major project & Seminar	-	6	2	4
ME429	General Proficiency	-	-	2	1
Total credit					20

List of Departmental electives

ME431 Energy conversion (power plant engineering) ME432 Concurrent Engineering
 ME433 Flexible Manufacturing System ME434 Computer Aided Machine Design
 ME435 Computer Aided Manufacturing
 ME436 Computer Aided Facility Planning
 ME437 Tool Engineering ME438 Robotics
 ME439 Computational Combustion & Turbulence Modelling
 ME441 Nuclear power engineering

21 DEPARTMENT OF ELECTRICAL ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH211B	Mathematics 3	3	-	-	3
EE212	Electrical Materials & Electromagnetic Fields	3	-	-	3
EE213	Power systems	3	-	-	3
EE214	Networks	3	-	-	3
EE215	EMEC 1	3	-	-	3
EE216	Electronics 1	3	-	-	3
EE217	Networks Lab.	-	-	2	1
EE218	Electromechanical Energy Lab	-	-	2	1
EE219	Electronics Lab. 1	-	1	3	2
Total credit					22

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EE221	Utilization electrical energy	3	-	-	3
EE222	Electrical machine Design	3	-	-	3
EE223	Generation of electrical power 1	3	-	-	3
EE224	EMEC 2	3	-	-	3
EE225	Measurement	3	-	-	3
EE226	Electronics 2	3	-	-	3
EE227	Electrical Measurement Lab	-	-	2	1
EE228	Electromechanical Energy Conversion Lab. 2	-	-	2	1
EE229	Electronics Lab. 2	-	1	3	2
Total credit					22

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EE311	EMEC 3	3	-	-	3
EE312	Power Electronics	3	-	-	3

EE313	Linear Control System	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
EE315	Lab. (Linear Control)	-	-	2	1
EE316	Electromechanical Energy Conversion Lab. 3	-	-	2	2
EE317	Power Electronics Lab.	-	1	3	2
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EE321	Instrumentation	3	-	-	3
EE322	Modern Control System	3	-	-	3
EE323	Microprocessor	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
EE324	Lab. (Instrumentation)	-	-	2	1
EE325	Lab. (Modern Control)	-	1	3	2
EE326	Lab. (Microprocessors)	-	1	3	2
Total credit 23					

List of Departmental electives

EE331 Electrical engineering graphics	EE332 Installation & Commissioning
EE333 Reliability Engineering	EE334 Prime Mover
EE335 Optimization Techniques	EE336 Modeling & Simulation using MATLAB
EE337 Electrical drives	EE338 Power controller
EE339 Renewable Energy Sources	EE341 EHVAC & HV DC

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EE411	Power System 2	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3

EE412	Power System-Lab. 2	-	-	2	1
EE413	Major Project/Seminar	-	2	2	2
EE414	Educational Tour & Training.	-	-	3	2
Total credit 20					

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HUM-421	Power System Control & Stability	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
EE422	Major project & Seminar	-	6	2	4
EE423	General Proficiency	-	-	2	1
Total credit 20					

List of Departmental electives

EE431 Power Quality	EE432 System Engineering
EE433 Special Machines	EE434 Advanced Microprocessor
EE435 Power System De-regulation	EE436 Electronics Instrumentation
EE437 High Voltage Engg.	

22 DEPARTMENT OF MATERIAL SCIENCE AND METALLURGICAL ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH211E	Mathematics 3	3	-	-	3
MSM212	Fuel, ceramics and furnaces	3	-	-	3
MSM213	Introduction to Manufacturing Processes	3	-	-	3
MSM214	Physical Metallurgy	3	-	-	3
MSM215	Polymeric Materials	3	-	-	3
MSM216	Metallurgical Thermodynamics & Kinetics	3	-	-	3
MSM217	Fuel furnace refractoriness	-	-	4	2

	Lab.				
MSM218	Manufacturing Processes Lab 1	-	-	3	2
Total credit 22					

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MSM221	Material Testing	3	-	-	3
MSM222	Mechanical Behavior of Materials	3	-	-	3
MSM223	Nature and properties of Materials	3	-	-	3
MSM224	Heat Treatment	3	-	-	3
MSM225	Iron making	3	-	-	3
MSM226	Foundry Technology	3	-	-	3
MSM227	Ceramics and polymer Lab	-	-	4	2
MSM228	Material Testing Lab	-	-	4	2
Total credit 22					

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MSM311	Iron and Steel Making	3	-	-	3
MSM312	Characterization of Materials	3	-	-	3
MSM313	Welding technology	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
MSM315	Heat treatment and welding Lab	-	-	6	3
MSM-316	Characterization of Materials Lab	-	-	4	2
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MSM321	Non Ferrous Metal Extraction	3	-	-	3
MSM322	Industrial powder metallurgy	3	-	-	3
MSM323	Corrosion Engineering	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
MSM325	Manufacturing and joining Lab.	-	-	3	1
MSM326	Process Metallurgy Lab.	-	-	3	1
MSM327	Minor Project	-	4	2	3
Total credit 23					

List of Departmental electives

MSM331 Welding and metal joining

MSM332 X-Ray Crystallography

MSM333 Ceramic engineering

MSM334 Physical Metallurgy of Steels

MSM435 transport Phenomena

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MSM411	Surface Engineering	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
MSM412	Surface Engineering Lab	-	-	2	1
MSM413	Major Project/Seminar	-	4	2	2
MSM414	Educational Tour & Training.	-	-	2	1
Total credit 20					

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
HUM-421	Selection and design of Engineering materials	3	-	-	3

	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective V	3	-	-	3
	Open Elective VI	3	-	-	3
MSM422	Major project & Seminar	-	4	4	4
MSM423	General Proficiency	-	-	2	1
Total credit 20					

List of Departmental electives

MSM431 Processing and Applications of Refractory Metals and Alloys

MSM432 Materials for cutting tool applications MSM433 Heat and Mass Transfer

SOFT TECHNOLOGY DIVISION

23 DEPARTMENT OF CHEMICAL ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH211C	Mathematics 3	3	-	-	3
CHE 212	Introduction to Chemical Engineering	3	-	-	3
CHE 213	Chemical Process Calculations	3	-	-	3
CHE 214	Fluid Mechanics	3	-	-	3
CHE 215	Chemical Process Technology 1	3	-	-	3
CHE 216	Chemical Engineering Thermodynamics	3	-	-	3
CHE 217	Chemical Technology Lab	-	-	4	2
CHE 218	Fluid Mechanics Lab.	-	-	4	2
Total credit 22					

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CHE 221	Chemical Reaction Engineering 1	3	-	-	3
CHE222	Mechanical Operations	3	-	-	3
CHE223	Heat Transfer 1	3	-	-	3

CHE224	Chemical Process Technology 2	3	-	-	3
CHE 225	Mass Transfer 1	3	-	-	3
CHE226	Instrumentation and Process Dynamics Control	3	-	-	3
CHE227	Heat Transfer Lab.	-	-	4	2
CHE228	Mechanical Operations Lab.	-	-	4	2
Total credit 22					

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CHE311	Heat Transfer 2	3	-	-	3
CHE312	Mass Transfer 2	3	-	-	3
CHE313	Chemical Reaction Engineering 2	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
CHE314	Mass Transfer Lab	-	-	6	3
CHE315	Process Control Lab	-	-	4	2
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CHE 321	Process Modeling and Simulation	3	-	-	3
CHE322	Transport Phenomena	3	-	-	3
CHE323	Process Equipments Design Drawing -I	2	2	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
CHE324	Chemical Reaction Engg. Lab.	-	-	2	1
CHE325	Modeling and Simulation Lab.	-	-	2	1

CHE326	Minor Project & Seminar	-	4	2	3
Total credit 23					

List of Departmental electives

CHE331 Bio Chemical Engineering	CHE332 Oil and Paint Technology
CHE333 Petroleum Refinery Engineering	CHE334 Fertilizer Technology
CHE335 Pharmaceutical Technology	CHE336 Corrosion Engineering
CHE337 Novel Separation Techniques	CHE338 Ceramic Technology
CHE339 Environment Pollution & pollution control	

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CHE411	Process Equipments Design Drawing -II	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
CHE412	Process Equipments Design Drawing	-	6	-	3
CHE 413	Major Project & Seminar	-	-	2	1
CHE414	Educational Tour & training	-	-	2	1
Total credit 20					

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CHE421	Process Engg. & Costing	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
CHE422	Major project & Seminar	-	4	2	3
CHE423	General Proficiency	-	4	-	2
Total credit 20					

List of Departmental electives

CHE431 Multiphase Reactions.	CHE432 Industrial Pollution Control
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CHE433 Computer Aided Process Control & Design
 CHE434 Process Piping Design CHE435 Fluidization Engg
 CHE436 Fuels and Combustion CHE437 Industrial Catalysis
 CHE438 Multi Phase Flow CHE439 Advanced Process Optimization
 CHE441 Cleaner Technologies in Chemical Process Industries
 CHE442 Computational Fluid Dynamics CHE443 Sustainability and Green Chemistry
 CHE 444 Nanotechnology in Catalysis

24 DEPARTMENT OF ELECTRONICS AND COMMUNICATION

(B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH211D	Computational Techniques	3	-	-	3
EC212	Electronic Devices & Circuits	3	-	-	3
EC 213	Digital Electronics & Microprocessor	3	-	-	3
EC 214	Network Analysis and Synthesis	3	-	-	3
EC 215	Signals and Systems	3	-	-	3
EC 216	Electronic Instrumentation And Measurement	3	-	-	3
EC 217	Electronic Circuit and Digital Electronics Lab	-	-	3	2
EC 218	N/W and Inst. & Measurement Lab	-	-	3	2
Total credit 22					

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 221	Analog Electronic Circuits	3	-	-	3
EC 222	Adv. Microprocessors and Microcontrollers	3	-	-	3
EC 223	Analog Communication	3	-	-	3
EC 224	Comm. Networks &	3	-	-	3

	Transmission Lines				
EC 225	Control system 1	3	-	-	3
EC 226	Integrated Circuits	3	-	-	3
EC227	Analog EL Circuit & μ P Lab.	-	-	3	2
EC 228	Analog Communication & CNTL Lab.	-	-	3	2
Total credit 22					

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 311	Digital Communication	3	-	-	3
EC 312	Digital Signal Processing	3	-	-	3
EC 313	VLSI design	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
EC 314	Digital Comm. & DSP Lab	-	-	2	1
EC 315	IC & VLSI Lab	-	-	2	1
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 321	Control systems 2	3	-	-	3
EC 322	Optical Communication	3	-	-	3
EC 323	Microwave Engg.	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
EC 324	Digital Image Processing & control Lab	-	-	2	1
EC 325	Optical & MW Lab	-	-	3	2
EC 326	Minor Project	-	-	4	2
Total credit 23					

List of Departmental electives

EC 331 Digital Image Processing

EC 332 Pattern Recognition

EC 333 Speech Recognition
 EC 335 Digital Message Transmission
 EC338 Design of Analog IC's
 EC 341 Industrial electronics
 EC342 Electronics Sensors and display devices

EC 334 Telecom Switching Systems
 EC 336 Data Compression and Cryptography
 EC339 Low Power VLSI design

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 411	Antenna and Wave Propagation	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
EC 412	Lab (Antenna & Advance Comm. Lab)	-	-	3	2
EC 413	Major Project& Seminar	-	-	4	2
EC 414	Educational Tour & Training.	-	-	2	1
Total credit 20					

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC421	Mobile Communication	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
EC 422	Major project & project Seminar	-	-	6	3
EC 423	General Proficiency	-	-	4	2
Total credit 20					

List of Departmental electives

EC 431 Satellite Communication
 EC 433 Active RF Devices and Circuits
 EC 434 RADAR and Navigation systems
 EC 436 TV Engineering

EC 432 Wireless Communication
 EC 435 Broadband Optical Networks
 EC 437 Design of Communication Network

EC 438 Fuzzy Logic

EC 439 Computer Vision

EC 441 Biomedical Image Processing

EC 442 CAD of Digital Systems

EC 443 Micro Electro Mechanical Systems

25 DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (B.Tech.)

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE211	Data structure	3	-	-	3
CSE212	Discrete Structure	3	-	-	3
CSE 213	Digital Electronics	3	-	-	3
CSE 214	Digital Communication	3	-	-	3
CSE 215	Computer Graphics	3	-	-	3
CSE 216	Principles of Programming Languages	3	-	-	3
CSE 217	DS Lab	-	1	3	2
CSE 218	PPL Lab.	-	-	2	1
CSE 219	CG Lab	-	-	2	1
Total credit 22					

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE 221	Probability and Queuing Theory	3	-	-	3
CSE 222	Computer Architecture	3	-	-	3
CSE 223	Theory of Computation	3	-	-	3
CSE 224	Database Management System	3	-	-	3
CSE 225	Analysis and Design of Algorithm	3	-	-	3
CSE 226	Software Engineering	3	-	-	3
CSE 227	DBMS Lab	-	-	3	2
CSE 228	ADA Lab2	-	-	2	1
CSE 229	SE Lab 3	-	-	2	1
Total credit 22					

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE 311	Compiler Design	3	-	-	3
CSE 312	Operating System	3	-	-	3
CSE 313	Microprocessor	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
CSE 315	CD Lab	-	-	2	1
CSE 316	MP Lab-	-	-	3	2
CSE317	OS Lab	-	-	3	2
Total credit 23					

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE 321	Computer networks	3	-	-	3
CSE 322	Data ware housing and mining	3	-	-	3
CSE 323	Artificial intelligence	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 2	3	-	-	3
CSE 325	Net work Lab. 1	-	-	2	1
CSE 326	Unix Lab. 2	-	-	3	2
CSE327	Minor project	-	-	4	2
Total credit 23					

List of Departmental electives

CSE 331 Advance Computer Architecture
 CSE 333 VLSI Design
 CSE 335 Distributed database
 CSE 337 Cryptography
 CSE 339 Digital Image Processing

CSE 332 Software Reusability
 CSE 334 Parallel and Distributed Algorithm
 CSE 336 Embedded System
 CSE 338 Heterogeneous computing,
 CSE 341 E-commerce & E-governance

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE 411	Soft Computing	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
CSE 412	Lab (Soft Computing	-	-	3	2
CSE 413	Major Project&Seminar	-	2	2	2
CSE 414	Educational Tour & Trining.	-	-	2	1
Total credit					20

Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSE421	Network Security	3	-	-	3
	Departmental Elective – VII	3	-	-	3
	Departmental Elective – VIII	3	-	-	3
	Open Elective V	3	-	-	3
	Open Elective VI	3	-	-	3
CSE 422	Major project & Seminar	-	-	6	3
CSE 423	General Proficiency	-	-	-	2
Total credit					20

List of Departmental electives

CSE 7431 Software Testing
 CSE 433 Distributed Computing
 CSE 435 Computer Vision
 CSE 437 Natural Language Processing
 CSE 439 Quantum computing
 CSE 442 Web search and Mining

CSE 432 Cloud Computing
 CSE 434 Pattern Recognition
 CSE 436 Randomized Algorithm
 CSE 438 Mobile computing
 CSE 441 Sensor Network

List of open Electives in third year

CE351 Remote Sensing & GIS
 CE353 Renewable energy Systems
 CE355 High way geometric design
 CE357 Bio-Energy
 CE359 Instrumentation and measurements

CE352 Environmental monitoring
 CE354 Rain water harvesting
 CE356 Finite element methods
 CE358 Theory of hydraulic machines

ME351 Operation Research	ME353 Environmental Quality Monitoring
ME354 Statistical Quality Control (SQC)	ME355 Industrial safety Engineering
ME356 Advanced MOM	

EE351 Computer applications in power systems	
EE352 Engineering economics modeling and analysis	
EE353 Demand side management	EE354 Biomedical Engineering
EE355 Network Synthesis	

MSM 351 Transport phenomena	MSM 352 Mineral engineering
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CHE351 Risk Analysis and Hazard	
CHE352 Environmental Impact Assessment and Environmental Audit	
CHE 353 Petrochemical technology	CHE 354 Polymer technology
CHE 355 Food technology	CHE 451 Bio Energy Technology

EC 351 Queuing Theory	EC 352 AI and Robotics
EC 353 TCP-IP	EC 354 Computer networking
EC355 B ISDN and ATM	EC356 Internet technology

CSE 351 Multimedia	CSE 352 Object-oriented Programming
CSE 353 Simulation & Modeling	CSE 354 UNIX internals & shell programming

MAN 357 Engineering Economics and business organization	
MAN358 Entrepreneurship Development	MAN 359 Industrial mangement

List of open Electives in Fourth year

CE451 Hydraulic Measurement System	CE452 Fluid Machines and hydraulic systems
CE453 Road safety engineering	CE454 Computational Fluid Dynamics
CE455 Operation research	CE456 Digital Processing of Remote Sensing Data
CE457 Environmental Impact Assessment	CE458 Finite element methods
CE459 Digital Mapping & Cartography	

ME451 Solar energy-	ME452 Industrial Organization & Management
ME453 Composite Materials	ME454 Material Management
ME455 Maintenance engineering and management	
ME456 Computational Fluid dynamics (CFD)	ME457 Technology Entrepreneurship
ME458 Vibration	ME459 Experimental Stress Analysis
ME461 Advanced production Engineering	ME462 Advanced machine design

EE451 Neural Network	EE452 Microcontroller and its applications
EE453 Digital Signal Processing	EE444 Embedded System
EE455 Solar PV Applications	EE456 Energy Conservation & Management
EE457 VLSI Design	EE458 Digital Image Processing

MSM453 Failure analysis
MSM455 Nuclear metallurgy

MSM454 Non destructive testing
MSM456 Materials for automobile applications

CHE451 Bio-energy techniques
CHE453 Optimization technique
CHE 455 industrial safety and hazardous management

CHE452 Solid waste Management
CHE 454 Advanced analytic technique

EC 451 Neural Networks
EC 453 Nano Technology
EC 455 Embedded systems
EC457 Statistical Signal Processing

EC 452 Biometric Signal Processing
EC 454 Modeling and Simulation Techniques
EC456 Real time systems

CSE 451 Graph Theory
CSE 453 Cyber crime and information warfare
CSE 455 Internet Technology

CSE 452 Optimization techniques
CSE 454 Wireless Networks
CSE 456 Ethical hacking.

MAN 451 Intellectual Property Rights
MAN 453 Project management

MAN452 Entrepreneurship development

ARCHETECTURE AND PLANNING DIVISON

26 DEPARTM,ENT OF PLANNING (B.Plan)

First Semester

Course number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
PLA 111	Introduction t0 physical Planning	3	0	3
PLA112	Planning theory 1	3	0	3
PLA 113	Statistical Method 1	3	0	3
PLA 114	Graphics 1	2	4	3
PLA 115	History of Settlement	3	0	3
PLA 116	Communication skills	0	6	3
PLA 117	Planning studio 1	0	10	5
Total credit				23

Second Semester

Course number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	

PLA 121	Graphics 2	2	4	3
PLA 122	Surveying	2	3	3
PLA 123	Statistical Method 2	3	0	3
PLA 124	Applied Geology& Hydrology	3	0	3
PLA 125	Demography and Urbanization	3	0	3
PLA 126	Computer application	0	6	3
PLA 127	Planning Studio 2	0	10	5
Total credit				23

Third Semester

Course number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
PLA 211	Settlement sociology	3	0	3
PLA 212	Planning theory 2	3	0	3
PLA 213	Traffic and Transportation Planning 1	2	3	3
PLA 214	Elements of Economics	3	0	3
PLA 215	Planning Practices 1	2	3	3
PLA 216	Techniques of Planning 1	0	6	3
PLA 217	Planning studio 3 (Neighborhood and site planning)	0	10	5
Total credit				23

Fourth Semester

Course number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
PLA 221	Traffic and Transportation Planning 2	2	3	3
PLA222	Landscape Planning	2	3	3
PLA 223	Environmental science (climatology)	2	3	3
PLA 224	Geo Informatics for Planning	3	0	3

PLA 225	Ecology and resource management	3	0	3
PLA 226	Techniques of Planning 2	0	6	3
PLA 227	Planning studio 4 (Transportation aspect)	0	10	5
Total credit				23

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
PLA 311	Urban Finance	3	0	3
PLA 312	Planning Practice 2& Training	2	3	3
PLA 313	Rural Planning	3	0	3
PLA 314	Settlement Geography	3	0	3
	Elective 1	2	3	3
PLA 315	Infrastructural Planning	0	6	3
PLA 316	Planning studio 5 (Area / Zonal Planning)	0	10	5
Total credit				23

Sixth Semester

Course Number	Subject	Periods per week		Credits
		Lecture	Studio	
PLA 321	Urban Design	2	3	3
PLA 322	Regional Planning	3	0	3
PLA 323	Housing	2	3	3
PLA 324	Disaster Planning & Management	2	3	3
PLA 325	Urban conservation	3	0	3
	Elective 2	0	6	3
PLA 326	Planning studio 6 (Development plan preparation)	0	10	5
Total credit				23

List of Departmental Electives

PLA 331 Utility, Services Planning and management

PLA 332 Planning for Informal Sector PLA 333 Environment Impact Assessments

PLA 334 Energy Efficient Planning

Seventh Semester

Course number	Subject	Periods per week		Credits
		Lecture	Studio	
PLA 411	Planning Legislation and Professional practice	3	0	3
PLA 412	Urban Management	3	0	3
PLA 413	Remote sensing and GIS	3	0	3
	Elective 3	2	3	3
PLA 417	Project formulation and appraisal	2	3	3
PLA 418	Dissertation	0	6	3
PLA 419	Training	0	0	2
PLA 420	Planning studio 7 (block sub regional plan)	0	10	5
Total credit 23				

Eighth Semester

Course Number	Subject	Periods per week		Credits
		Lecture	Studio	
PLA 421	Urban Governance	3	0	3
PLA 422	Real estate planning & Management	2	3	3
	Elective 4	2	3	3
PLA 423	Thesis / Dissertation	0	22	9
PLA 424	General Proficiency	0	0	2
Total credit 23				

List of Departmental Electives

PLA 431 Metropolitan Planning and development

PLA 433 Sustainable urban development

PLA 435 International finance

PLA 432 Planning for special area

PLA 434 Public Private Partnership

PLA 436 Planning and human values

27 DEPARTMENT OF ARCHITECTURE(B.Arch.)

First Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
AR111	Architectural Design 1	-	12	6
AR 112	Building Materials & Construction 1	2	4	4
AR 113	Structures 1	3	-	3
AR 114	Architectural Drawing 1	2	2	3
AR 115	History of Architecture 1	3	-	3
AR 116	Art & Graphics 1 (Basic Design)	2	2	3
AR 117	Workshop	--	3	3
Total credit				25

Second Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
AR 121	Architectural Design 2	2	8	6
AR 122	Building Materials & Construction 2	2	4	4
AR 123	Structures- 2	3	-	3
AR 124	Architectural Drawing 2	2	4	3
AR 125	History of Architecture 2	3	-	3
AR 126	Art & Graphics 2	2	4	3
AR 127	Computer Application	-	3	2
Total credit				25

Third Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
MTH211	Architectural Design 3		10	6

AR212	Building Materials & Construction 3	2	4	4
AR 213	Structures 3	3	-	3
AR 214	History of Architecture 3	2	2	3
AR 215	Environment Science (Climatology)	3	-	3
AR216	Theory of Design	3	-	3
AR 217	Architectural Graphics 3	-	6	2
Total credit				25

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
AR 221	Architectural design 4	2	8	6
AR 222	Building materials & Construction 4	2	4	4
AR 223	Structures 4	3	-	3
AR 224	Building and Energy	3	-	3
AR 225	Surveying & leveling	3	-	3
	Elective 1	-	6	3
AR 226	Communication Skill	-	4	3
Total credit				25

List of Departmental electives

AR 231 Traditional and Contemporary Indian Architecture

AR232 Aesthetics, Art and Appreciation

Fifth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 311	Architectural Design 5	-	12	6
ARC 312	Building materials & Construction 5	2	4	4
ARC 313	Structures 5	3	-	3
ARC 314	Specification and Estimating	2	2	3
ARC 315	Acoustics	3	-	3
ARC 316	Water supply & sanitation	2	2	3
ARC 317	Building Appraisal	-	3	3

Total credit 25

Sixth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 321	Architectural Design 6	2	10	6
ARC 322	Working Drawing	-	8	4
ARC 323	Structures -6	3	-	3
ARC 324	Principles of Human Settlements	3	-	3
ARC 325	Electrical services	3	-	3
ARC 326	Mechanical services	3		3
ARC 327	Building Bye Laws and Code of Practice	-	3	2
Total credit 25				

Seventh Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 411	Architectural Design 7	-	12	6
ARC 412	Advanced Building Construction	2	4	4
ARC 413	Structure Design	3	-	3
ARC 414	Town Planning	3	-	3
ARC 415	Landscape Architecture	3	-	3
ARC 416	Building Economics and Sociology	3	-	3
ARC 417	Elective 2	0	5	3
Total credit 25				

Eighth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 421	Architectural design 8	-	10	6

ARC 422	Modern building systems	2	4	4
ARC 423	Urban Design	2	3	3
ARC 424	Project management	3	-	3
	Elective- 3	3	-	3
ARC 425	Interior design	2	3	3
ARC 426	Research Principles and Dissertation	-	3	2
Total credit				25

List of departmental electives

ARC 431 CAAD and Visualization
 ARC 433 Architectural Journalism
 ARC 435 Architectural Conservation
 ARC 437 Hotel Services

ARC 432 Vastu shastra
 ARC 434 Visual Communication
 ARC 436 Earthquake resistant buildings

Ninth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 511	Project/ Thesis	-	20	9
ARC 512	Professional practice	3	-	3
	Elective- 4	2	4	4
	Elective- 5	2	4	4
Total credit				20

List of Departmental electives

ARC 431 Urban and Regional Planning ARC 432 Housing
 ARC 433 Remote Sensing and GIS ARC 434 Infrastructure Planning and Management
 ARC 435 Disaster Planning and Management ARC 436 Environment Impact Assessment
 ARC437 Valuation and Arbitration

Tenth Semester

Course Number	Subject	Scheme of Studies Periods per week		Credits
		Lecture	Studio	
ARC 521	Training	-	-	8
ARC 522	General Proficiency	-	-	2
Total credit				10

Note: Study tour during winter semester break will be conducted for fifth semester students to a city to study state of art service oriented building and seventh semester students to a city for urban design scale study.

COURSE CONTENTS

First and second Semester (Common to all B.Tech students)

MTH 111 MATHEMATICS 1

Partial differential equation- homogeneous functions, Euler's theorem, Taylor's series, maximum and minima of functions, Lagrange method of undetermined multipliers., Convergence and divergence series- summation of series, beta and gamma functions, length of curves, area volume and surfaces of solids of revolution, Ordinary differential equation statistics –solution, Claitauts forms, methods of variation of parameters..

References

- | | |
|-------------------------------------|------------------------|
| 1. Advanced engineering Mathematics | Erwin Krevszig |
| 2. Advanced engineering Mathematics | Peter V.O.Neil Thomson |
| 3. Higher engineering Mathematics | John Bird . |

CE 112 BASIC CIVIL ENGINEERING

Civil Engineering scope and importance, Construction materials such as Stone, Bricks and timber- Engineering properties, Soils, bearing capacity and its importance. Building components: Foundations- functions, types and applications, Walls, roofs, floors, doors, windows, beams, columns etc. Surveying basics and equipments.

References

- | | |
|--------------------------|---------------|
| 1. Engineering Materials | Rangwala |
| 2. Building construction | Shushil Kumar |
| 3. Surveying | B.C.Punmia |

PHY 113 PHYSICS

Electron ballistic-Motion of charges particles in electric and magnetic field, Electron microscope, Cathode ray tube, Spectrograph, Electron refraction. Bethes law; Solid state and Semi Conductor Physics- Energy bands in solids, Electron and hole mobility, hall effect, PN junction transistor, Transistor parameters, Photo cell and solar cell: Quantum Mechanics-wave equation, Schrodinger equation, tunnel effect, Harmonic oscillator: Laser and fiber optical- Ruby and He-Ne laser and applications, laser holography; Nuclear Physics & Theory of relativity-transformation equation, time dilation mass energy equation

. References

- | | |
|---------------------------|---------------------|
| 1. Physics of dielectrics | Tareev |
| 2. Principle of optics | Brijlal Subramanyam |
| 3. Engineering Physics | P.G.Kshirsagar |

HUM 114 COMMUNICATION SKILL

Introduction to Communication Process, Verbal and Non-Verbal, Communication Barriers, Electronic devices in communication. Business communication- Managerial communication, meeting skills, group discussion, presentation skills, negotiation skills. Employment Communication. Speaking Skills, Listening Skills and Reading skills. Writing Skills- Letter writing, report writing, emails, proposals, memorandum, writing notices, minutes and agendas. Soft Skills and Personality Development- Time Management skills, interpersonal skills, Leadership styles, positive personal attitudes, personal SWOT analysis.

References

- | | |
|--------------------------------------|--------|
| 1. Effective business communications | Murphy |
|--------------------------------------|--------|

2. Effective technical communication
3. The Ace of Soft Skills-

M.Ashraf Rizvi

Gopalaswamy and Mahadevan

CS 115 COMPUTER PROGRAMMING

Concepts, definitions, taxonomy and history of computer programming, operating systems and program execution, Unix system, Input/output devices, Storage devices, Flow chart and algorithm development, Computer program. C programming, Statements, Arrays and functions

References

- | | |
|-----------------------|---------------------|
| 1. Programming with C | Gottfried |
| 2. C programming | Ritchie & Kernighan |
| 3. UNIX programming | Kernighan & Pike |

ME 116 ENGINEERING GRAPHICS

Geometrical construction, use of instruments, scales, engineering curves.

Orthographic projections, conversion of pictorial views to orthographic views and vice versa.

Dimensioning, Projections of points, lines, planes and solids. Development of plane and curved surfaces, sections of solids. Orthographic projections of simple elements of machines like nut, bolt, rivets, keys and cotter joints, pulleys etc.

References

- | | |
|-------------------------------------|-----------------------------|
| 1. Engineering drawing with AUTOCAD | T. Jayapoovam |
| 2. Engineering graphics | K.R. Mohan |
| 3. Machine drawing | Lakshminarayan & Vaishwanar |

CS 117 COMPUTER PROGRAMMING LAB.

Introduction to fundamentals of DOS and window, C programming, Operating System, Use of algorithms and execution, small practical problems, Arrays, Matrices.

References

- | | |
|-------------------|-------------------|
| 1. Program with C | Brain W Kernighan |
| 2. C programming | Balagurusamy |

PHY 117 PHYSICS LABORATORY.

Experiments on Zener Diodes, characteristics, Newton Rings. Series/parallel resonance, Photoelectric and Hall effect.

References

- | | |
|--|-----------------|
| 1. Concepts of Modern physics | Arthur Beiser |
| 2. A text book on advanced practical Physics | Chauhan & Singh |

MTH 121 MATHEMATICS 2

Multiple integral: Multiple and triple integrations, series solution of differential equations Bessel and Legendre functions, Complex variable: Conformal mapping. Cauchy's theorem, Complex integration, Taylor's and Laurent's series, Laplace transform, Laplace transform of elementary functions, Inverse transform, solution of ordinary differential equations. Vector calculus: Cross products, vector differentiation, gradient and divergence theorem, Green's, Gauss and Stokes theorem. Partial differential equations.

References

- | | |
|-------------------------------------|-------------------------|
| 1. Advanced engineering Mathematics | Erwin Kreyszig |
| 2. Advanced engineering Mathematics | Peter V.O. Neil Thomson |
| 3. Higher engineering Mathematics | John Bird. |

CHM 122 ENGINEERING CHEMISTRY

Lubricants: function of lubricates, solid lubricants, synthetic lubricants, mechanism of lubrication, testing of lubricants Fuels: classifications, calorific value, selection of lubricants, knocking and anti-knocking compounds, combustion problems. Chromatographic and spectroscopic methods of chemical analysis: Classification of chromatography, Chromatography performance, gas and liquid chromatography. Water pollution and purification, (physical chemical and bacteriological tests), Polymeric materials, Introduction and classification of polymers, types of plastics, introduction to polymer composites, Cement: introduction of raw materials, types of cement and their derivatives.

References

- | | |
|---|---------------|
| 1. A Text Book of Engineering Chemistry | Jain and Jain |
| 2. A Text Book of Engineering Chemistry | S.S. Dara |
| 3. A Text Book of Engineering Chemistry | Shashi Chawla |
| 4. Engineering Chemistry | B.K. Sharma |

CE123 ENVIRONMENT ENGINEERING AND BIOLOGY

Natural Resources: Study of various natural resources like forest, minerals, atmosphere, soil and water conservation. Ecosystem: structure, function and classification of ecosystem, biogeochemical cycle, hydrological cycle, carbon cycle, nitrogen cycle, oxygen cycle, food chain, food web, energy flow in ecosystem.

Biological diversity and its conservation, Global Environmental Issues, Case studies of environmental disasters like Bhopal Gas Tragedy, Chernobyl Nuclear Accident, Concept of sustainable development. Environmental Pollution, pollutants and their classification, impact of pollution on environment. Types of pollution such as water, air, solid waste, noise, radioactive etc: sources, impact, Pollution control and environmental management.

References

- | | |
|---|------------------|
| 1. Environment Engineering and Management | Suresh K Dhaneja |
| 2. Environment Science | S.C.Santra |
| 3. Environment studies | J.P.Sharma |
| 4. Waste water treatment | B.C.Punmia |

EE 124 BASIC ELECTRICAL AND ELECTRONIC ENGINEERING.

D.C. circuits:voltage and current sources, KCL, KVL, loop and nodal equations. Network theorems Star delta transformers. Simple series and parallel circuits, A.C. circuits. Alternative quantities, RMS & average value, phase difference Power and power factor. Series & parallel AC circuits, resonance. Faraday's law of electromagnetic induction. Transformer construction, principle of operation, phasor diagram, equivalent circuit tests, losses and efficiency, DC machines construction, emf equation and principle of operation.

Semiconductor devices and applications, characteristics of PN junction Diode Zener effect, Zener diode and its characteristic. Half wave and full wave rectifier, ripple factor, conversion efficiency, bipolar junction transistor, Principle of operation, input/output & transfer characteristics of BJT in CB, CE, CC configurations

References

- | | |
|---------------------------------|---------------------------|
| 1. Basic electrical Engineering | V K Mehta & Rohit Mehta |
| 2. Basic electrical Engineering | D P Kothari & I J Nagrath |
| 3. Basic electrical Engineering | V N Mittal |

ME 125 BASICS OF MECHANICAL ENGINEERING

Review of Thermodynamics : Units and Dimensions system, Heat and Work, Ideal gas equation. Thermodynamic equations, Zeroth law and first law of Thermodynamics. Enthalpy and Internal energy of gases. Simple numerical of first law as applied to a closed and open system. Statement of Second law of Thermodynamics.

Steam Boilers, mountings & accessories. Boiler draught. Properties of Steam : Wet and Superheated steam, Volume, Enthalpy, Entropy and internal Energy of steam, Steam Table.

Internal Combustion Engines : Otto and diesel cycles and their efficiencies. Functions of different parts of the engines.

Machine tool : lathe, shaper, drilling machine, types of drilling machine, machining time for machine tool.

Welding : Types of welding process, important terms in welding, types of welding joints, gas welding, arc welding, comparison between A.C. and D.C.

Casting: Pattern materials, types of patterns, pattern allowances, mould, constituents of moulding sand,

References

- | | |
|--------------------------------------|---------------------|
| 1.Elements of mechanical engineering | Gupta P.N and Poonm |
| 2.Elements of mechanical Engineering | Roy and choudhary |

CE126 SOLID MECHANICS

Fundamentals of force systems, concept of Rigid body, Free body diagram Support Reactions, Frames and structure. Cenroid and moment of Inertia of plane area, Shear force and Bending Moment diagrams, Simple stress and strain, Mechanical properties of the materials, Elastic constants, compound stresses, Mohr's circle of stresses,

References

- | | |
|--------------------------|-------------------|
| 1. Strength of materials | Singer F.L. |
| 2. Mechanics of material | Hearn E.I. |
| 3. Engineering mechanics | Merian J.L.Kraige |

ME127 WORKSHOP PRACTICE

Students will do practice in following shop.

Carpentry (two models), 2. Fitting,(two models) 3. Foundry (demonstration) 4. Welding. (demonstration)

References

- | | |
|-----------------------------|-------------------|
| 1. Manufacturing science | Ghosh and Mallick |
| 2. Manufacturing Technology | P.N.Rao |

EE128 ELECTRICAL AND ELECTRONICS LABORATORY

Laboratory experiments and assignments to supplement EE124

CHM129 CHEMISTRY LABORATORY**Quantitative Analysis**

Oxidation-Reduction Titrations: Estimation of percentage of iron using potassium dichromate by internal indicator method. Estimation of percentage of iron using potassium dichromate by external indicators. Iodometric titration of copper sulphate by hypo. Iodometric titration of potassium dichromate by hypo.

Water Analysis: Determination of alkalinity, hydroxyl, carbonate and bicarbonate in water. Determination of total hardness in water using soap or EDTA titrations. Determination of salinity of water sample by Mohr's method.

Lubricant Testing : Determination of viscosity of lubricating oil with change of temperature by Determination of Flash and Fire point of liquid fuel and lubricants.

References

- | | |
|------------------------------------|-----------------|
| 1. Practical Chemistry | S.S. Dara |
| 2. Practical Engineering Chemistry | Mittal & Mittal |

28 DEPARTMENT OF CIVIL ENGINEERING

Third Semester

MTH211A MATHEMATICS 3

Numerical Methods: Solution of algebraic and transcendental equations, Solution of linear Simultaneous Equations, Finite Differences, Interpolation and Extrapolation, Inverse Interpolation, Numerical Differentiation and Integration, Numerical solution of Ordinary & Partial Differential Equations.

Statistics: Curve fitting, Correlation and Regression Analysis Probability Distribution, Sampling and Testing of Hypothesis.

References

- | | |
|---|------------------|
| 1. Numerical Analysis | Hildebrand |
| 2. Numerical Analysis | Scarborough |
| 3. Numerical Methods | E .Balaguruswamy |
| 4. Numerical Methods for scientific and Engineering | M.K.Jain |

CE212 SURVEYING - 1

Basic concepts, principles and classifications of surveying, linear measurements, chain surveying. Measurement of angles and Directions, Traversing and closing error adjustments. Plane table surveying. Leveling, Contouring: methods, characteristics, uses of contour maps

Angles and Directions with Theodolites: types of theodolites, measurement of horizontal and vertical angles. Theodolite traversing, omitted measurements

Computation of area planimeter. Computation of volumes: Mass Haul diagram, Hydrographic Surveying: Basic concepts and method

References

- | | |
|--|-----------------------------------|
| 1. Plane Surveying | A. M. Chandra |
| 2. Surveying and Leveling-Part-I & II | T. P. Kanetkar and S. V. Kulkarni |
| 3. Engineering Surveying: Theory and Examination Problems for Students | W. Schofield |
| 4. Surveying Principles and Applications | B.F. Kavanagh and S.J.G. Bird |

CE 213 FLUID MECHANICS 1

Review of Fluid Properties, Fluid Statics, forces on plane and curved surfaces, stability of floating and submerged bodies., relative equilibrium, Fluid Kinematics, continuity , energy and moment of momentum equation and their applications. Pressure, Velocity and flow measurement devices.

Dimensional Analysis and Hydraulic similitude, similarity laws, Stokes law, fluidization, boundary layer separation and methods of its control.

References

- | | |
|---|------------------|
| 1. Fluids Mechanics & Hydraulics Machines | Modi & Seth |
| 2. Fluids Mechanics & Hydraulics Machines | A.K. Jain |
| 3. Fluid Mechanics | Streeter & Wylie |
| 4. Fluids Mechanics & Hydraulics Machines | R.K. Bansal |

CE214 ENGINEERING GEOLOGY

Introduction to Geology, : Earth as a part of solar system, Origin of earth, Age of the earth, internal structure of earth, , Weathering of rocks, Geological work of wind, water, glaciers, river and sea. Plate tectonics and Sea-floor spreading, Geological Hazards : Volcanoes, Earthquake and Landslides.

Indian Stratigraphy: Introduction, Geological Time scale, classification and stratigraphic Correlation, study of different group and systems and their economic importance. Petrology: Mode of origin of Igneous, Sedimentary & Metamorphic rocks,

Mineralogy & Crystallography, Common rock forming minerals. Importance of Civil Engineering.

Structural Geology,. Engineering Projects: Dams, Reservoirs, Tunnels, Roads, Bridges, Importance of Geology in Engineering project constructions.

Recent Advancements: Fundamentals of Remote Sensing technique and its Applications

References

- | | |
|---|------------------------------|
| 1. Engineering Geology | B.S. Sathya Narayanan Swami. |
| 2. A Text Book of Geology and Engineering | L.M. Bangar. |
| 3. Text Book of Geology | V.D. Muthayya. |
| 4. Text Book of Geology | P.K. Mukherjee. |

CE215 BUILDING PLANNING AND DRAWING

General principles of composition, unity, symmetry, balance and proportion , functional treatment. Considerations in building-orientation and design, circulation, grouping of areas, privacy, planning & design concepts of energy efficient building.

Drawings of simple buildings, residential buildings and public buildings, empirical design of foundations, approximate proportioning of structural element. Building regulations: building by-laws , provisions in developed and developing urban areas , plan approval process Introduction to building drawing softwares

References

- | | |
|-------------------------------------|--|
| 1. Building Drawing | Shah M. G. Kale C. M., and S. Y. Patki |
| 2. Planning & Designing of Building | Sane Y. S. |
| 3. Architectural Design | Ernest Pickering |
| 4. National Building Code | |

CE216 STRUCTURE ANALYSIS

Concrete Technology:- Concrete making materials : cements, aggregates, water, admixtures, properties of fresh and hardened concrete, variability of concrete strength, extreme weather concreting. Testing of concrete mixes, ready mix concrete prestressed concrete, Modern construction equipments.

Mix Design-Principles of concrete mix design, basic considerations, IS guidelines, introduction to other mix design practices such as ACI, USBR, British mix etc. Building Materials: Bricks, stones, glass, wood, plywood doors, shutters, plastics, tiles, aluminum, steel, properties and tests. IS code procedure.

References

- | | |
|--|-------------------|
| 1. Hand Book of Mix Design | BIS Publication |
| 2. Concrete Technology | M.S.Shetty |
| 3. Civil Engineering Materials and Testing | Syed Danish Hasan |
| 4. Mechanics of Materials | Adarsh Swaroop |

CE217 SURVEYING LABORATORY 1

The laboratory work will consist of experiments and office work based on the topics taught in the theory paper of Surveying 1.

CE218 FLUID MECHANICS LABORATORY 1

List of Experiments

1. . Verification of Bernoulli's theorem.
2. Verification of Impulse momentum principle.
3. Study of various types of flows using Reynolds apparatus.
4. Calibration of Venturimeter.
5. Calibration of Nozzle meter.
6. Calibration of Orifice meter.
7. Calibration of Orifice.
8. Calibration of Rota meter
9. Calibration of V-Notch.
10. Calibration of water meter

CE219 ENGINEERING GEOLOGY LABORATORY

List of experiments

1. Determination of Specific Gravity of minerals by steel yard balance.
2. Identification of important rock forming minerals in hand specimen
3. Identification of important ore minerals in hand specimen
4. Petrological studies of igneous, sedimentary and metamorphic rocks in hand specimen & under microscope
5. Study of important crystal models
6. Study of structural models
7. Study of geological maps, describing topography, structure, history and geological cross section. Engineering geological maps.
8. Topographical maps, reading and interpretation.
9. Geological field work in and around Bhopal

Fourth Semester

CE221 SURVEYING 2

Trigonometric leveling: Basic concepts, principle and methods of tachmetry

Triangulation PrincipleCurves: Classifications and elements of curves, methods for the setting out of curves, Classification and elements and methods for curves setting out, vertical curves and obstacles and special problems in the setting out of curves.

Introduction to modern equipments for surveying: like digital levels and theodolites, Total Station and GPS receivers.

Global Navigation Satellite Systems (GNSS) based Surveying: Definitions, terminology and methods, projections and commonly used datums and map projections. GPS survey methods and their advantages.

Photogrammetry: Principle, definitions and classifications of terrestrial and aerial photogrammetry

Remote Sensing and Geographic Information System (GIS): Definition, principle, components, and classifications. introduction to popular remote sensing data processing and GIS software.

References

- | | |
|--|-----------------------------------|
| 1. Advanced Surveying | A. M. Chandra |
| 2. Surveying Vol II | S. K. Duggal, |
| 3. Surveying and Leveling-Part-I & II | T. P. Kanetkar and S. V. Kulkarni |
| 4. Engineering Surveying: Theory and Examination Problems for Students | W. Schofield |

CE222 FLUID MECHANICS 2

Turbulent flow, Boundary layer theory, Boundary layer separation and its control, flow through pipes, losses in pipe networks, forces on immersed body, lift and drag.

Flow in open channels, efficient channel sections, specific energy concept critical flow and its computations, channel transitions. Gradually varied flow, surges in channels.

Impact of free jets, Turbines classifications, specific speed and unit quantities. Design and construction of impulse and reaction, characteristic curves, runaway speed, cavitation.

Pumps classification and working principles, similarity law, hydraulic machine efficiency.

References

- | | |
|---|--------------|
| 1. Fluids Mechanics & Hydraulics Machines | Modi & Seth. |
| 2. Fluids Mechanics & Hydraulics Machines | A.K. Jain. |
| 3. Mechanics of Fluids | White. |
| 4. Hydraulic Machines | J.Lal. |

CE223 TRANSPORTATION ENGINEERING 1

Railway engineering: General Introduction to Transportation Engg.- Characteristics and comparison of important modes of Transportation in India. Permanent Way: surveys and alignment, gauges, coning of wheels etc. Components of permanent way like Rails, Sleepers, Rail fastenings, Ballast Construction & maintenance of permanent way. Geometric design. Various tractive resistance, hauling capacity & tractive efforts etc. Stations & yards, Signaling & interlocking, Modern techniques for safety in railways. Basic concepts of Bridges & tunnels

Airport Engineering: Airport site selection, wind rose diagram, basic runway length & corrections, runway and taxi way geometrics, airport lighting & traffic controls.

Docks & Harbours Engineering: Introduction to docks & harbour & their types, design & construction of breakwaters, port building, navigational aids ..

References

- | | |
|--|----------------------------|
| 1. A Text Book of Railway Engg | S.C. Saxena & S.P.Arora |
| 2. Airport planning and design | S.K Khanna, Arora and Jain |
| 3. A Course in Docks and Harbour Engineering | S.P Bindra |
| 4. Railway Track Engineering | I.S. Mundry |

CE224 STRUCTURAL DESIGN AND DRAWING (CONCRETE STRUCTURES)

Direct, Bending & Shear Stresses; Columns & Struts; Unsymmetrical Bending & Shear Center ; Strain Energy ; Analysis of trusses; Deflections of determinate beams and Trusses; Arches; Analysis of Indeterminate Beams. Introduction to Cable and Suspension Bridges.

References

- | | |
|--|----------------------|
| 1. Strength of Materials | Timoshenko and young |
| 2 Mechanics of Materials | E.P. Popov |
| 3. Strength of Materials & Mechanics of Structures', Vol. 1, | B.C. Punmia |

CE225 ENGINEERING HYDROLOGY

Rainfall: Hydrologic cycle, Measurement and analysis of precipitation, Estimation of losses, Runoff estimation and analysis of flow data, hydrograph analysis: unit hydrograph theory, synthetic unit hydrograph, Instantaneous unit hydrograph (IUH).

Floods: Estimation, Probability and frequency analysis, Flood routing, Flood control measures,

Ground water and wells: Hydraulics of wells, Infiltration galleries, Ground water recharge,

Storage works: Site selection, Zones of storage, Mass curve analysis, Life of reservoir.

References

- | | |
|--|----------------|
| 1. Engineering Hydrology | K. Subramanya. |
| 2. Hydrology Principles, Analysis and Design | H.M. Raghunath |
| 3. Hand Book of Applied hydrology | V.T. Chow |
| 4. Engineering Hydrology | R.S. Varshney |

CE226 GOTECHICAL ENGINEERING 1

Purpose and importance of estimates, principles of estimating methods of taking out quantities of items of work. Mode of Measurement, Measurement sheet and abstract sheet; bills of quantities. Specification of works, introduction to various types of estimates of Building, Services for building such as water supply, drainage.

Estimating for road and culverts. Rate Analysis:, various factors involved in the rate of an item, material and labour requirement for various trades; preparation for rates of important items of work. Current schedule of rates (C.S.R)/DSR

Cost of works : Factors affecting cost of work, overhead charges Contingencies and work charge establishment.

Valuation : Purpose, depreciation, sinking fund. scrap value year's purchase, gross and net income, dual rates interest. Method of Valuation, rent fixation of buildings.

Contracts : Different types notices inviting tenders, contract documents, departmental method of construction, security deposit and earnest money, conditions of contract, arbitration.

Preparation of detailed estimate: Detailed estimate for services of plumbing and water supply or Electrification work. Detailed estimate for earth work for the road construction and culvert. Rate analysis for at least 8 items of construction.

References

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|-------------------------|------------|
| 1. Estimation & Costing | B.N. Dutta |
| 2. Estimation & Costing | Rangwala |

CE227 SURVEYING LABORATORY 2

The laboratory work will consist of experiments and office work based on the theory paper of Surveying-II. At least one exercise should be taken up from each unit. The list of practicals is as below:

CE228 FLUID MECHANICS LABORATORY 2

List of Experiments

1. Losses in Pipe lines
2. Velocity distribution in open channel
3. Velocity distribution in pipe flow
4. Board crested weir
5. Pelton wheel
6. Francis Turbines
7. Kaplan turbines
8. Centrifugal Pump
9. Reciprocating Pump.

References

CE229 GEOTECHNICAL ENGINEERING LABORATORY

List of Experiments :

1. Determination of in-situ density of soil by sand replacement method
2. Determination of in-situ density of soil by core cutter method
3. Determination of specific gravity of fine grained soil
4. Determination of specific gravity of coarse grained soil
5. Determination of Atterberg limits of soil
6. Grain size distribution of soil by wet analysis
7. Grain size distribution of soil by dry process
8. Direct shear test
9. Triaxial shear test
10. Unconfined compression test
12. Compaction test

References

Soil mechanics manual

Shashier prakash and P.K.jain

Fifth Semester

CE311 GEOTECHNICAL ENGINEERING 2

Preliminary definitions and relationships: Soil mass, three phase diagram, weight-volume relationships. Index properties and its determination, use of index properties, classification systems based on particle size and consistency limits with emphasis on Indian standard soil classification. Soil water: Modes of occurrence of water in soils, Pore water pressure and effective stress, permeability, factors affecting permeability, laboratory and field determination of permeability. Stress distribution beneath loaded areas by Boussinesq, Westergaards and Newmark's influence chart, Contact pressure distribution. Compressibility & Consolidation: consolidation test, determination of coefficient of consolidation, determination of field compression index for normally and over consolidated clays, calculation of initial and primary settlement and time settlement curves, Secondary consolidation and creep. Shear Strength of soils: - Concepts, factors affecting shear stress, Coulomb's law conditions of failure of soil by Mohr stress circle, direct measurement of shearing resistance, measurement of pore pressure. Parameters, deformation and failure under shear in sands and in normally consolidated and over consolidated clays. Earth pressure

:Types, Rankine's and Coulomb's Theory of earth pressure, pressure distribution under various loading conditions , layered soil, effect of water table and wall friction, earth pressure due to cohesive soils, Tension cracks. Soil Exploration and field testing of soils: Methods of soil exploration, significant depth, spacing of borings, disturbed and undisturbed sampling, planning of exploration programme for buildings, highways and earthen dams. penetration test, plate load test, data interpretation and reporting.

References

- | | |
|--|------------------------------|
| 1. Soil Mechanics and foundation Engineering | B.C. Punmia. |
| 2. Basic & Applied Soil Mechanics | Gopal Ranian and A.S.R. Rao. |
| 3 Geotechnical Engineering | Purushattam Raj. |
| 4 Soil engineering in theory and Practice | Alam Singh |

CE312 STRUCTURAL DESIGN AND DRAWING 2 (STEEL STRUCTURES)

Method of Design; Limit State design of Beams, slabs, Columns and Footings, Stair Cases, Cantilever and counterfort retaining walls. Introduction of RCC Water Tanks and Prestress Concrete.

References:

- | | |
|---|--------------------|
| 1. Design of Reinforced Concrete Structures | N.Krishnaraju |
| 2. Design of R.C.C Structures | Vazirani & Ratwani |
| 3. Design of R.C.C Structures | P.C. Warghese |

CE313 TRANSPORTATION ENGINEERING 2

Introduction, Highway planning. Classification of roads, surveys and Alignments. Highway Geometric Design: - Cross section elements, sight distance, design of horizontal and vertical alignment, highway material characterization etc. Design of highway pavements: Characteristics and comparison of important types of pavement, design factors, Important Methods for Design of flexible and rigid pavements etc.

Construction and Maintenance: Various types of highway construction, construction of bituminous and concrete pavements, types of highway maintenance, distresses in flexible and rigid pavements, maintenance of bituminous and concrete pavements, rigid and flexible overlay etc.

Traffic Engineering and Transport Planning: Traffic characteristics, traffic studies, traffic control devices- signs, signals, markings, Islands etc. Introduction to transportation planning process etc. Basic concepts for intelligent transport system, road safety audit, transport economics, drainage of roads, expressway and freeway, design of traffic facilities like signals, intersections, mass transportation etc.

References

- | | |
|---|-----------------------------|
| 1. Principles of Transportation Engineering | Chakroborti and Das |
| 2. Highway Engineering | S.K.Khanna & C.E.G. Justo |
| 3. Principles & Practice of Highway Engg. | L.R. Kadiyali |
| 4. Principles of Pavement Design | E.J. Yoder And M.W. Witczak |

CE315 GEOTECHNICAL ENGINEERING LABORATORY 1

List of Experiments

1. Consolidation test
2. Plate load test
3. Cyclic plate load test
4. Static cone penetration test
5. Standard cone penetration test
6. Block vibration test.

References

- | | |
|---------------------------|-----------|
| 1. Manual of Soil testing | P.K. Jain |
|---------------------------|-----------|

2. Engineering soil testing Alam singh.

CE316 TRANSPORTATION ENGINEERING LABORATORY

List of Experiments

1. Aggregate Crushing Value Test.
2. Los Angeles Abrasion Test
3. Aggregate Impact Test.
4. Specific Gravity of Aggregate
5. Water Absorption of Aggregate
5. Shape Test (a) Flakiness Index (b) Elongation Index
6. Viscosity of Bituminous Material
7. Penetration Test.
8. Softening Point Test
9. Ductility Test.
10. Flash and Fire Point Test
11. CBR Test.

References:

1. Highway Materials and Pavement Testing S.K. Khanna, C.E.G. Justo and A Veeraragavan
2. Traffic Engineering and Transport Planning L.R. Kadiyali

Sixth Semester

CE321 IRRIGATION ENGINEERING

Irrigation and water requirement of crops, Soil - water relationship, Methods of water application, Duty, Evapo-transpiration, Reservoir Planning, Flow in canals, Design of unlined and lined canal. Diversion works: Weirs and barrage and their design. Canal structures: Canal falls, Cross drainage works. Design principles of Gravity and Earth dams, Introduction to Spillways.

References

1. Irrigation Water Resources and Water Power Engineering P.N. Modi.
2. Irrigation Engineering G.L. Asawa.
3. Theory & Design of Irrigation Structure R.S.Varshney, S.C Gupta & R.L. Gupta.
4. Irrigation Engineering & Hydraulic Structures S.K.Garg

CE322 STRUCTURAL ANALYSIS 2

Determinacy and indeterminacy of structures; Analysis of fixed and continuous beams; two hinged arches; Rolling load and Influence Line; Moment Distribution Method (sway and Non sway); Slope deflection Method; Kani Method; Introduction to Plastic Analysis, Approximate methods of frames for lateral loads, Matrix Method of Structural Analysis.

References

1. Analysis of Structure Vajirani and Ratwani
2. Theory of Structures Ramamurutham
3. Theory of structures B.C. punmia, vol. 2

CE323 WATER SUPPLY ENGINEERING

Water Demand, water supply engineering, Population forecasting, Sources of water and augmentation. Water Conveyance System, Intake Structures, Rising and Gravity mains, Pumps systems and pumping stations, Valves and appurtenances, Pipe materials and Pipe fitting, O&M and trouble shooting for conveyance system.

Aeration Sedimentation Coagulation and Flocculation, Filtration, Disinfection. Purification Processes in natural systems, Water Softening, Removal of Taste and odor, Deflouridation, Dissolved solids removal.

Distribution Reservoir capacity, Water Distribution Network , leak detection, Maintenance, Water supply in buildings and plumbing. Management issues in water supply & Treatment. Rural water supply. Inroduction to environment software.

References

- | | |
|-------------------------------------|---|
| 1. Environmental Engineering Vol. 1 | Santosh kumar Garg. |
| 2. Environmental Engineering | Howard S.Peavy, Donald R. Rowe and
George Tchobanoglous. |
| 3. Water Supply and Sewage | Terence J.Mcghee. |
| 4. Water and Waste Water Technology | Mark T Hammer. |

CE 325 GEOTECHNICAL ENGINEERING LABORATORY

Experiments connected with the theory paper on geotechnical Enginerring 2

CE326 WATER ANALYSIS LABORATORY

List of Experiments:

1. Sampling techniques.
2. pH, Electrical conductivity of water sample.
3. Suspended and dissolved solids in water sample.
4. Turbidity of water sample.
5. Alkalinity of water sample.
6. Acidity in water sample.
7. Hardness in water sample.
8. Optimum coagulant dose.
9. Dissolved Oxygen in water sample.
10. Residual chlorine and break point chlorination of water sample.

Most Probable number of coliform bacteria in water sample

Departmental Electives

CE331 CONCRETE TECHNOLOGY

Concrete Technology:- Concrete making materials : Cements, Aggregates, Water, Admixtures, Properties of Fresh and Hardened Concrete, Variability of Concrete Strength, Extreme Weather Concreting. Testing of Concrete Mixes, Modern Construction Equipments.

Mix Design-Principles of Concrete Mix Design, Basic Considerations, IS Guidelines, Introduction to Other Mix Deign Practices such as ACI, USBR, British mix etc. Building Materials:- Bricks, stones, glass, wood, plywood doors, shutters, plastics, tiles, aluminum, steel, properties and tests. IS code procedure.

References

- | | |
|--|-------------------|
| 1. Hand Book of Mix Design | BIS Publication |
| 2. Concrete Technology | M.S.Shetty |
| 3. Civil Engineering Materials and Testing | Syed Danish Hasan |
| 4. Mechanics of Materials | Adarsh Swaroop |

CE332 AIR QUALITY MONITORING AND CONTROL

Sources of Air pollution, Effects of air pollution on health, animal, plants and materials. properties of typical air pollutants, toxicity of various pollutants, photochemical smog. Meteorological aspects, lapse rate, plume behavior, air pollution dispersion, Gaussian dispersion model, stack height. Air pollution problem: historical episodes of air pollution.

Sampling of air pollutants, ambient air sampling, Instruments, high volume sampler, standards of air pollution. Stack sampling. Analysis of air pollutants: sulphur dioxide, nitrogen oxide, carbon monoxide, ozone, hydrocarbons. Principle of air pollution control, site selection and zoning, various control methods, process and equipment changes, design and operation of various air pollution control equipments for gaseous and particulate pollutants.

References

- | | |
|--------------------------|------------------------------|
| 1. Air Pollution | MN Rao & MN Rao |
| 2. Air Pollution Control | A.C.Stern |
| 3. Air Pollution | Perkins, H.C Wark and Warner |

CE333 APPLIED GEOLOGY

Study of minerals with their properties. Study of igneous, sedimentary and igneous rocks. Engineering properties of rocks for civil engineering work. Ground water potential of India. Aerial photogeological study and remote sensing. Earthquake - Terminology related to earthquake
Study of structural features such as folds, faults, unconformity and joints. Physical and engineering properties of soil,. Soil groups of India. Geophysical investigation methods and its importance for geological investigation, objects of Geological investigation of, reservoir, tunnels, roads, bridges etc. Indian examples of dams & Tunnels

References

- | | |
|--------------------------------------|-------------------------------------|
| 1. Engineering and General Geology b | Parbeen Singh. |
| 2. Physical & Engineering Geology | S.K.Garg. |
| 3. Principles of Engineering Geology | Rebert B Johnson, Jesome V.Degraff. |
| 4. Geology for Engineers | Joseph M.Trefethen |

CE334 GROUND WATER HYDROLOGY

Introduction, Groundwater occurrence and distribution, Fundamentals of ground water flow, Well Hydraulics, Surface and Subsurface investigations, Ground water flow modeling, Pollution of aquifers, salt water intrusion, Aquifer remediation and management, Groundwater recharge, Rainwater harvesting, Ground water rights.

References

- | | |
|---|----------------------|
| 1. Ground Water Hydrology | D. K Todd. |
| 2. Groundwater | H.M.Raghunath. |
| 3. Groundwater System Planning & Management | R.Willes & W.W.G.Yeh |

CE335 GEODESY AND GLOBAL NAVIGATION SATELLITE SYSTEMS(GNSS)

Global Positioning System (GPS) – introduction, principle, components of GPS, Space segment, control segment and user segment. Different types of ANSS receivers

Elements of geodesy and Satellite based surveys –International and local datums, time systems, satellite orbit determination, Map projection-necessity and classification, properties of cylindrical and conical projections. WGS-84 and Indian datums and transformation of GPS coordinates from WGS-84 to local datum.

GNSS Surveys: Methods and data analysis, Differential positioning, Static positioning and Kinematic positioning, data pre-processing and data formats. Sources of errors in GPS observations. Ground control and Real time kinematic (RTK) surveys.

Various applications of GNSS technology in the management and monitoring of natural resources, engineering projects, planning etc.

Reference:

1. Understanding GPS : Principles and Applications
2. Global positioning system: Theory and practice
3. Essentials of GPS
4. Global Positioning System: Principles and Applications

Kaplan, E.D.,
Hofman-Wellenhof, B. et. al
Agrawal, N. K.,
Satheesh, G.,

CE336 OPEN CHANNEL HYDRAULICS

Basic concept of free surface flow, uniform flow in open channel, Specific energy, specific force and critical depth computations , control sections, application of specific energy and critical depth concepts. Gradually varied Flow – Types, governing equation characteristics and classification of surface curves, computations of gradually , varied flow in prismatic and non prismatic channels, Delivery of canals and surges, hydraulic Jump, surges, Channel controls and transitions, subcritical and super critical flow.

References

- | | |
|----------------------------|-------------------|
| 1. Open channel hydraulics | V.T. Chow |
| 2. Open channel hydraulics | K Subthamanyam |
| 3. Open channel hydraulics | Richard H. French |

CE337 TRAFFIC ENGINEERING

Traffic Characteristics: Road user characteristics Vehicular characteristics- static and dynamic characteristics of vehicles affecting traffic performance etc. . Traffic Studies : Spot speed studies and volume studies, Speed and delay studies , Origin and destination studies (O&D), Traffic capacity studies,. Accident studies, preventive measures.

Traffic operations and Control : Traffic regulations and various means of control. traffic control devices, One way streets.

Basic concepts for traffic flow theory, intelligent transport system, traffic forecasting, road safety audit, , transport economics, expressway and freeway, design of traffic facilities like intersections, parking, street lighting etc.

References

- | | |
|---|---------------------|
| 1. Traffic Engineering and Transport Planning | L.R. Kadiyali |
| 2. Principles of Transportation Engineering | Chakroborti and Das |

CE338 COMPUTATIONAL METHODS IN STRUCTURAL ENGINEERING

Matrix Method for Skeletal Structural Analysis : static and kinematic matrices, principle of virtual work, force and displacement methods with application to plane and space frame problems. Organisation of computation, programming computations, equation solvers-Gauss elimination method, LDLT method, Cholesky method. Computer implementation of plane frame and plane truss problems. Structural Optimization : Concave and Convex functions, Zeroth , first and second order methods of optimization. Constrained Optimization - Kuhn Tucker conditions, Linear programming , Duality and sensitivity, Integer Programming, Exterior and Interior penalty functions, Geometric programming. Introduction to finite Element Method : Discretisation, Displacement and force models, shape function, use of parametric and local coordinates, convergence criteria, Numerical Integration.

References

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|--|----------------------|
| 1. Computational Methods in Structural Engineering | Swami Saran & Gupta. |
| 2. Matrix Methods | Kanchi. |

CE341 SOLID WASTE MANAGEMENT

Solid Waste: Nuisance, potential and extent of solid waste problems, scope and necessity of solid waste management. Sources, type, compositions, physical, chemical and biological properties of solid wastes, sources and types of hazardous and infectious wastes in municipal solid wastes. Solid waste generation,

collection, handling, storage, processing, transportation, container carrier system and route, selection and its suitability under Indian conditions

Materials separation and processing, recycling of material in municipal solid wastes. Thermal conversion, types of incinerator, biological conversions, Methods of composting, anaerobic digestion of waste. Disposal methods: Land filling, gas generation in landfill, closure of landfills.

References

- | | |
|--|--------------------------------|
| 1. Handbook of solid waste management | Frank Kreith |
| 2.. Management of Solid Wastes in Developing Countries | Frank Flintoff, |
| 3. Solid Waste Management in Developing Countries | A.L. Bhide and B.B. Sundarasan |
| 4. Solid waste conversion to energy | Harvey Alter, J.J. Dunn, Jr. |

Seventh Semester

CE411 WASTE WATER ENGINEERING

Wastewater Characteristic & Collection: Biological water quality Parameters, Flow fluctuations and estimations for domestic & industrial sewage, sewerage schemes and design of sewers for both separate and combined systems, sewer appurtenants, construction and maintenance of sewer, pumping stations, effluent standards. Engineered Systems for Wastewater Treatment: Water purification processes in natural systems : physical, chemical and biochemical processes involved, organic discharge and stream ecology. Preliminary and primary treatment methods.

Aerobic Systems for Wastewater Treatment: Theory and design of biological treatment methods such as trickling filters, activated sludge process include their modifications , stabilization ponds, oxidation ditches and aerated lagoons. Anaerobic Systems and Treatment of Sludge: Introduction to Anaerobic process such as Anaerobic filters, UASB etc. , Anaerobic lagoons, septic and Imhoff tanks, Source and Treatment (aerobic/ anaerobic) of sludge, sludge thickening, sludge drying beds and disposal of sludge.

Wastewater Treatment Plants and Advanced Wastewater Treatment: Treatment Plants : site selection, plant design, Hydraulic Profiles, operation and maintenance aspects. Disposal of treated effluents, standards for disposal, reuse of effluents. Advanced Wastewater treatment for Nutrient and Solids removal, tertiary treatment.

References

- | | |
|---------------------------------------|--------------------------|
| 1. Sewage treatment | S.K.Garg |
| 2.Solid waste engineering | W.A.Worrel &P.A.Vesilind |
| 3. Manual on sewer and sewage systems | CPHEEO |

CE412 WASTE WATER ANALYSIS LABORATORY

1. Total Organic Carbon in wastewater sample.
2. Sulphate in wastewater sample.
3. Phosphate in wastewater sample.
4. Chloride in water sample.
5. Nitrate in wastewater sample.
6. Nitrite in wastewater sample.
7. Total Kjeldal Nitrogen in wastewater sample.
8. Sodium in wastewater sample.
9. Oxygen Demand of wastewater sample.

CE413 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

CE414 EDUCATION TOUR & TRAINING

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

Eighth Semester

CE421 PROJECT COSTING AND CONTRACT MANAGEMENT

Purpose and importance of estimates, principles of estimating methods of taking out quantities of items of work. Mode of Measurement, Measurement sheet and abstract sheet; bills of quantities. Specification of works, introduction to various types of estimates of Building, Services for building such as water supply, drainage.

Estimating for road and culverts. Rate Analysis: various factors involved in the rate of an item, material and labour requirement for various trades; preparation for rates of important items of work. Current schedule of rates (C.S.R)/DSR

Cost of works : Factors affecting cost of work, overhead charges Contingencies and work charge establishment.

Valuation : Purpose, depreciation, sinking fund. scrap value year's purchase, gross and net income, dual rates interest. Method of Valuation, rent fixation of buildings.

Contracts : Different types notices inviting tenders, contract documents, departmental method of construction, security deposit and earnest money, conditions of contract, arbitration.

Preparation of detailed estimate: Detailed estimate for services of plumbing and water supply or Electrification work. Detailed estimate for earth work for the road construction and culvert. Rate analysis for at least 8 items of construction.

References

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|-------------------------|------------|
| 1. Estimation & Costing | B.N. Dutta |
| 2. Estimation & Costing | Rangwala |

CE428 MAJOR PROJECT & SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

CE429 GENERAL PROFICIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc.

Departmental Electives

CE431 REINFORCED EARTH AND GEOSYNTHETICS ENGG.

Reinforced Earth : History ,field of applications, natural fibers , overview of Geotextiles, Geomembranes, Geogrids, Geonets, Geowebs, Geomats and Geocomposites. Geotextiles , composites, physical, hydraulic and chemical properties. Functions of Geo-synthetics, fluid transmission, filtration, separation, protection. Soil Reinforcement : Basic principle of soil reinforcement, shear strength of reinforced soil, factors affecting and requirements on synthetic reinforcement, installation techniques.

Use of Geo-synthetics for, embankment on soft soils, internal stability, overall stability ,foundation stability and bearing capacity failures -Construction of the steep slope, retaining walls-external stability, internal stability. Use of Geo-synthetics in Roads and Railways, drainage system - Control of groundwater level, dewatering and reclamation of land , use of Geo-membranes - For lining application, management and maintenance

References

1. Geotextiles and Geomembranes in Civil Engineering Gerard P.T.M.
2. Reinforced Soil and Geotextiles J.N. Mandal
3. Geosynthetics : Application ,Design and Construction R.J. Tarmat
4. Geosynthetics World J.N. Mandal

CE432 MODERN FOUNDATIONS

Foundations in expansive soils, foundations in soft and compressible soils, foundations in over consolidated desiccated soils. Modern Foundation Techniques : Drilled piers, reinforced earth, and reinforced concrete retaining walls with relieving shelves. Diaphragm walls and piles, vibrofloatation, stone columns,

Foundations for special structures : Foundations for water tanks, chimneys

References

1. Modern foundations Arockia Samy
2. Design and construction of Foundations Kurian
3. Foundation Analysis and Design Bowels
- 4.

CE433 EARTHQUAKE ENGINEERING

Introduction : Engineering seismology, The concept of plate tectonics, earthquake damage, intensity & magnitude, seismic waves, seismic instruments. Sub surface exploration, liquefaction, mitigation of liquefaction, ground improvement techniques.

Concepts of seismic design and configuration : Behaviour of buildings, response spectra, seismic structural configurations, irregularities, time period, behaviour of masonry, reinforced masonry, r.c.c., steel and timber, shear walls. Seismic detaining, design procedures, introduction to Indian building codes on earthquake engineering, i.e. IS:1893, IS:4326, IS:13926 etc.. Seismic assessment, rehabilitation and retrofitting of R.C.C., masonry buildings.

References

1. Earthquake Resistant Design of Structures S.K. Duggal.
2. Earthquake Design Concepts CVR Murthy, Andrew W. Charleson.
- 2 Manual of Seismic Design James L. Stratta.
- 3 Earthquake Dynamics of Structures A Primer Anil K. Chopra.

CE434 COMPUTATIONAL METHODS IN CIVIL ENGINEERING

Need of computational methods, errors numerical methods for roots of polynomial equations, regression analysis, curve fitting and interpolation, Statistical analysis of data, probability distributions.

Boundary and Eigen value problems, numerical method for ordinary differential equations: Runge Kutta method, Euler's method, Finite Difference method , methods for solution of linear and non-linear algebraic equations, simple computer programs for problems related to civil engineering

References

1. Numerical Methods for Mathematics, Science and Engineering, Mathew John H.
2. Numerical Methods for Engineers Chapra S.C. and Canale R.P

CE435 ADVANCED REINFORCED CONCRETE DESIGN

Design of slabs, waffle slabs, slab of irregular shape by yield-line theory, circular slabs for different loading and edge conditions, circular slabs with central hole.

Composite construction, steel concrete composite beams, beams with in-situ slab and precast slab.

Design of buildings, Building frames and industrial frames

Folded plates and cylinder shells

References

- | | |
|---|--------------|
| 1. Reinforced concrete design | Sinha & Roy |
| 2. Advanced reinforcement concrete design | Krishnaraju |
| 3. Composite Structures Vol. | R.P. Johnson |

CE436 HYDRO POWER ENGINEERING

Current scenarios in hydropower development, Project feasibility, Impact of hydropower development on water resources systems, and environment.

Basic principle of hydropower generation: Hydropower Project Planning, Site selection, Hydropower development schemes.

Types of hydraulic turbines, their parts and selection of turbines.

Hydropower potential of a basin - estimation of available power, storage, pondage and Load studies.

Hydraulic design of various components of hydropower plants: Dams, intakes, water conveyance systems, Surge tanks,

Power house: Classification, preliminary dimensions and planning,

References

- | | |
|----------------------------|-----------------------------|
| 1. Water Power Engineering | M.M. Desmukh |
| 2. Water Power Engineering | M.M. Dandekar & K.N. Sharma |
| 3. Water Power Engineering | H.K. Barrows |
| 4. Water Power Development | E. Mosonyi, Vol. I & II |

CE437 SEDIMENT TRANSPORTATION ENGINEERING

Introduction to sediment & fluvial hydraulics. properties of sediments, movement of sediments

flow regimes and velocity distribution, bed load transport, suspended load transport, total load transport, design of stable channels sediment control in canals.

References

- | | |
|---|-------------------------|
| 1. The Flow of Complex Mixtures in Pipes | G.W. Govier & K. Aziz |
| 2. Hydraulics Transport of Bulky Materials | I. Zandi, |
| 3. Hydraulics of Sediment Transport | W.H. Graf, |
| 4. Mechanics of Sediment Transportation and alluvial Stream Problems, | R.J. Garde & K.G. Ranga |

CE438 ANALYSIS AND DESIGN OF SUBSTRUCTURES

Geotechnical Exploration–Penetration Tests, plate load test, field vane shear, large box shear, pressure meter test, foundation instrumentation – settlement and displacement gauges. Shallow Foundation: Bearing capacity & settlement analysis, Design for shallow Foundation under vertical, horizontal and moment loading in sandy and in clayey soil. Pile Foundation – pile capacity and settlement analysis for individual and group piles under vertical, horizontal and moment loading, pile load test Foundations on rocky strata. Carbon sequestration, Acid rain, depletion of the fossil fuel and non conventional analysis.

References

- | | |
|--------------------------------------|-------------------|
| 1. Foundation Engineering Hand book, | Winterkorn & Fang |
| 2. Foundation Design Manual, | N.V. Nayak |

3. Foundation Analysis and Design
4. Foundation Design & Construction

Joseph E. Bowels
M.J.Tomlinson

CE439 AIRPORT PLANNING AND DESIGN

Introduction: Characteristics of Air Transportation – Advantages, limitations, suitability, scope classification of Airports, Aircraft characteristics

Airport site selection, Airport capacity, Runway capacity etc.

Wind rose diagram, Runway orientation, basic runway length & its corrections, etc

Design of runway and taxi way geometric elements, .Zoning regulation, Imaginary surfaces etc.

Airport Visual Aids: marking and lighting, Air Traffic Controls etc.

References

- | | |
|------------------------------------|------------------------------------|
| 1. Airport Planning and Design | S.K Khanna, Arora and Jain |
| 2. Planning And Design of Airports | Robert Horonjeff And Francis X. Mc |
| 3. Airport Engineering | G.V . Rao |

CE441 INDUSTRIAL WASTE MANAGEMENT

Problem of Water Pollution: Effects of wastes on streams and sewage treatment plant, stream standards and effluent standards. Sampling of waste waters, grab and composite samples. analysis of waste water .Biochemical oxygen demand, chemical oxygen demand and pH value of waste, toxicity of waste by bio-assay method.

treatment of Wastes : Volume and strength reduction, recovery of bye products , reuse of wastewater, waste segregation. Conventional Methods of Treatment of Wastewater: Removal of suspended solids, removal of inorganic and organic dissolved solids, sludge disposal. Advance methods of treatment, such as reserve osmosis, ion exchange, electrodialysis, algal harvesting etc. low cost treatment plants.

Common effluent treatment plant, design and operation.

Combined Treatment of Wastewater Sewage: Energy requirement optimization and budget, municipal regulation. Sewer rental charge instrumentation in wastewater treatment plants, collection of data, operation and maintenance of plants, water pollution control board.

Brief study of industrial processes and treatment methods of waste water from common industries, such as textile dairy, paper and pulp, tannery, distillery.

References

- | | |
|---|------------------------------|
| 1. Industrial Water Pollution Control | Eckenfelder |
| 2. Environmental Industrial Pollution control | P.R.Trivedi and Gurdeep Raj. |
| 3. Pollution Control in process industries | S.P.Mahajan. |
| 4.Waste Water Treatment for Pollution Control | Soli J.Arcieivala |

CE442 SITE INVESTIGATION AND GROUND IMPROVEMENT

Site Investigation: Planning, Drilling methods, Geophysical methods: electrical resistivity, and seismic refraction methods. Codal provisions for Sampling techniques, Sampling disturbances, Sub Soil Investigation Report writing. Compaction,, Compaction control. Field methods for shallow surface compaction, Deep compaction methods for cohesiveless and cohesive sites/

Soil Stabilization: Mechanical Stabilization, method of mixing soil to get designed plasticity Index

Stabilization with Additives: Lime, flyash, cement and other chemicals and bitumen. Deep stabilization: Preloading, sand drains and sand columns. Grouting: Grout materials, Grouting techniques

References

- | | |
|------------------------------|---------------|
| 1. Advanced Soil Mechanics b | Varada Rajan. |
|------------------------------|---------------|

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|--------------------------------------|--------------|
| 2. Modern Geotechnical Engineering | Alam singh. |
| 3. Analysis and Design of Structures | Swami Saran. |
| 4. Foundation Analysis and Design | Bowels. |

CE443 SOIL DYNAMICS AND MACHINE FOUNDATION

Soil dynamics importance, applications, dynamic soil parameters, factor affecting, wave propagation through soils. Theory of Vibration : Free and forced vibrations - undamped and damped for single degree of freedom system. Harmonic and transient conditions. Mass Spring-Dashpot model and calculation of response magnification. Transmissibility of force.

Determination of dynamic Soils constants C_u , C_τ , C_ϕ , C_ψ , G and D etc and approximate values.

Machine Foundations, types, nature of dynamic forces produced by common machines, design criteria and permissible amplitudes, design approaches. Design of machine foundation, for impact and reciprocating machine.

Effects of dynamic loads on bearing capacity and earth pressure and slope stability.

References

- | | |
|-------------------------------|--------------------------|
| 1. Soil Dynamics | Shamsher Prakash. |
| 2. Soil Dynamics | B.M.Das. |
| 3. Handbook of M/c Foundation | Srinivasan & Vaidanathal |

CE444 HYDROLIC STRUCTURES

Continuity equation, vorticity, circulation, Kelvin relations, velocity potential, stream functions, kinematics, boundary conditions, Kutta-Joukowski law, vortex motion and construction theorem, Kelvin circulation theorem, vortex streets, D'Alembert's paradox, method of solution of potential flow, confined porous media flow, Darcy's law, wells in uniform bed, seepage under dams, water waves, magneto hydrodynamics.

References

- | | |
|----------------------------------|---|
| 1. Hydro Dynamics, | Drydon H.L., Murnagham F.P., Bateman H. |
| 2. Essentials of Fluid Dynamics, | Prandtl L |

CE445 HAZARDOUS WASTE MANAGEMENT AND RISK ANALYSIS

Hazardous wastes: Landmark episodes, classification, generation, guidelines of HWM, Regulatory frame work, Basal Convention, Monitoring of critical parameters/provide risk analysis. HAZON, HAZOP, Consequence analysis. Faculty and eventry analysis. Emergency Management: Indian and international legislation in respect of the above. Case Studies, leakage, explosion, oil spills and fire of hazardous chemical storage. Leakage in atomic plants.

Hazardous chemicals: Physical properties, chemical composition, lethal dose and concentration. Storage, collection and transport.

Hazardous waste treatment: Characterization of waste, compatibility and flammability of chemicals, Physico-chemical and biological treatment of Hazardous Waste including waste reduction, neutralization, incineration, combustion and pyrolysis, stabilization, solidification, bioremediation. Precautions in collection, reception, transport, storage and disposal. Import procedure for environmental surveillance.

Radioactive Waste Management -Sources, measures, health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options. Hazardous waste manifest system. Environmental Risk Assessment: Defining risk and environmental risk, methods of risk assessment, case studies, dose-response assessment, risk exposure assessment

References

- | | |
|-------------------------------|------------------|
| 1. Hazardous Waste Management | Michael LaGrega, |
|-------------------------------|------------------|

2. Risk Assessment and Risk Management:
3. Hazardous waste management

R E Hester, R M Harrison
Charles A. Wentz

CE446 ADVANCED HIGHWAY CONSTRUCTION

Introduction: Types of Highway constructions, construction equipments, safety during construction, management of highway construction projects Highway Material characterization: Aggregates, Binders, additives, and their suitability. Aggregates- Physical and strength characteristics, Bituminous binders- Classification, characteristics and application, modified binders Bituminous Mixes- Design of bituminous mixes and methods of testing, Marshall method, concrete paving mixes- mix design methods

Construction techniques and quality control of embankment, subgrade, sub-base and base course construction. Low Cost Road Construction: Types of low cost construction, soil stabilization techniques, Construction of WBM and gravel roads etc. Bituminous Road Construction: Type of Bituminous constructions and their suitability, Interface treatments, wearing courses like BM, DBM, SDBC, BC etc - construction techniques and quality control etc. Concrete Road Construction: Types of joints and their construction, Construction of DLC, construction of cement concrete slab

References

- | | |
|---|-----------------------------|
| 1. Highway Engineering | S.K.Khanna & C.E.G. Justo |
| 2. Principles of Transportation Engineering | Chakroborti and Das |
| 3. Principles & Practice of Highway Engg. | L.R. Kadiyali |
| 4. Principles of Pavement Design | E.J. Yoder And M.W. Witczak |

CE447 PAVEMENT DESIGN

Introduction: Important types of pavement, Component parts of the pavement structures and their functions, design factors etc Design of Flexible Pavements : stresses in flexible pavements, various design methods, design as per latest Indian standards guidelines: Design parameters and their estimation, design procedure etc.

Design of Rigid Pavements : stresses in rigid pavements, various design methods, design as per latest Indian standards guidelines: Design parameters and their estimation, design procedure etc., Design of Joints etc. Evaluation of Existing Pavements : Benkleman beam method, Service ability Index Method.etc. Strengthening of Existing Pavements : Rigid and flexible overlays and their design Procedures etc.

References

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|--|---------------------------|
| 1. Highway Engineering | S.K.Khanna & C.E.G.Justo. |
| 2. Pavement Design | Yoder & Witczak. |
| 3.Principles of Transportation Engineering | Chakroborti and Das |
| 4. Conc. Road Design | HMSO. |

29 DEPARTMENT OF MECHANICAL ENGINEERING

Third semester

ME211ENGINEERING THERMODYNAMICS

Basic Concepts: Continuum, macroscopic approach, thermodynamic systems, path and process; different modes of work; Zeroth law of thermodynamics; First Law of Thermodynamics: Energy, enthalpy, specific heats, Second Law of Thermodynamics: Kelvin-Planck and Clausius statements and their equivalence, reversible and irreversible processes, Carnot theorems, Clausius inequality and concept of entropy, availability and irreversibility.

Properties of Pure Substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, phase rule, ideal and real gases, equations of state, Thermodynamic Relations: Helmholtz and Gibbs free energy, Coefficient of volume expansion and isothermal compressibility, Maxwell Relations, Thermodynamic cycles: Carnot Cycle, Ideal Rankine cycle, Binary Vapour Power Cycle, Air-standard Otto cycle, Air-standard Diesel cycle, Brayton cycle, calculation for work and efficiency

References

- | | |
|------------------------|----------------|
| 1. Thermal Engineering | S. Domkundwar |
| 2. Thermal Engineering | R.K. Rajput |
| 3. Thermodynamics | E.J. Lay |
| 4. Gas Turbines | Cohen & Rogers |

ME212 MECHANICAL ENGINEERING GRAPHICS

Computer Graphics: Introduction to general purpose graphics software, plotting techniques, coordinate system transformations, line drawing, polygon and circle generation. Drawing entity commands of Computer drafting. Sectional and dimensional drawing using computer. Isometric projections and interpenetration of surfaces. Orthographic projections of machine parts and assembly drawings of couplings bearings, brackets, hangers, connecting rods, pistons, eccentric etc.

References

- | | |
|--|-------------------------------|
| 1. Engineering Drawing with Auto CAD | T. Jayapoovam |
| 2. Engineering Graphics including AutCAD | Lakshminarayan and Vaishwanar |
| 3. Machine Drawing by | Lakshminarayan and Vaishwanar |
| 4. Engineering Graphics | K.R. Mohan |

ME213 MATERIAL SCIENCE AND ENGINEERING

Crystal structure; Space lattice constants; Miller indices; Imperfections in crystals, point defects and line defects and surface defects. Plastic Deformation of Metals and Alloys: dislocation; slip and twinning. theory of work hardening; Theories of recrystallisation and grain growth, Phase and Phase Equilibrium : Types of phases, Solid solution, Hume Rothery's rules, Solidification of alloys; Phase diagrams, Phase and Lever Rules relationship, Iron–Carbon equilibrium diagram. Iron Carbon alloys,. Heat Treatment TTT diagram, Hardenability, case hardening.

Engineering Materials: Alloy steels, Tool steel, Spring steel, Corrosion resistant steel. Nonferrous alloys and their applications, Polymers : different types, their properties, selection. Ceramics, composites and their applications. Introduction to nano materials and applications.

References

- | | |
|---------------------------------------|------------------------|
| 1. Material Science | Narula, Narula & Gupta |
| 2. A first course on Material Science | Raghavan |
| 3. Principles of Physical Metallurgy | Reedhill |
| 4 Material Science | Callister |

ME214 KINEMATICS OF MACHINES

Kinematics :Types of plane motion, links, pair, kinematics of chains, mechanism and machines, constraints and degree of freedom, Gruber's equation, inversion of four bar, slider crank and double-slider crank chain, Movability Criterion.

Motion analysis: Absolute and relative motion, kinematics quantities and their relationship: vector diagrams ,instantaneous centers and Kennedy's theorem, velocity analysis, acceleration analysis, ,velocity and acceleration of reciprocating parts. Computer aided analysis of mechanisms.

Toothed Gears: Fundamental law of gearing, classification and terminology, geometry and kinematics considerations of various tooth profiles..

Cams: Classification, types of motion curve and analytical construction of cam, profile for different followers, pressure angle and cam size, cam with specified contours, cam synthesis, Gyroscopic: Gyroscopic Torque equation.

References

- | | |
|----------------------------------|------------------|
| 1. Theory of machines | Rattan |
| 2. Mechanism & machine theory | Rao & Dukkipati |
| 3 Theory of mechanism & machines | Ghosh and Mallik |
| 4 Theory of machines | Thomas Bevan |

ME215 MANUFACTURING PROCESSES 1

Cold and Hot Working of Metals: Press-working equipment and Operations, Shearing, Drawing, Spinning, Stretch Forming, Wire Drawing, Embossing, Squeezing, Swaging, Coining and Bending Operations, Calculation of Press Capacity.

Machine tools, Type of lathe, Lathe specifications, Lathe operations, Geometry of Single-point Cutting Tools, Lathe centers, Mandrels, Chucks, Collets, Face plates, Steady and Follow rests, Tool holders, cutting tool materials, Drilling Machine, Geometry of Twist Drills, Boring, Reaming, Spot facing, Counter Sinking and Counter Boring. Shaping and Planers and their operating mechanisms, Welding: Resistance welding, Gas welding, Arc welding, Thermit welding, Friction welding, Electron- laser beam welding, TIG- MIG welding. Weldability of metals, Welding defects and remedies.

Foundry: Pattern types, allowances for pattern, pattern materials Moulding methods and machines, Moulding sand testing, Mould design. Casting methods, Solidification, Defects & Remedies. Melting Furnaces, Design and Operation. Machine moulding, core moulding, shell moulding, investment moulding, plastic moulding, permanent mould casting, die casting and centrifugal casting.

References

- | | |
|--|--------------------|
| 1. Fundamentals of Modern Manufacturing | Mikell P. Groover, |
| 2. Fundamentals of Machining and Machine Tools | Boothroyd, |
| 3. Introduction to Manufacturing Processes | John A. Schey |
| 4. Work shop technology | Hazra Choudry |

AM216 MECHANICS OF MATERIALS

Stresses in Composite Sections, Thermal stresses, Elastic constants and their relationships, Torsion of Shafts of circular cross section, Power transmission through shafts, compound & composite shafts.

Strain Energy in tension, compression, direct shear, torsional shear and bending. Strain Energy due to principal stresses. Bending of Composite beams, Shear stresses in beams and shear center. Deflection of beams, method of integration, Macaulay's method, area moment method, energy method, Castligano's theorem, Maxwell's reciprocal theorem.

Helical, spiral and leaf springs, Column's and struts, buckling of columns, Eulers and Rankine's formulae.

Thin and thick cylindrical and spherical pressure vessels, compound cylinders, thin rotating discs. Concept of shrink fit

References

- | | |
|--------------------------|-----------|
| 1. Strength of Materials | G.H.Ryder |
| 2. Strength of Materials | Rajput |

ME217 THERMAL ENGINEERING TLABORATORY

List of experiments

1. General study of Boilers, its mountings & accessories
- 2 Study of Nestler's Boiler
- 3 Study of power plant
- 4 Study of cut models of Internal Combustion Engines
- 5 Study of cut of cut model of 4 cylinder 4 stroke petrol engine.
- 6 Load Test on Ruston Diesel Engine

ME218COMPUTER AIDED GRAPHICS LABORATORY

List of experiments

1. Introduction of computer aided software and application
- 2 Basic commands of 2D modeling
- 3 Basic commands of 3D modeling
- 4 Modeling of simple 3D components
- 5 Introduction of Basic Assembly tools.
- 6 Assembly of 3D components knuckle joint, coupling, tool head of shaping machine.
- 7 Drawing of assembly using CAD software knuckle joint, coupling, tool head of shaping machine

ME219MECHANICS OF MATERIALS & MATERIAL SCIENCE LABORATORY

The laboratory experiments related to material testing such as tension test, torsion test, compression test, hardness test and impact test will be performed. The experiments based on photoleastcity concepts in Mechanics of Materials such as determination of elastic constants, spring test and verification of basic theorems etc will be included. A student has to perform at least ten experiments in the semester.

References

1. Experiments in Engineering Materials Higgerson
2. Experimental Physical Metallurgy Kehl

ME220MANUFACTURING TECHNIQUES LABORATORY 1

List of Experiments

1. Principal parts of tool, tool geometry, Demonstration on lathe machine: Various parts and its functions, job & tool holding procedure, operational aspects etc.,
2. Simple jobs on center lathe involving plain turning, step turning, taper turning and facing.
3. Practice in shaping machine, drilling machine and grinding machine.
4. Practice on Milling machine, job holding procedures, making simple jobs
5. Different types of lathe operations. Calculations of cutting speed, material removal rate and machining time for lathe, drill and shaping machines.
6. Spot welding

Fourth Semester

MTH221 MATHEMATICS 3

Boolean Algebra and Its Applications, Fundamentals of Fuzzy Set Theory.

Calculus of Variations: Variational Problems, Approximate Solution of Boundary Value Problems.

Statistics: Curve fitting, Correlation and Regression Analysis Probability Distribution, Sampling and Testing of Hypothesis.

Optimization Technique: Linear Programming Problem, Transportation & Assignment Problem.

References

- | | |
|--|----------------|
| 1. Operation research | S. D. Sharma |
| 2. Numerical Optimization Techniques with Applications | Suresh Chandra |
| 3. Mathematical Statistic | M. Ray |
| 4. Mathematical Statistic | Fruend |

ME 222 MANUFACTURING PROCESSES 2

Automatic mass production lathes classification and operations, Turrets classification and operations, Tool lay out, Cycle time, Screw machines. CNC Machining, classification and fundamentals of operation & programming. Milling: Milling machines, specifications, Types of milling operations, cutter-types with geometry, materials, milling machine accessories, dividing heads, simple, compound, differential and angular indexing and calculations for cutting of different types of gears.

Grinding machines and grinding process, Grinding wheel, Types nomenclature and their selection. Centre less grinding and job feeding arrangement, Dressing and truing of grinding wheels. Super finishing processes: Honing, lapping, superfinishing, polishing and buffing. Gear cutting on milling machine and by generating methods viz, hobbing, shaping, and rack cutting, gear finishing by shaving and grinding. Thread: Types of thread and application, Standards, Thread making methods and machines, die threading and tapping. Broaching operation, types of broaching machines and broaches design, broaching tools.

References

- | | |
|--|-------------------------------|
| 1.Principles of Manufacturing Materials & Processes. | Campbell J. S. |
| 2. Manufacturing Processes. | Lindberg |
| 3. Workshop Technology part II and III | Chapman W. A. J. |
| 4.Workshop Technology | Hazra Choudhry or Raghuwanshi |

ME223 DYNAMICS OF MACHINES

Flywheel and Governors: Fluctuation of energy and speed, design of flywheel, force analysis of governors, controlling force curves, sensitivity, stability.. Friction devices: power screw, plate, cone and centrifugal clutches, band and block brakes. Dynamometer Absorption and transmission types. Transmission of power by belts, ropes and chains. Gear trains:simple and epicyclic, force analysis: piston, connecting rod and crank shaft

Dynamics of Reciprocating Machines: Equivalent dynamical systems, inertia forces, bearing loads, Crank shaft torque delivered, forces on connecting rod, forces on crank shaft.

Vibration: Free, damped and forced vibrations of single degree of freedom for a mechanical system, transverse vibration of loaded and unloaded shafts, transverse vibration of shafts having several loads , critical speed for whirling of shaft. torsional vibrations of two and three rotor systems, vibration transmission and isolation, vibrations in two degrees of freedom for a mechanical system

Balancing: Balancing of rotating masses in one plane and in different parallel planes, balancing of four bar linkages including slider crank mechanism, principal of balancing machines.

References

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|-----------------------------------|-------------------------|
| 1. Theory of mechanism & Machines | J.E. Shigley and Uicker |
| 2. Mechanical Vibration | W.T. Thomson |
| 3. Mechanics of Machines | V.Ramamurti |
| 4 . Mechanical Vibrations | G.K.Grover. |

ME224 FLUID MECHANICS & MACHINES

Review of Fluid Properties, Fluid Statics, Fluid Kinematics, continuity equation, velocity potential, stream function, flow nets. Fluid Dynamics, Bernoulli's equations and its applications, Impulse momentum equation, moment of momentum equation and their applications. Fluid Measurements, Velocity and flow measurement devices. Dimensional Analysis and Dynamic similitude, similarity laws, specific model investigations. Introduction to viscous & turbulent flow, Reynolds experiment, laminar flow through circular pipes and parallel plates.

Turbines classifications, impact of free jets, major and minor losses in pipes, siphon, transmission power through pipe lines., specific speed and unit quantities. Design aspects of Pelton turbine- its construction, power and efficiency for ideal case, characteristic curves. Design aspects of reaction turbines, construction & setting, draft tube theory, characteristic curves, cavitations.

Centrifugal pumps, various types and their important components, manometric, total head, specific speed, cavitations. Principle of working and characteristic curves. Reciprocating pumps : principle of working, single acting and double acting pump.

References

- | | |
|---|------------------|
| 1. Fluids Mechanics & Hydraulics Machines | Modi & Seth |
| 2. Fluids Mechanics & Hydraulics Machines | A.K. Jain |
| 3. Fluid Mechanics | Streeter & Wylie |
| 4. Fluids Mechanics & Hydraulics Machines | R.K. Bansal |

ME225 MACHINE DESIGN –1

Design of fasteners: Knuckle, cotter, threaded joint, design and drawing of permanent fasteners - riveted joints, welded joints, eccentric loading of riveted joints, welded and bolted joints, and computer aided design of at least one joint. Concepts of creep and fatigue, design of shaft, design for power transmission including combined bending and torsion and design of shaft couplings, effects of stress concentration. Spring design: Helical springs, closed and open coiled tension, compression springs and their ends, design of leaf springs, power screws - designing for various types of screw jacks, lead screw of lathe machine and screw press. Design methods, preliminary design, conceptual design, detailed design, concurrent engineering, reverse engineering, and creative design. Hydraulic presses and pneumatic presses.

References

- | | |
|----------------------------------|--|
| 1. Mechanical Engineering Design | J.E. Shigley and Charles R. Mischke, TMH |
| 2. Engineering Design | G.E. Dieter |
| 3. Machine Design | Kulkarni, TMH |
| 4. Handbook of Mechanical Design | G.M. Maitra and L.V. Prasad |

EE226 ELECTRICAL MACHINES & ELECTRONICS

Polyphase systems: measurement of 3 phase power for balanced and unbalanced loads. Single phase and three phase transformers, Induction motor construction, classification, working and various characteristics for selection and applications of industrial motors, thyristor and their characteristics, basic chopper, rectifier and inverter. Examples and construction features of stepper motor, servo motor and brushless permanent magnet motor.

Reference

- | | |
|---|-----------------------------|
| 1. Basic electronic engineering | V.N. Mishra and S.R. Mishra |
| 2. Power electronics | M. M. Singh |
| 3. Principle of electrical motors and power electronics | G. B. Gupta |

ME227 DYNAMICS OF MACHINE LABORATORY.

List of Experiments

Rearranged the Experiments on the availability of equipments in the Lab

1. To find the Speed at which jump Phenomenon occurs in the CAM follower Systems.
2. To verify the Formula for Gyroscopic Couple.
3. To determine whirling speed of the shaft on the whirling apparatus & to verify the Dunkerley's formula on it.
4. To find the Torsional frequency of Vibrations (Undamped and Damped) of single and two rotor systems.
5. To find Frequency of vibrations of a damped force Vibrating Systems.
6. To find Natural Frequency of Vibration of Compound and Torsional Pendulums (Bifilar and Trifilar Suspensions).
7. To determine the amplitude and frequency of forced damped vibration of simply supported beam without damping condition.
8. To determine the amplitude and frequency of forced damped vibration of simply supported beam without damping condition
9. To obtain the controlling force curves in watt, Porter, Proell and Hartnell Governors

Balancing of Rotor on the Dynamic Balancing Machine.

ME228 FLUID MECHANICS LABORATORY

1. Experiments on fluid flow through various channels and devices
2. Study and performance analysis on hydraulic machines

EE229 ELECTRICAL MACHINES & ELECTRONICS LABORATORY

List of experiments

1. Measurement of reactive power
2. Load test on 3 phase induction motor
3. No load and blocked rotor test on 3 phase induction motor
4. No load and blocked rotor test on 1 phase induction motor
5. Swinson test on 1 phase transformer
6. Study of semiconductor devices

Fifth Semester

MTH311 MATHEMATICS 4

Numerical Methods: Solution of Algebraic and Transcendental Equations, Solution of Linear and Non-Linear Simultaneous Equations, Finite Differences, Interpolation, Numerical Differentiation and Integration, Numerical Solution of Ordinary & Partial Differential Equations.

References

- | | |
|---|------------------|
| 1. Numerical Analysis | Hildebrand |
| 2. Numerical Analysis | Scarborough |
| 3. Numerical Methods | E .Balaguruswamy |
| 4. Numerical Methods for scientific and Engineering | M.K.Jain |

ME312 INTERNAL COMBUSTION ENGINES

Internal Combustion Engines:, S.I. and C.I. Engine operating parameters & performance characteristics,

Fuels and fuel systems: theory of carburation, SI engine fuel injection systems, SPFI, MAI, PISU, CI engine fuel injection systems classification.

Combustion in SI Engines: Combustion in SI Engines, Combustion in C.I. Engines: Alternate Engines : Rotary combustion I.C. Engine, Stratified charge engine, Principle of working and salient features. Fuel Engines. Super-charging in IC engines: Types and classification. Reciprocating Air compressors: Working & performance Characteristics

References

- | | |
|----------------------------------|---------------------------|
| 1. A Course in I.C. Engines | M.L. Mathur & R.P. Sharma |
| 2. Internal Combustion Engines | V. Ganesan |
| 3. Introduction to I.C. Engines. | Richard Stone. |
| 4. Fundamentals of I.C. Engines | J.B. Heywood |

ME313 METROLOGY

Standard of Measurements: Principles of Measurement, Line and end standards, Slip Gauges, End bars, Angle Measurement, Angle Gauges. Concept of limits fits and tolerances, Types of fits, Universal and local interchangeability, Systems of limits, fits and tolerances, Selective assembly and matched fits, B.S., I.S.O. and I.S. systems. Design of limit gauges, their types and manufacture.

Measuring Instruments: Comparators, Types, use and limitations, Optical Instruments, Projectors, Tool makers microscope, Measurement of geometrical Features, Measurement of Straightness, Flatness, Parallelism, Perpendicularity, Roundness, Cylindricity, Squareness and Symmetry, Interferometer and its applications, Automated Inspection, In process gauging and Principles of Co-ordinate Measuring Machine.

Measurement of Surface Roughness: E & M System, Surface roughness in various manufacturing processes, Measurement of Screw Threads and Gears : Measurement of elements of screw, threads, pitch and effective diameter measurement and errors in screw threads elements and their effect, Inspection of gears, Various methods of measuring gear tooth thickness, Measurement of base pitch, effective diameter and profile.

References

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|--------------------------------|--------------------------------|
| 1. Metrology | Gupta I. C. |
| 2. Metrology | Jain R. K. |
| 3. Statistical Quality Control | Grant Leavenworth, McGraw Hill |

ME314 I.C.ENGINES LABORATORY

List of Experiments

1. Heat balance sheet for Ruston Diesel Engine
2. The effect of ignition timing on Newage Petrol Engine
3. The IP of on Newage Petrol Engine by morse test
4. Variable speed load test on on Newage Petrol Engine
5. The 2 wheeler chassis dynamometer.
6. Morse test on IP of Suzuki 3 cylinder Petrol Engine
7. Variable speed load test on Single Cylinder 4 Stroke petrol engine

ME315 METROLOGY LABORATORY

List of Experiments

1. Calibration of Micrometer and Vernier Caliper
2. Inspection of Jig plate

3. Measurement of taper angle by sine bar
4. Measurement of various angles using Profile Projector
5. Measurement practice by using Coordinate Measuring Machine
6. Programming practice for measurement of complex jobs using CMM
7. Measurement practice on Surface Roughness Tester
8. Preparation of X-bar and R charts for the given data, interpretation of the charts
9. Preparation of p and c charts for the given data and interpretation of results

ME316 THERMAL ENGINEERING LABORATORY 2

1. Study of steam power plant
2. Study of oil fired boiler
3. Measurement of dryness fraction of steam
4. Performance of steam turbine
5. Performance of steam nozzle and surface conduction
6. Performance characteristic of blower.

Sixth Semester

ME 321 HEAT TRANSFER

Steady State Conduction: Fourier's law and general conduction equation in Cartesian coordinate, Analysis of composite slabs, cylinders and spheres, insulation desirable properties and critical thickness of insulation,.

Unsteady state Heat Transfer: Newtonian heating/cooling, Lumped parameter analysis, periodic heat flow, solution of unsteady state problems using Heisler charts.

Convection: Analysis of free and forced convection using dimensional analysis, significance of various dimensionless numbers empirical co-relations for plates and pipes under natural/forced convection conditions. Concept of thermal and hydrodynamic boundary layers.

Radiation: Mechanism, electromagnetic spectrum, reflectivity, absorptivity, transmissivity, emissivity, emissive power, intensity of radiation, Planck's law, Wien's law, Stefan Boltzman's law and Kirchoff's law. View factor for simple geometries and view factor relations, Concept of black and gray body, Black body, radiation shields.

Heat Exchangers: Definition and classification, concept of LMTD and overall heat transfer coefficient, fouling factor, NTU method to analysis exchangers performance. Derivation of LMTD and effectiveness for parallel and counter flow heat exchangers.

Fins: Heat transfer and temperature distribution in rectangular fins (Longitudinal & annular) of uniform cross section, effectiveness and efficiency of fin.

Condensation and Boiling: Heat transfer condensation process: Mechanism of condensation, Nusselt's theory, drop wise & film wise condensation;

Boiling heat transfer, nature of vaporization, nucleate pool boiling, empirical co-relation for boiling heat transfer, factors affecting boiling film coefficients.

References

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|----------------------------------|--------------------|
| 1. Heat and Mass Transfer | Dr. D.S. Kumar |
| 2. Engg. Heat and Mass Transfer | Mahesh M. Rathore |
| 3. Introduction to Heat Transfer | Incropera & Dewitt |
| 4. Heat and Mass Transfer | Yunus Cengel |

ME322 MACHINE DESIGN 2

Fatigue - Importance in Engineering design, concept of fatigue, fatigue strength and endurance limit, stress concentration, Goodman and modified Goodman diagram, Soderberg and Gerber hypotheses, effect of loading type, size, surface finish, notch, surface treatment, and corrosion, cumulative fatigue damage, applied problems.

Gears - design consideration, Hertzian stresses, design load, beam strength, surface strength, design procedure for helical and spur gears, design calculation for bevel and worm gears. Creep- temperature considerations in design, designing for creep, thermal stresses, applied problems. Bearing- Classification, design of hydrodynamic bearings, selection of ball and roller bearings.

Design of the Rotating Machines e.g. Centrifugal Pump, , Gear Box. Introduction to various Advanced CAD software's.

References

- | | |
|-----------------------------------|---------------------------|
| 1. Mechanical Analysis and Design | Burr and Chetan |
| 2. Centrifugal Pumps and Blowers | Church & Jagdish Lal |
| 3. Mechanical Engineering Design | J.E. Shigley & Charles R. |
| 4. Machine Tool Design | N.K. Mehta |

ME323 INDUSTRIAL ENGINEERING

Introduction to industrial engineering, history and development of I.E., concept of productivity, partial and total productivity, ethods to increase productivity, work content, measurement of work content, techniques to improve work content. Work study: use and applications, technique, Human factors in work study. Method study: objectives, basic procedure in various charts, flkow process, two handed chart etc. use of photographic techniques, SIMO charts, principle of motion encnomy.

Work measurement, purpose, basic procedure, various techniques used, PMTS, time study, rating, work sampling, analytical estimation, cae studies, wage incentives, mequred days work and wage incentives, different types of plans, design of inetives plans, Management , function of management, decsison making. Total productivity, management (TPM) management information system for TPM.

References

- | | |
|---|-----------|
| 1. Industrial engineering and production management | M.Mahajan |
| 2. Industrial engineering and management | Banga |
| 3. Production and operation management | Martunch |

ME324 HEAT TRANSFER LAORATORY.

List of Experiments

1. Determination of overall heat transfer coefficient for parallel and counter flow heat exchangers
2. Determination of effectiveness of given double pipe heat-exchanger
3. Determination of overall heat transfer coefficient for cross flow air/water heat exchanger
4. Performance of heat pipe as compared with thermal siphon and air pipe
5. Thermal conductivity of a material by guarded plate apparatus
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection
8. Determination of Stefan Boltzman constant by Stefan Boltzman apparatus
9. Determination of emissivity by emissivity measurement apparatus
10. Determination of transient thermal history of a metal

ME 325 MANUFACTURING TECHNIQUES LABORATORY 2

List of Experiments

1. CNC Lathe Machine
 - a) Understand operation procedures of the machine.
 - b) Demonstration of operating procedure with the help of a work piece.
 - c) Understand safety operations.
2. CNC Milling Machine
 - a) Understand operation procedures of the machine.
 - b) Demonstration of operation procedure with the help of a work piece.
 - c) Understand safety operations.
3. Robotics
 - a) Understand the operational procedure of Robot & mobile robot
 - b) Understand the applications of robotics in advanced manufactur

ME 326 MINOR PROJECT

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

Departmental electives

ME 331 MECHATRONICS

Elements of Mechatronics system, control Systems, Feedback, open loop and closed loop control, Measurement Systems, Mechatronics systems, Evolution of Mechatronics, Architecture of Mechatronics, Sensors & Transducers, Performance terminology, Various types of sensors and transducers, signal conditioning, data presentation. Actuation systems, Mechanical actuators, Applications, Electrical actuators and their applications, Hydraulic and pneumatic actuation systems. Logic Building and Processing, Logic Gates, combinational and sequential logic, fuzzy logic, microprocessor, programmable logic controller. Applications in CNC, FMS,

Indroduction to mechatronics system modeling and simulation of physical systems, transducer, signal systems and conrol, actuator systems, feedback and intelligent systems, micro processor and micro controller, application of mechatronics system

Introduction to Instruments: application of instrument systems, functional elements of a measurement system, classification of instruments. Measurements, methods and application: Force, Torque and power, pressure, temperature etc. measurements. Introduction to NDT, scope and advantage of NDT, Non destructive techniques: Ultrasonic Crack detection, Magnetic particle for various materials, Eddy current, Dye Penetrant, radiography, acoustic emission.

References

- | | |
|--------------------------------|-----------------|
| 1. Mechatronics | W. Bolton |
| 2 Mechanical Measurements | Beckwith & Beck |
| 3 Indroduction to mechatronics | Appu Kuttan |

ME332 MEASUREMENT TECHNIQUES

Fundamentals of industrial measurement: Basic principles of measurement, basic characteristics and dynamics of measuring instruments. Transducers and serving elements: Classification capability of

transducers, digital transducer, hydropneumatic sensor, thickness sensor, mechano-electrical transformation

Stress-strain measurement and strain gauges: Introduction, mechanical strain gauge, optical strain gauge, stress measurement by photo elastic, instruction for strain gauge stress-strain relationship, Measurement of vibration: Common causes of vibration, diagnosis and remedial measurement methods for vibration measurements, vibrations, vibration amplifier for permanent monitoring. Speed measurement: Mechanical tachometer, electric tachometer, different types of tachometer, pneumatic types speed transmitting elements. Temperature Measurement: Technical temperature measurement, method for measuring Temperature, radiation properties, optical properties, electrical properties, thermocouples, thermistors

Analysis: Spectroscopic analysis, absorption spectrometer, gas analysis, Chromatography, infrared gas analyser. Level Measurement: Direct and indirect methods, electrical conductivity method, robotics method, solid level detector, level measurement by capacitance probes. **References**

- | | |
|--|-------------------|
| 1. Industrial Instrumentation | D.P. Eckman |
| 2. Mechanical Measurements | Backwith and Buck |
| 3. Instrumentation Measurements and Analysis | Nakre & Chaudhary |

ME333 MATERIALS HANDLING

Materials handling : General introduction, definition of terms i.e. batched goods, charged pallet ratio, general cargo, handling, integrated transport, line load etc. Material handling: Engineering and economic factors, relationship to plant layout. Selection of material handling equipment. Types of equipments and their maintenance, Unrestricted Equipment: General information, counterbalancing of trucks, powered stokers, order pickers, side loader and forwarding trucks, straddle carriers and mobile lifting frame, hand pallet trucks and stokers, air cushion handling frames, carts and trolleys. Area restricted: General information on line restricted material handling equipment. Different type of conveyers like roller, wheel, belt, slat, chain, overhead rail etc.

Railmounted trolleys, trolley and tractors, automatically guided vehicles, lift, elevators, other equipment, sorting installations. Position restricted: Jib cranes and other fixed industrial robots. Auxiliary equipment: Load carriers (Pallets, Stillage etc.) warehouse layouts, goods reception and dispatch equipment, equipment for assembling and securing loads.

References

- | | |
|------------------------------------|------------------------|
| 1. Material Handling System Design | James Apple |
| 2. Hand Book of Industrial Engg. | G. Saliendy |
| 3. Facilities Planning | James Tomphines & John |
| 4. Industrial Engg. | John M. Hill |

ME334 PRODUCTION AND OPERATIONS MANAGEMENT

Introduction to Production and Operations management, difference between production, operations and manufacturing, production systems, production system model, types of production systems, Job, Batch, Mass and Continuous production systems, Flexible production systems, Lean production systems. Push and Pull production control systems. Facility design, facility location planning, factors affecting facility location decision, facility layout planning, principles and methods of facility layout design, shop floor management techniques. Forecasting, scheduling, Routing, dispatching and follow up.

Inventory management: function of inventory, inventory control problems, economic order quantity, reordering procedure, lead time, types of inventory control. Purchase management, its functions, methods

and principles. Stores management, Material handling. Aggregate planning, Aggregate planning methods, master scheduling, master scheduling methods, Materials Requirement Planning (MRP), MRP I and II, MRP system parameters, MRP logic, Scheduling, scheduling methods. Product development: Various stages, Concurrent engineering, Quality Function Deployment, modern product development approach. Design of production system, Quality Management, Quality circles, Six sigma concepts, Introduction to ISO9000, ISO14000, ISO18000, ISO22000, Introduction to Total Quality Management (TQM).

References

1. Operations Management: Theory and problems Joseph G. Monks
2. Production and Operations Management An Applied Modern Approach ,
Joseph S. Matinich
3. Industrial Engineering and Production Management Martand Telsang
4. Fundamentals of Supply Chain Management Chopra and Mendle

ME335 INDUSTRIAL TRIBOLOGY

Introduction: Surface interactions, science of rubbing surface, wear rate, modelling and solution of simple problems. Material properties influencing interactions: Introduction, elastic properties, plastic deformation properties, relation between the strength and other properties of solids, chemical reactivity of surfaces, absorbed surface layer, surface energy, relation between surface energy and hardness, surface interfacial energies of solids under engineering condition.

Surface Interaction: Size of real contact area and effect of surface energy, size of junction, rheological properties. Wear in tribological joints - classification, calculation methods with allowance for stiffness, wear limits, reliability of joints, simple examples Friction: Introduction, laws, function, properties of uncontaminated metals in air, outgassed metal surface, calculation of flash temperature using surface energy, stick-slip and its prevention. Quantitative expression for abrasive wear, of hardness and particle size on abrasive wear rate, surface fatigue wear, brittle fracture wear, corrosive wear with types. Lubrication: Solid film lubrication, boundary lubrication with single and multiple penetration model, properties of lubricants, effectiveness of lubrication-intermediate temperature, behaviour of a solid lubrication below melting point effect of speed, load on lubrication..

References

1. Basic Lubrication Theory A. Cameron
2. Friction and wear of Materials E. Rabinwicz
3. Maintenance Engg. Hand Book L. Higgs

ME336 AUTOMOBILE ENGINEERING

Development & Advances in Automobile Engineering: Engine induction and Exhaust Systems: Requirements and considerations. Manifold flow paths and tuning. Introduction to exhaust gas extraction. Turbocharging, types, variable geometry turbocharger. Engine valve operating systems: Effect of Valve timing and valve lift on engine operation; variable valve lift and variable valve timing. Valve operating conditions. Multi valva engines. Advanced Engine systems: Ignition systems for petrol engines. Advanced cooling concepts, radiators and thermostat. Wind shield wiper fuel gauge. Chassis and suspension: Requirements and general consideration of strength and stiffness. Engine mountings, types of suspension. Transmission: Clutch, types, fluid flywheel, torque converter, gear boxes, universal joint, propeller shaft, differential, rear axles and their types, front axles and their types. Steering: Factor controlling rolling and directional stability, castor angle, wheel camber, steering geometry and system, power assisted steering. Brakes: Principle of braking system, braking mechanism, mechanical and

hydraulic brakes, power brakes, vacuum and air brakes. Wheels and Tyres: Wheel drum, tyre, materials and manufacturing of tyres, trouble shooting and maintenance.

References

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|-------------------------|------------------------|
| 1. Automotive Mechanics | Heitner |
| 2. Automobile Engg. | GBS Narang |
| 3. Automobile Engg. | TR Banga & Nathu Singh |

ME 323 TURBO-MACHINES

Basic Concepts of Turbo Machines. Continuity equation, Momentum equation and Energy equation. Measurements with various flow devices: Pitot tube, Orifice meter and Rota meter.

Blade theory: Aerofoil section, types of aero-foils, Drag and Lift coefficients, Cascade testing and curves, cascade lift and drag coefficients, losses in a cascade.

Power absorbing machines: Rotary Compressors & Blowers: Classification, Centrifugal compressor, Static and total heat, Velocity Diagrams, Work done by Impeller, Width of blades, slip factor and slip coefficient, Surging, Rotating Stall and Choking, Characteristics curves, Axial flow compressors, Comparison between Rotary, axial flow and reciprocating compressors.

Steam Nozzles: Steady flow energy equation and its application to steam nozzle. Isentropic expansion of steam through convergent and divergent nozzles. Critical pressure, condition for maximum discharge, choking of nozzles, effect of back pressure. Super saturated flow through nozzles, flow with friction, nozzle efficiency, steam ejectors and injectors.

Power producing machines: Steam Turbines, gas turbines and jet propulsion.

References

- | | |
|----------------------------|-------------|
| 1. Turbo Machines | A. V. Arasu |
| 2. Compressible Fluid Flow | S.M. Yahya |
| 3. Steam and Gas Turbine | W. Kearton |
| 4. turbomachines | Appu Kuttan |

ME338 SUPPLY CHAIN MANAGEMENT

Introduction to Supply chain management: meaning and objectives, Characteristics of global supply chains, Supply chain relationship to business performance, Key tasks of supply chain managers, Role of Government in controlling international trade and its impact on supply chain, Supply Chain Strategy, Supply chain as a competitive advantage, Supply Chain Security-International Sourcing. Planning the global supply chain, Risk management in the global context, Performance measurement and evaluation in global supply chains, E commerce advantages and disadvantages for SCM – e-commerce as an enabler: evolution of world class supply chains, ERP.Importance of Coordination in Supply Chain, Effect of lack of Coordination on performance, Obstacles to Coordination, Strategies to achieve coordination, Building Strategic Partnership and Trust In Supply Chain.

Key concepts in relationship marketing concepts: Characteristics of relationships, promise, trust, commitment,, satisfaction, quality, Service competition, customer value, customer defections, customer loyalty, loyalty programs. Sustaining Customer Relationships. E-Customer Relationship Management, The Economics of e-Loyalty, The importance of trust, Price rational vs. price obsessive consumers, loyalists vs. butterflies, Upselling and crossselling. Relationship Capital, e CRM, Internet strategies facilitating CRM, including personalization, collaborative filtering, data mining, data warehousing and real-time profiling

References

- | | |
|--|--------------------------------------|
| 1. Supply Chain Logistics Management | Bowersox, Closs & Cooper |
| 2. World Class Supply Management | Burt, Dobbler, Starling |
| 3. Designing and Managing the supply chain | David Simchi, Levi & Philip Kaminski |

ME339 LEAN MANUFACTURING ENGINEERING

Lean manufacturing, introduction, background, lean thinking, importance of philosophy, strategy, culture, alignment, focus, systems view, Cases of Lean Production Systems, Lean production preparation, system assessment, process and value, system mapping, sources of waste, Lean production processes, approaches and techniques, Importance of focussing upon flow, 5 Ss, Stability, Just in Time, Cellular system, Setup time reduction, Total productive maintenance, Poka Yoke, Standards, Leveling, Visual Management

Employee involvement, teams, training, supporting and encouraging involvement, involving people in change process, communication, importance of culture, Start up of lean processes and examples of applications, sustaining involvement and change, auditing, follow up actions.

References

- | | |
|--|-------------------------|
| 1. Simplified Lean Manufacturing Elements, Rules, Tools & Implementation | Gopal Krishnan |
| 2. Lean and Agile Manufacturing Systems | Idis Zehrudin Muhammed, |
| 3. Lean Manufacturing Perspectives and Applications | Aruna Desai |

Seventh Semester

ME411 REFRIGERATION & AIR CONDITIONING

Introduction: Definition, history of refrigeration, standard rating of refrigerating machines, C.O.P. of refrigerating machines, types of refrigerating machines, vortex tube refrigeration and thermoelectric refrigeration. Air compression refrigeration: Basic air compression cycle. Flow diagram its working and function of its main components. Air cycle systems for aircraft and missiles, numerical examples.

Vapour compression refrigeration: Theoretical vapour compression cycle, its working and representation on P-H, T-S and P-V diagrams. Coefficient of performance, practical vapour compression cycle, dry and wet compression, COP as heat pump, Components their types and relative merits. Advanced vapour comparison systems..

Absorption Refrigeration System: Simple absorption systems, Steam Ejector Refrigeration Refrigerants: Requisites of an ideal refrigerant, properties of commonly used refrigerants ammonia, Freon-12, Freon-22 etc. Alternate eco friendly refrigerant.

Production of low Temperature(Cryogenics): Limitations of vapour compression system for the production of low temperature. Multi stage system, cascade system. Production of solid CO₂. Joule Thomson effect and liquification of gases. Application of low temperature. Vortex Tube. air conditioning systems: summer and winter: importance of each of these on human comfort and health

Psychrometry: Definition, properties of air, vapour mixtures, definitions of psychrometric properties, representation of psychrometric properties on chart, psychrometric processes and their representation on psychrometric chart for calculations.

Load calculations (comfort air conditioning): Sources of heat and moisture gains as applied to summer air conditioning. Their relative importance in various weather conditions and applications air conditioning, their relative importance. Methods of reducing winter air conditioning load.

Industrial airconditioning: Purpose of industrial air conditioning, justification of industrial air conditioning, components of cooling loads for typical application.

References

- | | |
|---------------------------------------|--------------------------|
| 1. Refrigeration and Air-conditioning | P.L. Balaney |
| 2. Refrigeration and Air-conditioning | S. Domkundwar & C. Arora |
| 3. Refrigeration and Air-conditioning | C.P. Arora |

ME412 ENVIRONMENT ENGINEERING LABORATORY 2

List of Experiments

1. Experiment on Physiological Status of Different Subjects
2. Practice on Rating in Time Study
3. Practice on Method Study and Principles of Motion Economy
4. Preparation of Flow Process Chart - A Case Study
5. Preparation of Two Handed Process Chart - A Case Study
6. Preparation of SIMO Chart -A Case Study
7. Metallographic study of test specimens [Microscopic]

References

- | | |
|---|----------------|
| 1. Motion and Time study : Design and measurement of work | Ralph M.Barnes |
| 2. Work Study by ILO, Geneva. | |

ME413 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

ME414 EDUCATION TOUR & TRAINING

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

Eighth Semester

ME412 INDUSTRIAL MANAGEMENT

Fundamentals of industrial management (MBE) and productivity principles of management, Management of organizational behavior, Human and industrial relations, human behavior management information systems, professional ethics. Personnel management practices, motivation, leadership, Human resource development, wages and salary administration, labour, industrial laws, accident and safety, material management, deterministic inventory control models, statistical quality control, financial management, marketing and sales management.

References

- | | |
|---|--------------------------|
| 1. Industrial Engineering and Management | I R.Banga |
| 2. Industrial Engineering and Management | O P Khana |
| 3. Industrial organization and Management | Tara chand and Nem chand |
| 4. Industrial management | KK Ahuja |

CE422 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth

semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

CE423 GENERAL PROFICIENCY

The department committee evaluate the general proficiency in the subject.

Departmental Electives

ME431 ENERGY CONSERVATION SYSTEMS

Introduction: need for energy conservation. Energy conservation in production of heat, Introduction to different energy conversion systems, site selection criteria of thermal power plant layout of modern thermal power plant, details of different components of thermal power plant selection criteria of different components of thermal power plant ex. Fuel consumption economy, firing arrangement and selection of burners,. Fluidized bed combustion. Energy conservation in use of heat. Economical design of furnace, water treatment, drying, conditioning and industrial space heating, boiler accessories etc.

Selection of cycles: Combined cycle, power generation for better energy efficiency management.

combined cycle power plant. Energy conservation furnish better management techniques, improved production design, improved production powers, substituted materials, waste recovery and recycling. New and renewable energy technologies. Appropriate energy technology for rural development. Energy conservation in production, agriculture sector. Instrumentation and control in energy conservation: Economics of conventional and new and renewable energy technologies. Environmental aspects and case studies :

References

- | | |
|----------------------------|-----------------------|
| 1.Power plant Engineering | Domkundwar |
| 2. Power plant Engineering | G.D. Rai |
| 3. Power plant Engineering | R.L. Agrawal |
| 4. Energy Technology | S. Rao & B.B. Parulka |

ME432 CONCURRENT ENGINEERING

Definition of CE- Sequential verses CE- Need of CE- Basic principals of CE- Benefits of CE- Implementation of CE, Integrating Mechanisms: - Introduction – Various interacting Mechanisms, Quality by Design: QFD-QFD Methodology – Taguchi Methods of Robust design, Design for Manufacturing: - introduction –PDS- Value Engineering – Design Guidelines – Design Axioms –poka Yoke – Manufacturability Analyzer, Rapid Prototyping: - introduction –Need & Use of RP –Various RP Technique Design for Assembly introduction Various DFA Techniques, Design for Reliability: - Introduction serviceability Fundamentals Reliability Analysis During Design –General Design for Reliability Principles, Design for Serviceability: introduction –Serviceability – Factors affecting serviceability Service modes – Serviceability evaluation, Design for Maintainability, Design for Economics: - Introduction – Fundamental approaches to design Economic Justification, Decomposition in CE: Introduction – Decomposition of design process- Decomposition of design constraints, A 1A based System for CE: Introduction – An1 A based frame work for CE - Conflict detection and Conflict resolution, KBE System in CE: - Role of KBE System – KBE System –KBE and Design optimization.

References

- | | |
|--|-----------------------|
| 1. Fundamentals Concurrent Engineering | Kuldeep Singh Sangwan |
| 2. Concurrent Engineering: Concepts, implementation and practice | Chanan S. |
| 3. Concurrent Engineering: Automation, Tools and Technique | Andrew Kushik |

ME433 FLEXIBLE MANUFACTURING SYSTEMS (FMS)

Review of Computer Aided Design and Drafting (CADD): The design processes, advantages and applications of CAD, computer hardware system, computer programming languages, model storage and data structure, CADD software packages – AutoCAD, orthographic projections. CAD/CAM Interface and Product Design: Rationale for CAD/CAM, Computer-Aided Manufacturing, Elements of CAM Systems, NC in CAM, Product Design and Development. Machine Tool Control: Elements of the NC Systems, Types of Control Systems, NC Part Programming, Computer Aided Part Programming, Machining Centers.

Manufacturing Systems and Automation: Trends in Manufacturing Systems, system Defined, Classification of Manufacturing Systems, Leveling and balancing the manufacturing Systems, Robotics and Automated Guided Vehicles: Definition Robotics, Terminology, Types of Robots, basic robot motion and their control, robot programming, Automated Guided Vehicles. Typical applications in manufacturing like in welding, assembly, material handling, spray painting etc., Group Technology (G T): Part families, parts classification, machine group/cell, cad/cam and GT, applications. Flexible Manufacturing Systems and Computer Integrated Manufacturing Systems: (FMS) (CIMS): Components of FMS, components of CIMS, applications. Hardware and software pertaining to FMS installations.

References

- | | |
|---|-----------------------------------|
| 1. Computer Aided Manufacturing | Rao P N Tewari N K and Kundra T K |
| 2. Introduction to Robotics – A System Approach | Rehg J A |
| 3. CAD/CAM Handbook | Tercholz E |
| 4. Robotics: An Introduction | Malcolm D R Jr |

ME434 COMPUTER AIDED DESIGN

Introduction to computer technology, computer systems, operating the computer system, hardware in computer aided design. Mechanical design process, benefits of computer aided design, role of design analysis programs in CAD. Principles of interactive computer graphics, geometric modelling, modelling and display of curves and surfaces, introduction and application of a graphic software (e.g. Auto CAD, Creo, CATIA, ANSYS, ABAQUS, SOLIDWORKS, INVENTOR etc.). Computer aided design and drafting data base facility, part library, standard component and symbol library creation and operation, associability between master entities and occupancies, attribute definition and generation of bill of materials, database management. Introduction to optimal design and optimization techniques for design of mechanical elements, computer aided optimum machine elements such as springs, shafts, bearings gears, etc.

References

- | | |
|--------------------------|------------------------|
| 1. Computer Aided Design | Taylor & Taylor Series |
| 2. Computer Aided Design | Sadhu Singh |
| 3. Computer Aided Design | Grover & Zimmer |

ME435 COMPUTER AIDED MANUFACTURING

C. N.C. System : Definition, applications, Historical background Role of Computers in Manufacturing. Computer Numerical control in CAM: Definition, basic components of CAM system, Procedure, Co-ordinate system, motion control systems, Advantages of CNC system; Features of CNC Machine tools, Application of CNC systems, Economics of CNC machining centers, Part Programming : CNC part programming : manual part programming, computer aided part programming

Robot Technology: Introduction, Industrial Robots, Robot physical Configuration, Basic Robot motions, Technical features, such as work volume, precision of movement speed o movement, weight carrying capacity, type of drive systems, Programming of the robot, Introduction to robot languages, End erectors, work cell control and interlocks, Robotic sensors, Robot applications & economics, Intelligent robots, interfacing of a vision system with a Robot, **FMS:** Definition and broad characteristics of Flexible Manufacturing Cells, , Group technology Systems FMS hardware CNC machines tools, robots, AGVs, ASRs, Inspection and Cleaning stations - Control aspects of FMS-DNC of machine tools, cutting tools, Types of Flexibility in FMS, Flexible and Dynamic Manufacturing Systems, Computer Aided Inspection: Principles and interfacing, software metrology. Applications of Lasers in precision measurements - Laser interferometer, speckle measurements, laser scanners. Coordinate Measuring Machine - Types of CMM - Probes used - Applications - Non contact CMM using Electro optical sensors for dimensional metrology - Non contact sensors for surface finish measurements. Image processing and its application in inspection.

References

1. Automation, Production Systems and Computer Integrated Manufacturing M.P.Grover,
2. Principal of Computer integrated manufacturing S.KantVajpayee.
3. Numerical control and computer aided manufacturing Kundra, Rao & Tiwari

ME436 COMPUTER AIDED FACILITY & PROCESS PLANNING

Elements of plant design systematic layout planning, industrial component and its consideration. Objectives types, goal, design process and techniques of facility planning, Schematic technique, travel charting, sequence analysis systematic layout –planning mathematical models, optimizing heuristics algorithm, branch and board technique, quadramatic assignment techniques, travelling salesman problem, single goal improvement type models, single goal construction type models.

Multiple facility design problem and construction type existing improvement type, multiple goal models and modifications, design problem solving technique, Estimation of distribution parameters. Empirical models, computer aided models. Estimation of distribution parameters in multigoal facilities design problem, computer aided techniques for finding optimum and sub optimum and sub optimum facilities design problem solution, Computer aided facility management, application softwares, application areas, Application of CAFM in manufacturing sector and service sectors.

References

1. Computer Aided Processes M Chidambaram
2. Computer Aided Process Control S.K.Singh
3. Computer Aided Facilities Planning H Lee Hales

ME437 TOOL ENGINEERING

Single Point cutting tool, form tools, milling cutters, drills, reamers, broaches, gauges and gauge design, machine tool drives, gear box design, acceptance test of machine tools, design of jigs and fixtures.

ME438 ROBOTICS

Introduction: Robot, classification of robot, characteristics of robot, performance, advantages and disadvantages of robot, application of robot, Fundamentals of robot: Various system, structure and definition, terms relating to type of industrial robots, basic term relating to robot performance and characteristics, Controlling the robot systems: Introduction to drives, mechanical, hydraulic, pneumatic drives, electric drive, feed back control ,Sensing System: Introduction, types of sensor, machine vision, artificial intelligence, control techniques, robot language features, Robot safety: Introduction, potential safety hazards, safety planning check list, safety guide lines, latest development in safety measurement.

References

1. Introduction to robotics: mechanics and control John J. Craig
2. Robotics for Engineers Y. Koren

ME439 COMPUTATIONAL COMBUSTION & TURBULENCE MODELING

Introduction to computational combustion and turbulence, Combustion and thermo-chemistry, Mass Transfer analysis, Chemical Kinetics of Combustion, Coupling chemical and thermal analysis of reacting systems, Simplified Conservation equation for reacting flows, Laminar Premixed & Diffusion Flames, Droplet Evaporation and Burning, Turbulent flows, Turbulent premixed and non-premixed flames, Burning of solids, Pollutant Emissions,

References

1. An introduction to combustion Stephen R Turns
2. Theoretical and numerical combustion T Poinsot

ME441 NUCLEAR POWER ENGINEERING

Atomic structure, properties of sub-atomic particles, isotopes, radiation quanta, mass-energy equivalence, radio-active decay, nuclear reactions, artificial radioactivity, nuclear equations, nuclear fission, the mononuclear fission, particle acceleration

Neutron Physics: Fission process and reactor behavior, reactor classification, fast and breeder reactors, thermal reactors, critical size, effect of delayed neutrons, reactor control. Construction and design of nuclear reactors, materials fuels, moderator, coolant, stainless steels and special metals. Generation and transfer of heat. Comparison of cooling methods, electromagnetic pumps, liquid metal techniques, radiation detectors, shielding. Handling of fuel elements and fission products, disposal of radioactive wastes, radiation hazard and health physics, useful by products their separation and use of nuclear power economics, comparison with conventional methods

References

- 1 Power plant Engineering Domkundwar
2. Power plant Engineering G.D. Rai

30 DEPARTMENT OF ELECTRICAL ENGINEERING

Third semester

MTH211B MATHEMATICS 3

Numerical methods: solution of algebraic and transcendental equations, solution of linear simultaneous equations, finite difference, interpolation and extrapolation, inverse interpolation, numerical differentiation and integration, numerical solution of ordinary and partial differential equations, statistics, curve fitting, correlation and regression analysis, probability distribution, sampling and testing of hypothesis

References

1. Numerical analysis Hildebrand
2. Numerical analysis Scarborough
3. Mathematics statistics M. Ray
4. Advanced Engineering Mathematics Erwin Kreyszig, .

ME212 ELECTRICAL MATERIALS & ELECTROMAGNETIC FIELDS

Electrostatic Fields -Coulomb's law, electric field intensity, Gauss's Law, boundary relations, physical concepts of divergence, gradient and curl. Electric potentials, electric boundary conditions,

capacitance, continuity equation, Poisson's and Laplace's equations. Magnetic Fields - Boit-Savart Law, Stoke's theorem, Ampere's circuital law, magnetic boundary conditions, energy storage in magnetic fields, Scalar and vector magnetic potential, Maxwell's equations, EM Wave, Propagation, Poynting theorem, instantaneous, average and complex, Polarization of waves, reflection and refraction of waves, *Insulating & Dielectric Materials, Conducting Materials, Magnetic Materials, superconductivity*

Reference Books :

- | | |
|------------------------------------|------------------|
| 1. Electromagnetic field | William & Haytt, |
| 2. Electromagnetics | Jorden |
| 3. Electrical Engineering Material | C.S. Indulkar |

EE213 POWER SYSTEMS I

Introduction of electric power systems, transmission line constants, performance of transmission lines, mechanical design of overhead lines, line insulators, corona loss, Underground cables, distribution systems and their application, HVDC transmission system and its control.

Reference

- | | |
|--------------------------------------|---------------------|
| 1. Electric Power System | C.L.Wadhwa |
| 2. Electric Power System | Asfaq Husain |
| 3. Elements of Power System Analysis | William D.Stevenson |
| 4. Power System Analysis & Design | B.R.Gupta |

EE214 NETWORKS

Circuit Concept, coupled circuits, Network Topology, Steady State Analysis, Initial conditions. Laplace transform, Waveform synthesis, Transient Analysis-Poles & zeros of transfer function, one and two port networks, Network theorems, Frequency Domain Analysis - Sinusoidal steady state analysis, Fourier series, Network synthesis. Driving point & transfer impedance, Foster form & Cauer form of RC, RL & LC networks. Conditions for realizing an immittance function of passive elements.

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|-----------------------------------|-----------------|
| 1. Network Analysis | Van Valkenberg, |
| 2. Network Analysis and Synthesis | Pankaj Swarnkar |
| 3. Network Synthesis | Van Valkenberg, |
| 4. Network Analysis and Synthesis | Kuo |

EE215 ELECTRO-MECHANICAL ENERGY CONVERSION (EMEC) -1

Polyphase circuits : Three-phase systems with balanced load & unbalanced load.

Energy in electromagnetic system, D.C. Generators-Emf equations, characteristics of D.C. generators. DC motors- Torque equation, characteristics, Losses & Efficiency of D.C. machine, Testing of D.C. machine.

Transformer review, transformer tests : polarity test, Sumpner's test, Three phase transformers vector group, 3 to 2 and 6 phase conversion, parallel operations of 1 & 3 phase transformers, load division between transformers in parallel.

Reference Books

- | | |
|--|---------------------------|
| 1. Electrical Machines | P.S.Bhimbra |
| 2. Performance & design of A.C. Machines | M.G. Say |
| 3. Electrical Machines | Fitzerald Kingsley Otmans |
| 4. Electrical Machines | Nagrath & Kothari |

ME216 ELECTRONICS 1

Special Purpose Diodes- Diode Applications. Zener voltage regulators, photodiode etc. Transistor Biasing - Purpose of biasing, dc operating point, dc load line, different biasing techniques Thermal Runaway, Thermal stability. Small Signal Amplifiers- Transistor as an amplifier, classification of amplifiers RC coupled CE-amplifier, ac equivalent circuits, analysis using h-parameters, frequency response, cascading, Analysis of transistor amplifier at high frequency, miller theorem, Gain band width product.

FET & MOSFET, low frequency common source and common drain amplifiers, FET biasing, The common source and common drain amplifier at high frequencies, MOSFET as a switch, MOSFET driver circuits.

Reference

1. Electronic Devices – Millman & Halkias
2. Electronics Principles – A.P.Malvino
3. Electronic Circuit Discrete and Integrated – Donald I. Schilling
4. Electronic Devices – David Bell

EE217 NETWORKS LABORATORY

Laboratory experiment connected with theory subject on network analysis

EE218 ELECTROMECHANICAL ENERGY LABORATORY

Laboratory experiment connected with theory subject on EMEC 1

EE219 ELECTRONICS LABORATORY

Laboratory experiment connected with theory subject on basic electronics

Fourth Semester

EE221 UTILIZATION OF ELECTRICAL ENERGY

Nature of light, units, sensitivity of eye, luminous efficiency, production of light, different types of lamps, polar curves, effect of voltage variation on efficiency and life of lamps. Distribution and control of light, factory lighting, flood lighting and street lighting, electrical heating advantages, methods and applications, resistance over general construction, design of furnaces and light frequency eddy current heating, dielectric heating, principle and applications, arc furnaces, different methods of electric welding and equipments. Electric traction, diesel electric locomotives, specific energy consumption, traction motors, braking of traction motors, use of flywheel, criteria for selection of motors. Various industrial drives. Modern 25 KV ac single traction systems, ac traction.

- 1 Utilization of Elect. Energy E.O. Taylor
- 2 Utilization of Elect. Energy H. Pratap
- 3 Utilization of Elect. Energy J.B. Gupta

EE222 ELECTRICAL MACHINE DESIGN

General concepts & considerations of electrical machine design- heating and cooling characteristics of machine, DC Machine-calculation of magnetic circuit, main dimensions and armature winding, Transformer-design of magnetic frame and windings, performance calculations, Induction motor-design and performance calculations, Synchronous machine design, Introduction to computer aided design.

Reference

4. Design of DC Machines : By Clayton
5. Performance and Design of A.C.Machines : By M.G.Say
6. Synchronous machine design : By G.C.Jain
7. Computer aided design : By Say & Sinha

8. Performance & Design of Electrical Machines: By V.N. Mittal & A. Mittal

9. Design of Electrical Machines: By A.K. Sawhney

EE 223 GENERATION OF ELECTRICAL POWER 2

General discussion on various types of conventional & non-conventional power generation, Hydro-Electric Stations, Thermal Power Stations : Choice of coal fired station site, arrangement of plant and principal auxiliaries, coal handling plant, Nuclear Power Stations-Nuclear Physics, Atomic energy fuels, moderator materials, fissile and fertile materials, types of reactors, Economic Aspects of Power Plant Operation, power factor improvement by static and synchronous capacitors, Economic Scheduling of Power Stations, Iterative methods to solve coordination equations, combined hydro thermal system.

Reference

- | | |
|-------------------------------------|-------------------|
| 1. Generation of Electrical Energy | –B.R. Gupta |
| 2. Non-conventional Energy Sources | –G.D. Rai |
| 3. Elements of power station design | – M.V. Deshpande |
| 4. Economic Load Dispatching | - L. R. Kirchmare |

EE224 EMEC 2

3-phase Induction Machines, production of rotating magnetic field, working principle, phasor diagram, equivalent circuit, torque and power equations, No-load and blocked rotor test, performance by circle diagram. Starting & speed control of Induction Machines (with & without emf injection in the rotor ckt.). Synchronous Generators- armature windings, e.m.f. equation, winding coefficients, distribution factor, harmonics in the induced e.m.f., armature reaction, OC & SC tests, voltage regulation, parallel operation, operation on infinite bus. Two reaction theory, power expressions for cylindrical and salient pole machines, OCC & SC characteristics. Synchronous motor : Principle of operation, starting methods, phasor diagram, torque angle characteristics, V-curves, power factor control of synchronous motor. Single Phase Induction Motor-Double revolving field theory, equivalent circuit, no load & block rotor tests, starting methods.

Reference

- | | |
|---|---------------------|
| 1. Electrical Machines | P.S. Bhimbra |
| 2. Performance & design of A.C. Machines- | M.G. Say |
| 3. Electrical Machines | Fitzgerald Kingsley |
| 4. Electrical Machines | Nagrath & Kothari |

EE225 MEASUREMENT

Indicating Instruments, Sources of errors, deflecting, controlling and damping torque, Moving Iron, Moving coil, Dynamometer. Induction & electrostatic type of instruments, Detectors & Potentiometers, Measurement of Phase and Frequency, Ohm-meters, Megger, CRO, Measurement of Energy, Magnetic Measurements -B-H curve, determination of hysteresis loop, permeameters,

Reference

- | | |
|---|---------------|
| 1. Electrical Measurement & Measuring Instruments | E.W. Golding |
| 2. Electrical Measurement | A.K. Sawhney, |
| 3. A Course in Electronic and Electrical Measurements & Instrumentation | J.B. Gupta |

EE226 ELECTRONICS 2

The differential amplifier, Amplifier and its applications-opamp instrumentation amplifier, current to voltage and voltage to current converter. Feed back concept, topologies voltage series current series, voltage shunt and current shunt, Wien bridge oscillator RC phase shift, Hartley and Colpitt oscillator,

555 timer. Large signal amplifiers class A, class B and basic idea of push pull action, distortion, the current mirror, darlington and complementary pairs. Boolean algebra, logic gates, Half/ Full Adder, Multiplexer/Demultiplexer. Multivibrators –Flip flops & their Application, Sequence generators.

Reference

- | | |
|---------------------------------------|----------------------|
| 1. Electronic Devices & Circuits | Millman & Halkies |
| 2. Electronics Principles | A. P. Malvino |
| 3. OPAMP & Linear Integrated Circuits | Ramakant A. Gayakwad |
| 4. Digital Electronics | William H.Gothmann |

Fifth Semester

EE311 ELECTROMECHANICAL ENERGY CONVERSION (EMEC) 3

Kron's primitive machines, park's and inverse Park's transformers and their physical significance, generalized model DC machine, interconnection of machines, generalized model for different types of DC machines, generalized model of 3 phase synchronous machine, performance equation and steady state analysis, effect of voltage and frequency variations on the induction motor performance, operation of I.M. on unbalanced supply voltage, induction motor starting analysis, construction features, universal motor, stepper motor, linear induction motor, hysteresis motor, reluctance motor, brushless DC motor, Schrage motor, repulsion motor, applications of special machines, .

Reference

- | | |
|--|-----------------------------|
| 1. Generalised Theory of Electrical Machines | P.S.Bhimbra |
| 2. Electrical Machines | P.S.Bhimbra |
| 3. Electrical Machines | P.S.Nagrath and D.P.Kothari |
| 4. Electrical Machines | Fitzgerald Kingsley |

EE312 POWER ELECTRONICS

Introduction to SCR and Thyristor family, Self Commutated Switches such as MOSFET, IGBT etc., AC/DC uncontrolled and Controlled converters, DC-DC, DC-AC and AC-AC converter circuits : topologies, operation and waveform analysis, Basic concepts of firing and control circuit, gate/base drive circuits

Reference

- | | |
|----------------------|-------------|
| 1. Power Electronics | C.Y.Lander |
| 2. Power Electronics | M.H. Rashid |
| 3. Power Electronics | P.S.Bhimbra |

EE313 LINEAR CONTROL SYSTEM

System concept, mathematical modeling of mechanical and electrical systems, Transfer function of linear systems, system components, Time response, Automatic controllers, Stability analysis of linear systems : Time and frequency domain analysis Polar plot, Design of compensating network using bode plots and root locus.

- | | |
|------------------------------|-----------------|
| 1. Linear control system | B.S.Manke, |
| 2. Automatic control system | B.C.Kuo, |
| 3. Modern control system | Nagrath Gopal |
| 4. Automatic Control Systems | Pankaj Swarnkar |

EE316 ELECTRICAL MACHINES AND ENERGY CONVERSION LABORATORY

Laboratory experiment connected with theory subject on electrical machines

EE317 POWER ELECTRONICS LABORATORY

Laboratory experiment connected with theory subject on power electronics

Sixth Semester

EE321 INSTRUMENTATION

transducers- Resistance, inductance and capacitance transducers, measurement of displacement, strain, force, liquid level, pressure, velocity and acceleration. D.C. & A.C. bridges, instrument transformers, Hall effect devices, Rectifier instruments, electronic voltmeter, differential voltmeters, multimeters, display devices, U-V and X-Y Recorders, Digital meters, Methods of Data transmission, General telemetry systems, DC and AC telemetry system.

Reference

1. Electrical Measurement & Measuring Instruments E.W.Golding
2. Electrical Measurement Sawhney
3. A Course in Electronic and Electrical Measurements & Instrumentation J.B.Gupta

EE322 MODERN CONTROL SYSTEM

State space representation of systems, solving time invariant state equation, State Transition Matrix, Zero input response, Zero state response, Relationship between state equation and transfer function, eigen values, eigen vectors. Phase variable representation, canonical variable representation, controllability and observability, pole placement, controllability and observability, pole placement, Z transform, pulse transfer function, sampling theorem, data reconstruction, zero and first order hold. Time response of sampled data system.

Stability criterion, methods of stability analysis, bilinear transformation, stability analysis using Nyquist criterion and root locus.

Reference

1. Discrete control Engineering Ogata
2. Automatic Control System B.C. Kuo
3. Modern Control System Nagarth Gopal
4. Linear Control System B.S.Manke

EE323 MICROPROCESSORS

Evolution and overview of Microprocessor, 8-bit Microprocessor Architecture (viz 8-bit Intel 8085), timing and control signals, Instruction set and programming, Memory types and organization, Programmable Peripherals Interface (8255), Programmable Interval Timer 8253, A/D and D/A Converters and interfacing, Applications, 16-bit Microprocessor (viz – Intel 8086) and its internal architecture

Reference

1. Fundamentals of Microprocessors and Microcomputers B.Ram
2. Microprocessors Architecture Programming and Applications - Ramesh S.Gaonkar.

EE324 INSTRUMENTATION LABORATORY

Laboratory experiment connected with theory subject on instrumentation

EE325 MODERN CONTROL LABORATORY

Laboratory experiment connected with theory subject on control systems

EE326 MICROPROCESSOR LABORATORY

Laboratory experiment connected with microprocessor

Departmental Elective

EE331 ELECTRICAL ENGINEERING GRAPHICS

Introduction to general purpose graphics software, **AutoCAD**. Conventional Symbols and brief introduction to electrical equipments and electronic devices, measuring instruments, Sketches of transmission line structures, insulating equipments. Sectional drawing of different types of Cables, overhead conductors, wiring systems, domestic, staircase and godown wiring, wiring installation in small residences. Types of transformer and their parts, core construction, sectional view of 1-phase and 3-phase transformers, H.T and L.T windings. DC machine and its parts, construction of pole, yoke and field coils, commutator and its details. Layout of Primary and Distribution substations, Bus bar arrangement and sub station equipments.

Reference

- | | |
|---|--------------|
| 1. Electrical Drawing | K.L.Narang |
| 2. Engineering Drawing | N.D.Bhatt |
| 3. Engineering Drawing with AutoCAD | T.Jayapoorva |
| 4. Electrical Engineering Drawing (Part I & II) | Surjit singh |

EE332 INSTALLATION AND COMMISSIONING

ITools accessories and instruments required for installation, maintenance and repair work, substation and earthing, testing of electrical equipments, domestic installation, environmental pollution prevention, electrical accident and safety measures, treatment of shock

Condition monitoring and maintenance of electrical equipments, transformers, machijes switch gears, cables, fault locations in cable and transmission/distribution feeders:

Reference

- | | |
|---|------------|
| 1. Electrical Maintenance & Repairs | P.P. Gupta |
| 2. Estimating Commissioning And Maintenance of Electrical Equipment | S.Rao |
| 3. Fundamentals of Maintenance of Electrical Equipments | Bhatia, |

EE333 RELIABILITY ENGINEERING

Basic Concepts of Reliability-indices and criteria, use of probability theory for reliability evaluation, System Reliability Evaluation using Probability Distributions- series, parallel and series-parallel, MTTF, MTBF, concept of redundancy, Markov Modelling, Frequency and Duration techniques, Generating System Reliability Analysis-recursive model building, Reliability indices, Distribution System Reliability analysis-application to radial networks, Effect of protection system and their failures.

Reference

- | | |
|--|--------------------------|
| 1. Reliability Evaluation of Engg. System | R. Billinton, R.N.Allan, |
| 2. Reliability Evaluation of Power systems | R. Billinton, R.N.Allan, |
| 3. System Reliability Engg. | G.H.Sandler. |
| 4. Probabilistic Reliability Evaluation | Endreynil . |

EE334 PRIME MOVERS

Expansion of gases, reciprocating air compressors, volumetric efficiency, adiabatic and isothermal efficiency, multistage compressor, steam power cycles and steam nozzles, carnot cycle, rankine cycle analysis, regenerating feed heating cycles, binary vapor cycle, isotropic flow of steam through nozzles, steam turbine turbine bladres, efficiencies, condensers, Gas turbines, ICengine, hydraulic turbines.

References

- | | |
|------------------------|------------------|
| 1. Thermal engineering | Mathur and Mehta |
|------------------------|------------------|

EE335 OPTIMIZATION TECHNIQUES

Introduction and Classical Optimization Techniques: Optimization problem, Classification, Classical Optimization Techniques,, Lagrange multipliers, multivariable Optimization with inequality constraint, Linear Programming: simplex algorithm, Transportation problem, testing for optimality of balanced transportation problems. Unconstrained & Constrained Nonlinear Programming: Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method and steepest descent method, Interior and Exterior penalty function method, convex Programming Problem, Dynamic Programming, Dynamic Programming multistage decision processes, principle of optimality.

Reference

- | | |
|--|---------------------------|
| 3. Quantitative Techniques in Management | N. D. Vohra, |
| 4. Operation Research | P.K. Gupta & D.S. Hira, |
| 5. Operation Research | Sesiani, Arkoff & Arkoff, |
| 6. Principles of Operation Research | Wagner, |

EE336 MODELING & SIMULATION USING MATLAB

Simulation Mechanism and Simulation Tools, Handling Arrays, Control Structures, File Handling, Functions and Function Files, Differential Equation Solver, Simulation of Electrical Networks with linear and nonlinear equations , Simulink Solution of Differential Equation, Solution using Laplace Transform Approach, Study of dynamic response, Simulation of Non-Linear System, Modeling and simulation of electrical and electromechanical systems, Transient analysis of dynamic systems, study of dynamic system using state space approach

Reference

- | | |
|---|------------------|
| 1. MATLAB®/Simulink Users Manual , MathWorks Inc | |
| 2. Modelling and simulation using matlab-simulink | Shailendra Jain, |
| 3. "MATLAB programming | Rudrapratap |

EE337 ELECTRICAL DRIVES

Introduction of Electrical Drives, Energy conservation in Electrical Drives. Modes of operation, closed loop control of drives, current limit control, closed loop torque control, closed loop speed control, closed loop speed control of multi-motor drives, speed sensing, current sensing, phase locked loop (PLL) control, closed loop position control

Review of DC Motors, single phase & three phase controlled rectifier fed DC drives, power factor improvement, chopper controlled DC drives and their industrial applications.

Review of three phase induction motor, PWM Inverter fed I.M. Drive, harmonics analysis. Slip power recovery, Rotor resistance control and their industrial applications.

Synchronous motor, operation from fixed frequency supply, synchronous motor variable speed drives. Brushless DC motor, Stepper motor and switched reluctance motor drives and their industrial applications.

Reference

- | | |
|--|-----------|
| 1. Fundamental of Electrical Drives | G.K.Dubey |
| 2. Power Semiconductor controlled drives | G.K.Dubey |
| 3. Thyristor DC Drives | P.C.Sen |
| 4. Power Electronics and AC Drives | B.K.Bose |

EE338 POWER CONTROLLERS

Principles, characteristics & ratings, protection, comparison types of GTO's, power transistors, MOSFET's, IGBT's, static induction tran

Analysis of 1-ph and 3-ph fully controlled and semi converter, performance analysis Power factor improvement Methods., Dual converters.

Single phase controllers, 3-phase half wave & full wave 3-phase bidirectional delta connected controllers & effect of source and load inductance. 3-phase to single phase cycloconverters. 3-phase to 3-phase cycloconverters.

Switch mode inverter. Principle of operation of PWM inverters, Harmonics reduction Technique.

Thyristorised ac, dc drives, UPS, Inverters, SMPS, HVDC Transmission ,SVC.

Reference

1. Power Controller Dubey, Doradla, Joshi & Sinha
2. Power Electronics P.S. Bhimbra
3. Power Electronics Rasid

EE339 RENEWABLE ENERGY SOURCES

Energy for sustainable development, Renewable and Non-renewable Energy sources, Policy option. Renewable Hydro – potential, flow, duration and storage, mini-micro hydro, small hydro power, types of turbines, generators & controls. Wind energy: Wind Energy Conversion, Potential, Site selection, Types of wind turbines, Wind Generation and Control. The Solar Option, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems. Energy Alternatives: The Nuclear Option, Wave and Tidal Energy, Geothermal, Bio energy, Ocean thermal energy systems, MHD & fuel cells. Grid Interactive and Off Grid / Distributed Renewable Power, Renewable Energy for Rural Applications.

References

7. Solar Energy - Principles of thermal collection and storage S. P. Sukhatme,
8. Solar Engineering of Thermal Processes J. A. Duffie and W. A. Beckman
9. Principles of Solar Engineering D. Y. Goswami, F. Kreith and J. F. Kreider
10. Biomass Regenerable Energy D. D. Hall and R. P. Grover,

EE341 EHV AC & DC TRANSMISSION

EHV AC Transmission: Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, bundled conductors. Electrostatic fields of EHV lines and their effects, corona effect Load Frequency Control: a Speed governing characteristic of generating unit and load sharing between parallel operating generators. Method of Load Frequency Control. Voltage Control: Methods of voltage control. Synchronous phase modifier, shunt capacitors and reactors, saturable reactors, Thyristorised static VAR compensators- TCR, FC-TCR and TSCTCR. FACTS: Introduction to FACTS controllers, types of FACTS controllers. HVDC Transmission: Types of D.C. links Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission

Reference:

1. EHV AC & DC Transmission Begamudre
2. EHV AC & DC Transmission S. Rao
3. H.V.D.C. Transmission P. Kundur, McGraw Hill Pub.

Seventh Semester

EE411 POWER SYSTEM 2

Faults in power system, Symmetrical components and sequential networks, Symmetrical and unsymmetrical faults, current limiting reactors, load flow solutions, protective relays and their applications, Theory of current interruption, different types of circuit breakers, LT switch gears, HRC fuse.

Reference

- | | |
|--|-----------------------------|
| 1. Electrical Power Systems | C.L.Wadhwa |
| 2. Modern Power System Analysis | Nagrath & Kothari |
| 3. Fundamentals of power system protection | Y.G.Paithankar & S.R.Bhinde |
| 4. Power System Protection | Badriram & Vishwakarma |

EE412 POWER SYSTEM LABORATORY

Laboratory experiment connected with theory subject on POWER SYSTEM

EE413 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

EE414 EDUCATION TOUR & TRAINING

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

Eighth Semester

EE421 POWER SYSTEM CONTROL AND STABILITY

Elements of an excitation system, types of excitation, systems, comparison of the various excitation system, Block diagram of excitation system and the transfer function Nature of control problems, Basic concept of Governor Mechanism and their performance in steady state, Turbine and Generator model. Load frequency control of an isolated power system. Division of load between Generators, Generation and absorption of reaction power, relation between voltage, power and reactive power at a node, methods of voltage control. Injection of reactive power, use of tap changing transformers, combined use of tap changing transformers and reactive power injection, power angle curve, transfer reactance, swing equations, steady state stability theoretical and practical, transient stability using equal area criterion and step by step method, Methods of improving stability using traditional techniques and new approaches, reduction of transmission system reactance, regulated shunt compensation

Reference

- | | |
|-------------------------------------|--------------------|
| 1. Power system engineering | Nagarath & Kothari |
| 2. Electric Power System | B.M.Weedy |
| 3. Power System Stability & Control | P.Kundur |
| 4. Electrical Power System -C.L. | Wadhwa |

EE422 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth

semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

EE423 GENERAL PROFICIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc

Departmental Elective

EE432 POWER QUALITY

Understanding Power quality, Causes and effects of power quality disturbances. Causes and effects of harmonics, converter configuration and their contribution to supply harmonics. Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters, high power factor pre-regulator, switching control circuit, transformer connections. Elimination/suppression of harmonics using active power filters. Electro-magnetic compatibility, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control.

Reference

1. Power Quality R.C. Duggan
2. Power system harmonics A.J. Arrillaga
3. Power electronic converter harmonics Derek A. Paice

EE433 SYSTEM ENGINEERING

System modeling, analysis, optimization, classification, topological models, Analogy among different systems. linear graph theory. two terminal component, development of system model using Branch formulation, interconnection equation and chord formulation and state space formulation. Modeling of systems with multiterminal components, component graph, model of n-terminal dissipative component, linear perfect couplers and Gytrators, model of two port components, system models using multiterminal components using graph theoretic approach

fuzzy logic, fuzzification, defuzzification, Applications of fuzzy logic control.

Artificial Neural Network, Multilayer feedforward networks, Applications & implementation of Neural Algorithms and systems. Stability, sensitivity, controllability, observability of the system, system optimization using linear and dynamic programming. Technological forecasting methods.

References:

1. Systems Modelling and Analysis I.J. Nagrath & M.Gopal
2. Analysis of Discrete Physical System Koenig and Tokad
3. Introduction to Artificial Neural Systems J.M.Zurada
4. Neural Networks Simon Haykin

EE437 SPECIAL MACHINES

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis-EMF and Torque equations- Characteristics and control

Principle of operation – EMF and Torque equations - Phasor diagram - Power

controllers – Torque speed characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor. Constructional features –Principle of operation- Torque prediction –Characteristics Power controllers – Control of SRM drive- Sensorless operation of SRM – Applications. Constructional features

–Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics
 – Drive circuits – Closed loop control – Applications.

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Permanent magnet DC and AC motors, Applications.

References:

- | | |
|--|---------------|
| 1. Brushless magnet and Reluctance motor drives | T.J.E. Miller |
| 2 Switched Reluctance motor drives | R.Krishnan, |
| 3. Stepping motors and their microprocessor controls | T.Kenjo, ‘ |

EE438 ADVANCED MICROPROCESSORS

Introduction to 16-bit microprocessors, internal architecture of 8086, various types of segments used like CS, DS, ES & SS, study of various registers used in 8086, various types of addressing modes like immediate addressing, register addressing, direct addressing mode & indirect addressing modes. Instruction set of 8086, conversion of high level statements like assignment statement, if statements, for loops, while loops, procedures, functions etc. to 8086 statements, programming using 8086. Interrupts in 8086, maskable & non-maskable interrupts, hardware & software interrupts, conditional interrupts, type 0, type 1, type 2 and other such types of interrupts, timing diagrams for interrupts, steps for interrupt handling. Introduction to microcontroller 8051, architecture, instruction set, assembly language programming and applications. Introduction to PLC, architecture, programming & applications.

Reference

- | | |
|--|--------------|
| 1. Microprocessor architecture, programming & applications with 8085 | R.Gaonkar, . |
| 2. Microprocessors & interphasing | D.V.Hall |
| 3. Microcontroller | K.J. Ayala, |

EE439 POWER SYSTEM DEREGULATION

Introduction of Market structure, Spot market, forward markets and settlements, Electricity sector structures and Ownership /management, the forms of Ownership and management, Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model, Bilateral and pool markets, LMP based markets, Power wheeling transactions ,Congestion management methods, Ancillary Services and System Security in Deregulation. Classifications and definitions, Technical, economic, & Regulatory issues involved in the deregulation of the power industry.

References

- | | |
|--|---|
| 1. Power generation, operation and control | J. Wood and B. F. Wollenberg |
| 2. Operation of restructured power systems | K. Bhattacharya, M.H.J. Bollen and J.E. Daalder |
| 3. Market operations in electric power systems | M. Shahidehpour, H. Yami and Z. Li |
| 4. Optimization principles: Practical Applications to the Operation and Markets of the Electric Power Industry | N. S. Rau |

EE442 ELECTRONICS INSTRUMENTATION

Transducers-Temperature, Flow measurement, Optical Transducer, Piezo-electric transducer.. Measurement of Radio Frequency Power, Fiber Optics Measurement, Data Acquisition System (DAS), D-A/A-D Conversion, Data Logger, Digital-Frequency, Phase Meter, Time, Tachometer, pH Meter, Counter, The IEEE 488 Bus, Signal Generator, analyzer.

References

- | | |
|---|---------------|
| 1. Electrical and Electronic Measurements and Instrumentation | A. K. Sawhney |
|---|---------------|

2. Modern Electronic Instrumentation and Measurement Techniques

A. D. Helfrick and W. D. Cooper .

3. Electronic Instrumentation,

H. S. Kalsi, .

4. Electronic Instruments and Instrumentation Technology

M. M. S Anand,

EE443 HIGH VOLTAGE ENGINEERING

Causes of over voltages and their effects on power system – Lightning, switching and temporary over voltages – protection against over voltages - Insulation coordination –BIL.Gaseous breakdown in uniform and non-uniform fields – corona discharges – Vacuum breakdown – conduction and breakdown in pure and commercial liquids – breakdown mechanisms in solid and composite dielectrics.Generation of high DC, AC, impulse voltages and currents, tripping and control of impulse generators.Measurement of high voltages and high currents, digital techniques in high voltage measurement.

High voltage testing of electrical power apparatus – power frequency, impulse voltage and DC testing – International and Indian standards.

References:

1. High Voltage Engineering

M.S.Naidu and V.Kamaraju

2. High voltage Engineering fundamentals

E.Kuffel and W.S. Zaengl, J.Kuffel

31 DEPARTMENT OF MATERIAL SCIENCE AND METALLURGICAL ENGINEERING

Third Semester

MTH211E MATHEMATICS 3

Numerical methods: solution of algebraic and transcendental equations, solution of linear simultaneous equations, finite difference, interpolation and extrapolation, inverse interpolation, numerical differentiation and integration, numerical solution of ordinary and partial differential equations, statistics, curve fitting, correlation and regression analysis, probability distribution, sampling and testing of hypothesis

References

1. Numerical analysis

Hildebrand

2. Numerical analysis

Scarborough

3. Mathematics statistics

M. Ray

4. Advanced Engineering Mathematics

Erwin Kreyszig, .

MSM212 FUELS, REFRACTORIES AND FURNACES

Fuels characterization and energy balance: Energy Resources and Environment, Characterization of Fuels, Production of Secondary Fuels: Carbonization, Materials Balance in Coke-making, Heat Balance and Clean Development Mechanism, Gasification, Materials and Heat Balance in Gasification, Combustion and heat utilization: Principles of combustion, Materials balance in combustion, Flame Temperature, Refractory in Furnaces: Properties, Applications, Types and Classification, Heat Utilization in furnaces, Energy flow diagrams, Heat Recovery, Transport phenomena in furnaces: Fluid Flow, Macroscopic Energy Balance, Design of flow measuring devices, Principles of Burner Design, Types of flame, Heat transfer- Conduction, Convection and Radiation, Role of refractory surfaces, Refractory Design, Heat transfer calculations, miscellaneous topics and carbon credit: Steady Heat flows in Furnace and Heat Exchanger, Atmosphere in Furnaces, Temperature measurements, Pyrometry, Electric Resistance Heating, Furnace efficiency, Fuel Saving, Carbon Offset: Concepts and Exercises

References

- | | |
|-------------------------------------|-----------------------------|
| 1. Met. Engg. Principles. | R.Schumann |
| 2. Industrial and Process furnaces. | P.Mullinger and B. Jenkins: |
| 3. Refractories & Ceramics | Norton. |
| 4. Heat Transfer | J.P.Hollman |

MSM 213 INTRODUCTION TO MANUFACTURING PROCESSES

Lathe: Turning and related operations lathe centers, mandrels, chucks, collets, face plates, steady and follow rests, tool holders their study and use. Lathe Operations, lathe attachments, taper turning, thread cutting and their calculations, lathe specifications. Introduction to CNC lathes. Drilling: Geometry of twist drills, drill chucks, feeds in drilling, machine types and specifications, boring, reaming, spot facing, counter sinking and counter boring. Shaping: Shaping and planing processes, type of shapers and their mechanisms, types of planers and their mechanism, principal tools, specifications of shaper and planer. Introduction CNC Drilling. Single & Multi-spindle

Foundry: Molding sand testing, molding methods and machines, casting processes, gray Cast Iron, white cast iron and malleable Cast Iron. Iron castings. Melting furnaces : Cupola and electric furnaces, oil fired, air furnaces, cupola design and operation, design of casting, casting solidification, casting defects & remedies, gates, runners & risers. Welding: Resistance welding, weldability of metals, submerged, electroslag, inert gas (TIG, MIG and CO₂) carbon arc welding, cold welding, thermite welding, friction welding, plasma arc welding, electron beam welding, laser beam welding, pre-heating, post heating and stress relieving, welding defects and remedies, brazing and soldering, welding symbols, welding consumables, classification, use and specifications. Cold working of metals: Press working equipment and operations, cutting action in a die, clearance, classifications, shearing, drawing, spinning, stretch forming, wire drawing, embossing, squeezing, swaging, coining and bending operations, calculation of press capacity.

References

- | | |
|--------------------------------------|-----------------|
| 1. Workshop Technology Volume I & II | Hazra Chowdhary |
| 2. Workshop Technology Volume I & II | Raghuwanshi |

MSM 214 PHYSICAL METALLURGY

Structure of metals and alloys, Miller indices, crystal orientation, stereographic projection. Crystal defects in metals, dislocations, stacking fault, grain boundary Experimental tools and techniques in metallography, Diffusion in solids, Fick's laws, Solidification of pure metal: Surface Energy & under cooling, Nucleation & Growth, homogeneous & heterogeneous nucleation, directional solidification, structure of cast metal, segregation & porosity, Solidification of binary alloys, Fe-C equilibrium diagram, Cu – Zn, Al – Cu systems, ternary diagram, Grain size and Hall Petch relation, Strengthening mechanisms, micro alloyed steel, ultra high strength steel, super alloy, texture.

References:

1. Fundamentals of Material Science and Engineering: William D. Callister
2. Introduction to Physical Metallurgy: S. H. Avnir.
3. Physical Metallurgy (Vol. I & II): Dr. P. R. Khangaonkar.
4. The Science and Engineering of Materials: D. R. Askeland and P.P. Phule

MSM-215 POLYMERIC MATERIALS

Basic concepts on polymers, Classification of polymers; Polymer structure: Copolymers, Tacticity, Geometric Isomerism, Nomenclature. Polymerization principles and processes Structure and properties

of polymers: Amorphous state, crystalline state, Thermal transitions; Glass transition; Crystalline melting temperature; Structure property relationships, Effect of weight, composition and pressure on T_g, Mechanical properties of polymers, Viscoelastic properties of polymer solutions and melts; Dielectric analysis; Dynamic calorimetry, Additives, Blends and Composites: Plasticizers, Fillers and reinforcements, polymer blends; Polymer processing: Extrusion, Molding; Calendering; Coating, Polymer Rheology, Biopolymers, Natural polymers; Fibres; Engineering and Specialty polymers: Polyamides; Polycarbonates; Engineering polyesters etc; Ionic polymers; Liquid crystal polymers; Conductive polymers; High performance fibres; Dendritic polymers, environmental Problems with polymers.

References

- | | |
|--|----------------------------|
| 1. Polymer Science | W. Billmeyer. |
| 2. Structure & Properties of Polymeric materials | D.W. Clegg & A. A. Collyer |
| 3. Engineering Materials Vol. I and II | Jones. |
| 4. Polymer Science & Technology | J.R.Fried |

MSM 216 METALLURGICAL THERMODYNAMICS & KINETICS

Laws of Thermodynamics, Basic concepts, Heat capacity, Enthalpy, Hess' Law, Kirchoff's Law, Entropy change for reversible and irreversible process, Free energy of substance, reaction and equilibrium, Fugacity, Activity and Equilibrium constant, Lechatelier principle, Inter relations between thermodynamic variables, Van't Hoff Equation, Application of Clausius-Clapeyron equation to phase changes, solutions and partial molar quantities, Sievert's law phase rule and Free energy – composition-Temperature diagrams, metastable phase, Free energy – Temperature diagram, Reaction Kinetics: Rate of reactions, order, rate controlling mechanism, mass transfer concepts, film diffusion, product layer diffusion, chemical controlled reaction, Fick's laws of diffusion, Rate measurement in extractive metallurgy, Electrochemical kinetics: Activation and concentration overpotential, Electrowinning and corrosion.

References

- | | |
|--|---------------------------|
| 1. Physical Chemistry of Metals | L.S.Darken and R.W. Gurry |
| 2. Problems in Metallurgical Thermodynamics and Kinetics | G.S.Upadhyaya, R.K.Dubey |
| 3. Metallurgical Thermodynamics | D.R.Gaskell |
| 4. Metallurgical Thermodynamics, Kinetics and Numericals | S.K. Dutta, A.B. Lele |

MSM 217 PHYSICAL METALLURGY LABORATORY

List of experiments

1. Study of crystal structure of materials using ball models
2. Specimen preparation of Ferrous and Non-ferrous Metals and alloys
3. Study of Microstructure of Steels
4. Study of Microstructure of Cast Irons
5. Study of Microstructure of Brass, Bronze and Babbitt Metal
6. Study of Recovery, Recrystallization and Grain growth
7. Micro structural Analysis: Inclusion rating
8. Microstructural Analysis: Grain size determination
9. Microstructural Analysis: Coating thickness measurements
10. Image processing and Micro structural analysis using software

MSM218 MANUFACTURING PROCESS LABORATORY-I

List of experiments

1. Introduction to various machine tools and demonstration on machining
2. Making a steel pin as per drawing by machining on centre lathe
3. External screw thread by single point chasing in lathe
4. Making a cast iron Vee block by shaping
5. Making a regular polygon prism (MS) by milling
6. Making a gauge as per drawing
7. Study of machining in computer machining centre (CNC) and Electro discharge machining (EDM)

Fourth Semester

MSM-221 MATERIALS TESTING

Engineering materials and their applications, testing of materials: Types of testing systems, significance of measurement of properties and test conditions, interpretation of test results, Tensile Testing: significance of measured parameters, necking, stress distribution, ductility measurement, effect of gauge length, effect of strain rate and temperature on flow properties, Machine stiffness in tensile testing system, measuring instrument computerization, Torsion Test: Mechanical properties in torsion. torsion vs tension test, Hardness Test: Rockwell, Brinell, Vickers and micro-hardness, elastic and plastic behavior during hardness testing, Special hardness tests: superficial, micro and shore, Ductile, brittle fracture, Griffith theory, Ductile to brittle transition, Notch effect in fracture, Fatigue Tests: Stress cycles, SN curve, effect of stress concentration, size and surface conditions on fatigue, Creep, Stress rupture tests, Creep curve and its analysis, Non-destructive Testing: Visual, magnetic, radiographic, ultrasonic, electromagnetic, penetrant tests, their applications in quality control and inspection.

References:

- | | |
|--|--------------------------|
| 1. Practical Non – Destructive Testing | Baldev Raj, T. Jayakumar |
| 2. Introduction to Physical Metallurgy | S. H. Avnir. |
| 3. Physical Metallurgy (Vol. I & II) | P. R. Khangaonkar. |
| 4. Principles of Metallographic Practice | R. Kehl. |

MSM222 MECHANICAL BEHAVIOUR OF MATERIALS

Introduction to deformation behaviour: Concepts of stresses and strains, types of loading, stress - strain response for metal, ceramic and polymer, elastic region, yield point, plastic deformation, necking and fracture, Bonding and Material Behaviour, theoretical strength in metals and ceramics, Elasticity Theory: The State of Stress and strain, stress and strain tensor, transformation, principal stress and strain, elastic stress-strain relation, anisotropy, Yielding and Plastic Deformation: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, true stress and true strain, flow rules, strain hardening, Ramberg-Osgood equation, stress - strain relation in plasticity dislocations, slip and glide, dislocation generation - Frank Read and grain boundary sources, stress and strain field around dislocations, force on dislocation - self-stress, dislocation interactions, partial dislocations, twinning, dislocation movement and strain rate, deformation behavior of single crystal, critical resolved shear stress (CRSS), deformation of poly-crystals - Hall-Petch and other hardening mechanisms, grain size effect, Fracture: types of fractures, KIC, elasto-plastic fracture mechanics, JIC, Measurement and ASTM standards, Fatigue: S-N curves, Low and high cycle fatigue, Life cycle

prediction, Deformation at High temperature: different stages of creep, creep and stress rupture, creep mechanisms and creep resistant alloys.

References:

- | | |
|---|----------------------|
| 1. Mechanical Metallurgy | George E. Dieter |
| 2. Fundamentals of Material Science and Engineering | William D. Callister |
| 3. Introduction to Physical Metallurgy | S. H. Avnor. |
| 4. Physical Metallurgy (Vol. I & II) | P. R. Khangaonkar. |

MSM 223 NATURE AND PROPERTIES OF MATERIALS

Phase diagrams, Free energy vs composition diagrams, Cu-Ni alloys, Solidification: Nucleation and Growth, solid-liquid interfaces, Theory of Thermally Activated Growth: Interface controlled growth, Diffusion controlled growth, Interface instability and Widmanstatten growth, Rapid solidification, Glass transition, metallic glasses; Precipitation and Particle Coarsening; Stability of regular solution and miscibility gap, intrinsic stability of solution and spinodal decomposition; Zone refining; Order, Disorder transformations, Case studies: Coherent precipitation Ni-Al, Al-Li and Ti-Al, Metastable precipitates: Al-Li and Al-Cu, Cellular precipitation, Precipitate-free zones, Examples from ceramic and polymeric materials, Intermediate phases e.g., λ , σ , electron compounds; non-equilibrium structures; Ternary phase diagrams -Gibbs triangle, isothermal and vertical sections, polythermal projections, Eutectoid growth, Discontinuous precipitation, Massive transformation; Transformation Kinetics-Johnson-Mehl equation, Avrami model, Transformation kinetics in diffusion-controlled transformations, Kinetics of recrystallization, Martensitic transformation, Bain distortion, Thermoeleastic martensite; Diffusion equation in spinodal region, Effect elastic strain energy.

References

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|---|--------------------|
| 1. Introduction to Physical Metallurgy | S. H. Avnor. |
| 2. Physical Metallurgy (Vol. I & II) | P. R. Khangaonkar. |
| 3. Engineering Metallurgy (Vol. I & II) | R. A. Higgins. |
| 4. The Science and Engineering of Materials | D. R. Askeland |

MSM224 HEAT TREATMENT

Role of heat treatment on structure and properties, Recapitulation of Fe-C equilibrium diagram, effect of alloying elements on phase diagram, formations of austenite on heating, decomposition of austenite, Time-Temperature-Transformation (TTT) diagrams, effect of alloying elements on TTT diagram, Continuous cooling transformations (CCT), Pearlitic and bainitic transformations, Martensitic transformation: Mechanism, effect of applied stress, Athermal and Isothermal martensite, Habit planes, Bain distortion, Heat treatment processes of steels: Recovery, Recrystallization and Grain Growth, Annealing, spheroidizing, Normalizing, hardening, tempering, precipitation hardening, Quenching media and their evaluation, Sub-zero treatment, Temper embitterment, Austempering, Martempering, Patenting, Hardenability: Grossman's critical diameter, Jominy end quench test, Fracture Test, Surface hardening treatments: Carburizing, Nitriding, Cyaniding, Boronizing, Flame and Induction Hardening, Chromizing, Defects in heat treatment and remedies, Heat treatment of non-ferrous metals.

References:

- | | |
|--|-----------------------------------|
| 1. Physical Metallurgy for Engineers | D. S. Clark & W. R. Varney |
| 2. Material Science & Metallurgy | V. D. Khodgire |
| 3. Handbook of Heat Treatment of Steels | K. H. Prabhudeva |
| 4. Heat Treatment- Principals & Techniques | T.V. Rajan, C.P. Sharma, A Sharma |

MSM 225 IRON MAKING

History of iron making, Raw materials: Iron ores coal and coke, limestone, dolomite characteristics, availability, Iron ore: beneficiation, bedding, blending, granulation, sintering, Pelletization, Characteristics of sinter, compression, tumbler test, reduction behaviour, softening-melting test, Burdon preparation, blast furnace efficiency, Detail of B. F. layout and its accessories, constructional details of iron blast furnace, construction and working of B. F.

stoves, B. F. product handling and processing systems, cleaning of the B. F. gas, Physico-chemical, thermal principal of iron making in general and B. F. in particular. Quality of hot Metal, External hot metal treatment, Modern trends in B.F. practice. Comparison of Indian BF's with those from others countries, BF efficiency. Alternate methods of iron production viz. charcoal blast furnace, small shaft furnace, electro thermal smelting. Sponge iron production-coal and gas based processes. Raw materials for sponge iron production, evaluation of sponge iron quality, Blast furnace products and utilization.

References:

- | | |
|--|----------------|
| 1. Modern Iron making | R. H. Tupkary. |
| 2. Manufacture of Iron & Steel, Volume I | R.W. Bashforth |
| 3. Physical Chemistry of Iron & Steel | R.G. Word |
| 4. Principals of Blast furnace Iron making | A.K. Biswas |

MSME 226 FOUNDRY TECHNOLOGY

Introduction, review of solidification, Micro segregation, Macro segregation, Behavior of insoluble particles, Patterns and Pattern making; Moulding and casting processes: Equipments and Mechanization; Mould materials; Bond formed in mould aggregates; sand testing, Resin binder processes; Sand moulding, core making; plaster molding; Ceramic molding; Investment casting; Replicast process; Rammed graphite moulds; Permanent mold casting; Die casting; Centrifugal casting; counter gravity low pressure casting; continuous casting; Directional and mono crystal solidification; Squeeze casting; Semi solid casting and forging; Mould reinforcement, Mould factors in metal flow, Moulding factors in casting design. Brief introduction to various types of binders for mould and core-making, Melting units and practices; Degassing processes; Pouring systems; Shake out and Core knockout; Blast cleaning of casting; Casting defects and remedies; Industrial melting practices as adopted to a few Metals and Alloys, such as Cast Iron, Steel, Copper, Aluminium etc, Design considerations: Riser design; Gating design; Casting design; Dimensional tolerances and Allowances; Various measures for improving casting yield. Foundry automation and quality control, Pollution and control.

References:

- | | |
|-----------------------------------|---------------|
| 1. Fundamentals of metal casting | R.W. Flinn |
| 2. Principles of Metal Casting | P.C.Mukherjee |
| 3. Non-ferrous Foundry Metallurgy | J.L. Bray |
| 4. Metallurgy of steel casting | R.W. Briggs |

MSM 227 CERAMICS AND POLYMERS LABORATORY

List of experiments

1. Making green compacts of ceramic materials using hydraulic pellet press
2. Sintering of green compacts of ceramic materials
3. Demonstration of glass forming
4. Determination of pyrometric cone equivalent (PCE) of refractory materials

5. Determination of porosity and specific gravity in ceramics and powder metallurgical components
6. Demonstration on production of thermosetting and thermoplastic polymers
7. Study on melt flow index, glass transition of polymers
8. Determination of viscosity using viscometer

MSM 228 MATERIALS TESTING LABORATORY

List of experiments

1. Tensile testing
2. Compression testing
3. Torsion, Bend Testing
4. Creep testing
5. Impact Testing: Charpy and Izod
6. Hardness Testing: Brinell, Vickers and Rockwell
7. Ultrasonic testing
8. Eddy current testing
9. Magnetic particle testing

Fifth Semester

MSM311 IRON AND STEEL MAKING

Steelmaking Fundamentals: Types of steels,, History of modern steelmaking and Indian scenario, Steelmaking Fundamentals: Solution thermodynamics: Role of slag in steelmaking, Physico-chemical properties of slag, Oxidation reactions: Iron and silicon, Decarburization and Manganese oxidation, Dephosphorization reaction, Oxidation and reduction of chromium, Refractory in steelmaking, Modern Trends in refractory, Modern Steelmaking Practice: Introduction to practices, pretreatment of hot metal, Basic Oxygen furnace: Design and Operation, Fundamentals of Converter steelmaking technology, Feed materials and practice, Combined blown steelmaking, Modern trends in BOF Technology, Steelmaking in electric arc furnace; design and operation, Development in Electric Furnace steelmaking, DRI in electric steelmaking, Alloy Steelmaking, Novel steelmaking technologies: CONARC and EOF, Process control and automation, Ladle Metallurgy: Evolution of ladle treatments and requirements, Synthetic slag practice, deoxidation, degassing, Clean steel : Impact of inclusions on steel properties, Sources of inclusions in steel and their control, Inclusion engineering, Numerical problems and exercises, Solidification and casting and finishing operations: Principles of solidification of steel, Ingot casting, Continuous casting, Developments in Continuous casting technology, Final finishing operation: Surface treatments, Heat treatment, Deformation processing, Few case studies and discussions, Future of steelmaking in India.

References:

- | | |
|--|---------------|
| 1. Modern Steel making | R.H. Tupkary. |
| 2. Fundamentals of steel making | E.T. Tukdogan |
| 3. Secondary processing and casting of liquid steels | A. Ghosh |
| 4. Steelmaking | Kurdin. |

MSM312 CHARACTERIZATION OF MATERIALS

Advance microscopic techniques: Phase contrast, interference and polarized light microscopy, and High temperature microscopy, X Ray diffraction: working principle, counters, filters and cameras, Calculations for SC, BCC, FCC and HCP structures,, Indexing patterns, Precise lattice parameter determination,

Chemical analysis, Particle size and strain, Electron microscopes: Construction and working principles of TEM, Image formation, resolving power, magnification, depth of focus, elementary treatment of image contrasts, important lens defects and their correction, Bright field and dark field images, Stereographic projection, Formation of SAD patterns, reciprocal lattice and Ewald sphere construction, indexing of diffraction patterns, sample preparation techniques, Scanning electron microscope; construction, interaction of electrons with matter, modes of operation, Chemical analysis using EDX, EPMA Atomic force microscopy, working principles of XRF, Augur spectroscopy, TG-DTA and DSC.

References:

- | | | |
|----|--|-------------------------|
| 1. | Materials Characterization – ASM Metal Hand Book Vol. 11 | |
| 2. | Metallographic Lab. Practices | G. L. Kehl |
| 3. | Thermal analysis | T. Hatakyama & FX Quinn |
| 4. | Introduction of Materials Science | Wolf & Rallis |

MSM313 WELDING TECHNOLOGY

Fusion welding processes: OAW, SMAW, GTAW, PAW, GMAW, FCAW, SAW, ESW, EBW, LBW, Analysis of Heat flow in welding, Gas-metal reactions, Slag-metal reactions, Residual stresses, distortion and fatigue, Fusion zone: Solidification, micro-segregation, banding, effect of cooling rate, Grain structure, Epitaxial growth, effect of welding parameters on grain size, solidification models, dendrite and cell spacing, refining microstructure and grains, Post solidification phase transformations, Weld metal solidification cracking, Partially melted zone, liquation cracking, hydrogen cracking, loss of strength and ductility, remedies, Heat affected zone, Precipitation hardening materials: Al-Cu-Mg, Al-Mg-Si, Transformation hardening materials: Carbon and alloy steels, Welding of stainless steel and dissimilar metals.

References:

- | | | |
|----|--|------------------------|
| 1. | Selection and use of engineering materials | F. Cranes & J. Charles |
| 2. | Engineering Materials Vol II & III | M. Ashby, |
| 3. | Mechanical Metallurgy | G Dieter |

MSM-315 HEAT TREATMENT AND WELDING LABORATORY

List of experiments

1. Studies on Recrystallization, Grain growth
2. Annealing
3. Normalizing
4. Hardening: Water quenching
5. Hardening: Oil quenching
6. Tempering
7. Surface Hardening: Carburizing
8. Jominey End Quench Test
9. Microhardness testing
10. WELDING CARBON AND ALLOY STEEL

MSME-316 CHARACTERIZATION OF MATERIALS LABORATORY

List of experiments

1. Principles and operations of SEM
2. Sample preparation for SEM characterization
3. EDX Analysis

4. Principles, working and operations of XRD
5. Interpretations of XRD data
6. Principles, working and operations of OES
7. Chemical analysis of Steel, Cast Iron and Al samples using OES

Sixth Semester

MSME-321 NON FERROUS METAL EXTRACTION

Sources of nonferrous metals, Principles of metals extraction, General methods of extraction: Pyro-metallurgy, Hydrometallurgy, and electrometallurgy, General methods of refining, Extraction of metals from oxide sources: magnesium, aluminum, tin and ferro-alloying elements, production of ferro alloys, Extraction of metals from sulphide ores: copper, lead, zinc, nickel, Extraction of metals from halides: titanium, rare earths, uranium, thorium, plutonium, beryllium, zirconium, Production of precious metals: gold, silver and platinum, Secondary metals and utilization of wastes, Energy and environmental issues in nonferrous metals extraction

References:

- | | |
|--|--------------------------------------|
| 1. Extraction of Non-ferrous Metals | H. S. Ray, R. Sridhar, K. P. Abraham |
| 2. Principals of Extractive Metallurgy | A. Ghosh & H. S. Ray |
| 3. Principals of Extractive Metallurgy | T. Rosenquist, |
| 4. Unit Processes of Extractive Metallurgy | R. D. Pehike, |

MSM322 METAL FORMING

Elementary stress analysis, Principal stresses, Yield criteria, Overview of metal forming processes, classification, Formability limits, Non-uniformity and segregation in materials, Hot, Cold and Warm working of materials, Strain rates in metal forming, Development of metallurgical structure during deformation, Flow curves, Rolling, Forging, Extrusion, Wire drawing, Deep drawing, Other sheet metal working processes, Defects in metal forming and remedies, methods of estimating formability,

References:

- | | |
|---|----------------------|
| 1. Mechanical Metallurgy | Dieter. |
| 2. Principal of industrial Metal Working | G.W. Rowe |
| 3. Metal Forming Mechanics and Metallurgy | Hosford and Caddell. |
| 4. Hot Rolling and Steels: Roberts. | |

MSM323 CORROSION ENGINEERING

Basic principles of electrochemistry and aqueous corrosion processes; thermodynamics and kinetics related to oxidation and corrosion studies, Pourbaix diagram, rate laws, Wagner's theory of parabolic rate laws, mechanism of oxidation: Oxidation of pure metals, multiple scale formation, scale cracking, oxygen dissolution: Oxidation of alloys, internal oxidation, catastrophic oxidation, stresses in oxides: Tafel equation and plots, Activation and Concentration Polarization, Types of corrosion; atmospheric, galvanic, intergranular, dealloying, crevice and pitting corrosion, microbiological, stress corrosion cracking, hydrogen damage, radiation damage; Oxidation and hot corrosion of materials at high temperatures, Wear of materials, Prevention methods, cathodic and anodic protection, metallic, organic coating, inhibitors and passivators, wear resistant coatings, Metal-gas reaction at high temperatures, corrosion by liquid metals, hot corrosion, acid fluxing, basic fluxing, High temperature materials, super alloys, intermetallics: Protection against oxidation, coatings, atmospheric control: Corrosion testing methods. Case studies.

References:

- | | |
|--------------------------|-------------|
| 1. Corrosion Engineering | M.G.Fontona |
| 2. Surface Engineering | Davis |

MSM325 MANUFACTURING AND JOINING LABORATORY**List of experiments**

1. Orientation, demonstration and practice of metal casting
2. Practicing sand molding using split and uneven parting line pattern
3. Practice on CO₂ molding and machine molding
4. Sand Testing: Preparation of standard samples
5. Determination of clay content in molding sand samples
6. Permeability, Moisture content
7. Shatter Index, Green strength
8. Practice on oxy-acetylene gas welding and cutting
9. Practice on manual metal arc welding
10. Demonstration of deep drawing process
11. Erichsen cupping tester

MSM326 PROCESS METALLURGY LABORATORY**List of experiments**

1. Identification of minerals and ore samples
2. Gravity and magnetic separation of minerals
3. Froth flotation process
4. Grinding studies of samples in Ball mill
5. Study on burdon calculations
6. Pelletization of iron ore fines
7. Leaching studies
8. Electro deposition of copper

MSM327 MINOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

Department electives**MSM332 X-RAY CRYSTALLOGRAPHY**

X-ray diffraction: Diffraction theory, atomic scattering factor, integrated intensity of diffracted beams, temperature factor, line broadening: Techniques: Laue, powder and rotating crystal techniques, techniques for studying bent crystal, texture, order-disorder changes etc.

References:

- | | |
|--|------------------|
| 1. X-ray crystallography | O.N.Srivastava |
| 2. X-ray diffraction; a practical approach | C.Suryanarayanna |
| 3. Elements of X-ray diffraction | B.D.Cullity |

Seventh Semester

MSM411 SURFACE ENGINEERING

Fundamentals of surface engineering: surface dependent properties and failures, Surface and surface energy, Structure and types of interfaces, surface energy and related equations, Conventional surface engineering practices: Cleaning, pickling, etching, grinding, polishing, buffing / puffing, hot dipping, Electro-deposition / plating, carburizing, Aluminizing, calorizing, diffusional coatings, Surface Cyaniding, Nitriding, carbonitriding, Advanced surface engineering practices: Laser assisted microstructural modification – surface melting, hardening, shocking and similar processes, surface alloying of steel and non-ferrous metals and alloys., cladding, composite surfacing and similar techniques, Electron beam assisted modification and joining, Ion beam assisted microstructure and compositional modification, Flame spray, Plasma coating, HVOF, Evaporation - Thermal / Electron beam, Sputter deposition of thin films & coatings – DC & RF, Sputter deposition of thin films & coatings – Magnetron & Ion Beam, Hybrid / Modified PVD, CVD, Measurement of coatings thickness, porosity & adhesion of surface coatings, residual stress, Surface microscopy & topography by scanning probe microscopy, Spectroscopic analysis of modified surfaces, Functional and nano-structured coatings and their applications in photovoltaics, bio- and chemical sensors, Surface passivation of semiconductors & effect on electrical properties, Surface engineering of polymers and composites, Thin film technology for multilayers & superlattices for electronic, optical and magnetic devices, Modeling Analytical Techniques: X-ray diffraction, TEM, SEM and EDX, WDX analysis, surface analysis by AES, XPS and SIMS, overview of other techniques. Data interpretation and approaches to materials analysis.

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|----|--|----------------|
| 1. | Surface Engineering for Wear Resistances | K.G. Budinski |
| 2. | The Materials Science of Thin Films | M. Ohring, |
| 3. | Surface Engineering & Heat Treatment | P.H Morton |
| 4. | Metals Handbook Ninth Edition, Vol.5, Surface Cleaning, Finishing & Coating, | ASM |
| 5. | Corrosion Engineering | M.G. Fontana . |

MSME412 SURFACE ENGINEERING LABORATORY

List of experiments

1. Acid pickling
2. Anodizing of Aluminium
3. Study of ceramic, polymer and metallic coated materials
4. Corrosion and oxidation of metals
5. Galvanic coating
6. Wear testing
7. Plasma spaying
8. Electroplating
9. Sputtering

MSM413 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

MSM414 EDUCATION TOUR & TRAINING

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

Eighth Semester

MSM421 SELECTION AND DESIGN OF ENGINEERING MATERIALS

Overview of manufacturing systems; role of traditional and near-net shape processes in manufacturing industry; Basic attributes of manufactured products -size and shape complexity, machining requirement and machining losses, dimensional tolerances, surface condition, mechanical properties and manufacturing costs, expendable mold and permanent mold shape casting processes; Open die and closed die forging processes and design considerations; Manufacturing processes for making products such as sheets, round/sectioned bars, seamless tubes/rings and wires; Criteria for selection of metal and ceramic powder production processes for a given application; Powder processing equipments and their selection; Joining processes, selection and design; Case studies with CAD/ CAM aspects.

References:

- | | |
|---|----------------------------------|
| 1. Materials and design | Michael F.Ashby and Kara Johnson |
| 2. Elements of Workshop technology, Vol.1&Vol 2 | A,K,Hajra Choudhury |
| 3. Fundamentals of Modern manufacturing | Mikeil P.grover |

MSM423 MAJOR PROJECT/SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by departmental committee formed by HOD.

MSM423 GENERAL PROFICIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

Department electives

MSM431 PROCESSING AND APPLICATIONS OF REFRACTORY METALS AND ALLOYS

Characteristics of Pure Refractory Metals- crystal structure, Physical, chemical, mechanical and thermal properties of refractory metals; Alloys of Refractory Metals, Powder processing of refractory metals and alloys; dispersion-strengthening alloys, tungsten heavy alloys, composites reinforced with refractory metal fibers, refractory metal cermets, amorphous refractory alloys; Application of Refractory Metals & Alloys: general applications, requirements for special applications, porous metals, refractory alloy for electrical contacts, refractory metals for superconductors, requirements of use in thermo-nuclear reactors, refractory alloys for thermal-management applications, refractory alloys for wear-resistant applications.

References:

- | | |
|--|-------------------------------------|
| 1. Tungsten refractory metals & alloys | Animesh Bose and Robert E Smallwood |
| 2. Refractory metals and their Industrial applications | Robert E Smallwood |
| 3. Handbook of Refractory Carbide & Nitrides | Hugh O Pierson |

MSM432 MATERIALS FOR CUTTING TOOL APPLICATIONS

Classification of cutting materials-tools steels, cemented carbides, ceramic tools, and diamond tools: Production method of raw materials powder steel, tungsten, carbide, cobalt, Al_2O_3 , Si_3N_4 , Consolidation of shaped products, sintering, mechanism liquid phase sintering, cold and hot isostatic pressing: Reclamation of tool materials, Evaluation of sintered tool material.

References:

- | | |
|----------------------------------|------------------|
| 1. Tool materials | Joseph R.Davis |
| 2. Sintering Theory and practice | Randall M.German |
| 3. Liquid Phase sintering | Randall M German |

MSM433 HEAT AND MASS TRANSFER

Review of the basic concepts in heat, mass and momentum transfer: Advanced topics in convective heat and heat transfer: Radiative heat transmission: Simultaneous heat and mass transfer: Selected topics in metallurgical engineering, Reaction kinetics.

References:

- | | |
|--|--------------------------|
| 1. Transport Phenomena in Materials Processing | Poier D.R and G.H.Geiger |
| 2. Transport Phenomena | R.Byron Bird |
| 3. Course in heat transfer | Domkundwar |

32 CHEMICAL ENGINEERING

Third Semester

MTH211C Mathematics 3

Numerical Methods: Solution of algebraic and transcendental equations, Solution of linear Simultaneous Equations, Finite Differences, Interpolation and Extrapolation, Inverse Interpolation, Numerical Differentiation and Integration, Numerical solution of Ordinary & Partial Differential Equations.

References

- | | |
|---|-------------------|
| 1. Numerical Analysis | Hildebrand, |
| 2. Numerical Analysis | Scarborough |
| 3. Numerical Methods | E .Balaguruswamy, |
| 4. Numerical Methods for scientific and Engineering | M.K.Jain |

CHE 212 INTRODUCTIONS TO CHEMICAL ENGINEERING

Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and recent developments, Fuels –Solid, liquid and Gaseous fuels, Chemical Kinetics Constant Rate constant order and molecularity of a reaction, zero, 1st, 2nd, and 3rd order reactions. Kinetics of opposing reactions, methods of determination of order of reactions. Reaction rate theories, Arrhenius Parameters, Catalysis (including enzyme catalysis), effect of catalysis on reaction rate, Introduction to Heat Transfer, Conduction, Convection, Radiation, Flow Arrangement in Heat Exchangers, Variation of Fluid Temperature in Heat Exchangers, Heat Transfer Equipment, Evaporation, Problems, Introduction to Mass Transfer, crystallization, distillation, evaporation absorption.

References

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|--|--|
| 1. Introduction to Chemical Engineering | Salil. K Ghosal, Shyamal K Sanyal, Siddhratha Datta. |
| 2. Introduction to Chemical Engineering | Enderson & Belzil |
| 3. Elementary Principles of Chemical Processes | R. M. Felder and R.W. Rousseau |

CHE 213 CHEMICAL PROCESS CALCULATIONS

Stoichiometry: Introduction- Units and Dimensions - stoichiometric principles composition relations, density, specific gravity and basis of calculation. Ideal gases and vapor pressure: Behaviors of Ideal gases -kinetic theory of gases -application of ideal gas law- gaseous mixtures - volume changes with change in composition. Vapor pressure- effect of Temperature on vapor pressure. Humidity and solubility: Humidity - saturation - vaporization - condensation – wet and dry bulb temperature, dew point, adiabatic saturation temperature, Solubility and Crystallization-Dissolution -solubility of gases. Material balance: Material Balance - Processes involving with chemical reaction and without chemical reaction - Combustion of coal, fuel gases and sulphur - Recycling operations -bypassing streams - Degree of conversion -excess reactant - limiting reactant, Energy balance: Thermo chemistry - Hess's law of summation - heat of formation, reaction, combustion and mixing - mean specific heat -Theoretical flame Temperature.

References

- | | |
|--|--|
| 1. Chemical Process Principles | O.A.Hougen, K. M. Watson and R. A. Ragatz, |
| 2. Basic Principles and Calculations in Chemical Engineering | D. Himmelblau |
| 3.. Process Calculations | V.Venkataramani and N.Anantharaman, |
| 4. Stoichiometry | Bhutt, Vors |

CHE 214 FLUID MECHANICS

Properties of fluid, forces on fluid, stresses, fluid statics, Normal forces on fluid, pressure Measurement, forces on submerged, forces on submerged bodies, buoyancy, stability. Newtonian and Non-Newtonian fluid, Viscosity measurement, Equations of Continuity & Equation of Motion. Navier stokes equation, concept of Reynolds number and friction factor, friction factor for rough and smooth pipes, loss of head due to friction in pipes and fittings. Boundary layer theory, Bernoulli's equation, fluid machinery pumps, fans, blowers, and compressor. Flow of incompressible fluid in conduits and thin layers, flow past immersed bodies. Dimensional analysis, Buckingham π theorem, dimensionless numbers and their significances, similitude criteria. Pitot tube, Orifice meter, Venture meter, Rotameter, Weirs and Notches. Rayleigh's theorem

References

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|---|---|
| 1. Unit operations in chemical engg. | W. L. McCabe & I.C. Smith |
| 2. Chemical engineering – Vol I & II | J.M. Coulson & J.F. Richardson |
| 3. Mechanics of fluid | B.S. Maney, zel (SI) Van Nostand & Reinhold |
| 4. Fluid mechanics for engg. and technology | I. Grannet |

CHE 215 CHEMICAL PROCESS TECHNOLOGY 1

Chlor-alkali Industries: Manufacture of Soda ash, Manufacture of caustic soda and chlorine - common salt. Sulphur and Sulphuric acid: Mining of sulphur and manufacture of sulphuric acid. Manufacture of hydrochloric acid. Cement: Types and Manufacture of Portland cement. Glass: Manufacture of glasses and special glasses. Ceramics: Refractories. Industrial Gases: Carbon dioxide, Nitrogen, Hydrogen, Oxygen and Acetylene - Manufacture of paints - Pigments. Nitrogen Fertilizers: Synthetic ammonia, nitric acid, Urea, Ammonium Chloride, CAN, Ammonium Sulphate - Phosphorous Fertilizers: Phosphate rock, phosphoric acid, Super phosphate and Triple Super phosphate, MAP, DAP. Potassium Fertilizers: Potassium chloride and Potassium sulphate.

References

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|--|-------------------------------------|
| 1. Shreeves Chemicals Process Industries | Austine G.T.. |
| 2. Outlines of Chemical Technology . | Dryden C.E., M. Gopala Rao |
| 3. Outlines of Chemical Technology | R. Gopal Rao and M.Sittig,"Dryden's |
| 4. Text book of Chemical Technology | S.D. Shukla and G.N. Pandey |

CHE 216 CHEMICAL ENGINEERING THERMODYNAMICS

Fundamental Concepts and Definitions. PVT relationships. First law of Thermodynamics. Application of law to different processes in closed systems. Second Law of Thermodynamics. Physical meaning of entropy. T-S diagrams. Relations among thermodynamic properties. Thermodynamic functions in terms of measurable properties. Construction of thermodynamic charts. Third Law of Thermodynamics. Thermodynamics of flow processes. Application of first law to flow processes. Power and Refrigeration Cycles. Single Component Systems. Multicomponent Systems. Phase Equilibria. Thermodynamics of Electrolytes. Statistical Thermodynamics.

References

- | | |
|--|---------------------------|
| 1. Introduction to Engineering Thermodynamics | J. M. Smith and Van Ness. |
| 2. Introduction to Chemical Engineering Thermodynamics | Rao Y.V.C. |
| 3. Chemical Engineering Thermodynamics | B. F. Dodge |
| 4. Chemical Engg Thermodynamics. | V.C. Rao |

CHE 217 CHEMICAL TECHNOLOGY LAB

List of Experiments:

1. To determine the viscosity of a viscous liquid by falling sphere method.
2. Determination of saponification value of oil sample
3. Application of pH meter to find acidity and alkalinity of a solution.
4. To Study the Colorimeter.
5. To Study the Ion-Analyzer.
6. To study the hydrolysis of cane sugar solution in the presence of an acid by Fehling's solution method and find out the reaction constant.
7. To Study the adsorption of benzoic acid on animal charcoal and room temperature and to determine the Freundlich constants k,n.
8. Determination of the strength of unknown hydrochloric acid by titrating it against caustic soda by conducto-metric method.
9. To determine the % composition of a given binary liquid solution by polarimeter.
10. To determine the solubility of a sparingly soluble salt in water by conductance measurement.
11. Determination of pH of mixture of CH_3COOH and CH_3COONa and the dissociation constant of the acid.
12. Preparation of laundry soap and to determine its yield.
13. To study the Gas Chromatograph.

CHE 218 FLUID MECHANICS LABORATORY

List of Experiments:

1. To determine the local velocity pressure with the help of pilot tube.
2. To find out the terminal velocity of a spherical body in water.
3. To determine the viscosity of a given viscous liquid by capillary tube flow method.
4. To find the pressure drop in a packed bed.

5. To study the flow behaviour of a non-Newtonian fluid and to determine to flow constants.
6. To determine to power-number-Reynolds number curve for an agitated vessel.
7. To differentiate between laminar and turbulent flow using Reynolds experiment.
8. To study the characteristics of an air compressor.
9. To study the characteristics of a centrifugal pump.
10. To study the flow of a fluid in a pipeline and to prepare the friction factor – Re plot.
11. To determine velocity through orifice meter, venture meter.
12. To prepare the calibration curve for an orifice meter and Rota meter.
13. To calculate to prepare the calibration curve for venturimeter.

Fourth Semester

CHE 221 - CHEMICAL REACTION ENGINEERING 1

Classification of reaction, Definition of reaction rate, Variables affecting the rate, concept of reaction equilibria, order of reaction and its determination, theoretical study of reaction rates, collision and activated complex theory, determination of kinetic parameters using batch and continuous reactors; Interpretation of data using differential and integral techniques, batch reactor data for constant volume and varying volume systems using integral and differential methods for, effect of temperature on rate constant. Classification of Reactors: Concept of ideality, design equation for single reaction systems using batch- and semi batch- reactors, CSTR, PFR and recycle reactor, auto catalytic reactions, reactor choice for single reaction, combination of reactors, Reactors with recycle, yield. Design for Multiple Reactions: Parallel and series reactions, analysis of product distribution and determination of reactor size for different types of ideal reactors, selectivity and yield factors, reactor choice for multiple reactions. Non-ideal Flow: Residence time distribution (RTD) theory, role of RTD in determining reactor behavior, age distribution (E) of fluid, experimental methods for finding E, relationship between E and F curve; Models for non ideal flow – single parameter and multi parameter models.

References

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|--|--------------------------|
| 1. Chemical Reaction Engineering | O. Levenspiel |
| 2. Elements of Chemical Reaction Engineering | Fogler, H.S |
| 3. Chemical Engineering Kinetics | J.M. Smith. |
| 4. Chemical Process Principles Part – III – (Kinetics & Catalysis) | Houghen Watson & Ragatz. |

CHE 222 MECHANICAL OPERATIONS

Properties and characterization of particulate solids, analysis and technical methods for size and surface area distribution of powder; Introduction to size reduction equipment, energy and power requirement in milling operations, computer simulation techniques for mill performance. Mechanical classifiers: Screening equipment, capacity and effectiveness. Filtration equipment, filtration media and filter aids, principles of filtration and clarification, estimation of filtration parameters for compressible and incompressible cakes and calculations, centrifugal filtration equipment and principles of operation. Separation based on the motion of particles through fluids, gravity settling processes, Sedimentation, Kynch theory of sedimentation, equipment for sedimentation thickness, rate of sedimentation and sedimentation zones in continuous thickeners, design of thickeners and clarifiers, principles of centrifugal sedimentation and characteristics and sedimenting centrifuges. Introduction to agitation and mixing of liquids, agitation equipment, Axial and radial flow impellers and flow patterns in agitated vessels ,prevention of swirling, power consumption in agitated vessels, Blending and mixing, dispersion operations, mixing of solids and pastes and types of mixers. Introduction to storage and conveying of

solids, bins, hoppers and silos, flow out of bins, design consideration of bins, loading and unloading of solids. Bucket elevators, apron conveyors. Belt conveyors: types of belt conveyors, selection considerations.

References

- | | |
|---|----------------------------------|
| 1. Unit Operation of Chemical Engineering | McCabe and J.C.Smith |
| 2. Chemical Engineering", Vol.II | J.M.Coulson and J.F .Richardson. |
| 3.. Materials Handling Handbook | Raymond A. Kulweic, |
| 4., Introduction to Chemical Engineering | Badger and Banchero |

CHE 223 HEAT TRANSFER 1

Heat Transfer: Introduction, Applications, Relation between heat transfer and thermodynamics, and transport properties. Conduction: Fourier's law of conduction, Thermal conductivity, Heat conduction equation in spherical, cylindrical, and rectangular co-ordinates. Composite wall structure.Thick wall tube. Sphere, insulation and optimum thickness of insulation, extended surfaces. Unsteady state condition. Convection: Natural & Forced convection. Heat transfer in laminar &turbulent flow insides tubes, Dimensional analysis, boundry layer, Colburn analogy. Heat transfer by external flows across cylinders, tube bank, spheres. Radiation: Basic equations, emmisivity, absorption, black and gray body, Thermal radiation between two surfaces.

References

- | | |
|--|-------------------------------------|
| 1. Heat Transfer | Holman J.P |
| 2. Fundamentals of Heat & Mass Transfer | Incropera F. P. and Dewitt D.P. |
| 3. Unit operations of chemical engineering | Mcabe W.L., Smith J.C., Harriott. P |
| 4. Fundamentals of heat & mass transfer, | |

Foust A.S., Wemzel L.A., Clump C.W., Maus L., and Anderson L.B

CHE 224 CHEMICAL PROCESS TECHNOLOGY 2

Production of pulp, paper and rayon. Manufacture of sugar, starch and starch derivatives. Gasification of coal and chemicals from coal. Fermentation processes for the production of ethyl alcohol, citric acid and antibiotics. Refining of edible oils and fats, fatty acids. Soaps and detergents. Petroleum refining to produce naphtha, fuel hydrocarbons and lubricants. Processes for the production of petrochemicalprecursors: ethylene,propylene, butadiene, acetylene, synthetic gas, benzene, toluene and xylene. (Cracking, Catalytic reforming and separation of products) Plastics: Production of thermoplastic and thermosetting resins such as polyethylene, polypropylene, phenolic resins and epoxy resins; Polymers and their applications in engineering practice. Synthetic fibres: polyamides, polyesters and acrylics from monomers. Processes for the production of natural and synthetic rubbers.

References

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|--|------------------------------|
| 1. Shreve's Chemical Process Industrie | G.T. Austin s |
| 2. Dryden's Outline of Chemical Technology | R. Gopal Rao and M. Sittig |
| 3. Text Book of Chemical Technology | S. D. Shukla and G.N. Pandey |

CHE 225 MASS TRANSFER – I

Diffusion: Diffusion in fluids: Molecular and eddy diffusion measurement and calculation of diffusivities. Ordinary diffusion in multicomponent gaseous mixtures. Diffusion in solids. Interphase mass transfer: Interphase Mass Transfer: Mass transfer coefficients. Theories of mass transfer. Analogies between momentum Heat and mass transfer. Mass Transfer Equipments: Batch and continuous Stage wise contactors- Differential contactors Absorption Theories of gas absorption - design of absorption towers.

Absorption with chemical reactions. Adsorption: Types of adsorption, nature of adsorbents, Adsorption isotherms, Operation of adsorption columns. Batch and continuous operations, Design of adsorbers. Drying: Equilibrium, Drying operation, Method of operation, the mechanisms of Batch drying, types of equipments.

References

- | | |
|---|--|
| 1. Mass Transfer Operations | R. E. Treybal |
| 2. Unit Operations in Chemical Engg. | W. L. McCabe, J. C. Smith and P. Harriot |
| 3. Chemical Engineering. Vol - II, | M. Coulson and J. F. Richardson |
| 4. Transport Processes in Chemical Operations | C. J. Geankopolis |

CHE 226 INSTRUMENTATION AND PROCESS DYNAMICS CONTROL

First Order Systems: Linear open loop systems - First order and Linearised first order systems - Response to various disturbances. Higher Order Systems: First order in series - Higher order systems - Response to various disturbances. Block Diagram: Controls - Block Diagram - closed loop transfer function - Transient response - Simple alarm Modes of control and controller characteristics. Stability Analysis: Stability - Routh analysis - Frequency response - Control system design - Controller tuning. Special Controls: Cascade - feed forward and ratio control - dead time compensation - Internal Model Control - Control valves - Process identification. Instrumentation: Introduction: Temperature measurement, Pressure measurement, Flow measurement, Level measurements Viscosity measurement, Moisture and humidity measurements. Conductivity meter- pH meter, Analytical instruments – Liquid chromatography – HPLC – Mass spectroscopy - Computer aided analysis – process instruments and automatic analysis.

References

- | | |
|---|--------------------------------|
| 1. Process Systems Analysis and Control | D. P. Coughnowr & Koppel |
| 2. Industrial Instrumentation | D.P. Eckman |
| 3. Principles and Practice of Automatic Process Control | C. A. Smith and A. B. Corripio |
| 4. Process Control | P. Harriot |

CHE 227 HEAT TRANSFER LAB.

List of experiments:

- To determine the thermal conductivity of metal rod.
- To determine the equivalent thermal conductivity of composite wall.
- To determine heat transfer coefficient in force convection.
- To determine heat transfer coefficient in Natural convection.
- To determine heat transfer coefficient with the help of Steafan Boltzman Apparatus.
- To calculate emissivity of the test plate by emissivity measurement apparatus.
- To determine heat transfer coefficient in double pipe heat exchanger.
- To study the heat transfer characteristics of a shell and tube heat exchanger (heating/cooling) of water.
- To determine heat transfer coefficient in parallel and counter flow heat exchanger.
- To measure the rate of evaporation using an open pan evaporator.
- To measure the rate of condensation of pure water vapour and to determine the heat transfer coefficient.
- Demonstrate the film-wise drop-wise condensation and determination of the heat transfer coefficient.
- To study the single effect evaporator and find out the transfer coefficient.

CHE 228 MECHANICAL OPERATIONS LAB.

List of experiments:

1. Sphericity factor on friction losses.
2. Agitated vessel
3. Settling studies
4. Drag studies
5. Filtration (constant rate)
6. Filtration (constant pressure)
7. Screening
8. Elutriation Clarification, cyclone separator
9. Jaw crusher
10. Ballmill
11. Particle size distribution
12. Storage of Solids
13. Cyclone studies, multiple cyclone, mixer – screw type ribbon type

Fifth Semester

CHE 311 HEAT TRANSFER 2

Heat Exchanger: Classification, Design of shell- tube and double pipe heat exchanger, compact heat exchanger, plate heat exchanger, fouling , Extended surface for heat transfer, effectiveness and NTU of heat exchanger, Boiling: Boiling characteristics, Nucleate pool boiling and forced convection boiling, boiling mechanism, boiling curve & heat transfer correlations, Condensation: mechanism & types of condensation, Nusselt equation for film wise condensation on vertical surface and its extension to inclined and horizontal surfaces, condensation number, film condensation inside horizontal tubes, Evaporator: classification and its use in process industries, evaporator calculation in process industries, effect of boiling point elevation and hydrostatic head on evaporator performance, fouling in evaporator, estimation of surface area in multiple effect evaporator.

References

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|--|--------------------------------------|
| 1. Heat Transfer | Holman J.P |
| 2. Fundamentals of Heat & Mass Transfer | Incropera F.P and Dewitt D.P |
| 3. Unit operations of chemical engineering | McCabe W.L., Smith J.C., Harriott. P |
| 4. Fundamentals of heat & mass transfer | |
- Foust A.S., Wemzel L.A., Clump C.W., Maus L., and Anderson L.B

CHE 312 MASS TRANSFER 2

Distillation: Vapour Liquid Equilibrium Data, Methods of distillation-batch, continuous, flash, steam, vacuum. Continuous Fractionation: Stage - wise and continuous contact operations. Design calculations. Reboilers and condensers, Multicomponent Distillation: Azeotropic distillation and Extractive distillation, Multi component Flash and differential distillation. Continuous fractionation. Liquid - Liquid Extraction: Liquid - Liquid Equilibrium data. Batch and continuous operations. Design of extraction towers. Leaching: Solid - Liquid equilibria, Batch and continuous operations. Equipments

References

- | | |
|--------------------------------------|--|
| 1. Mass Transfer Operations | R. E. Treybal |
| 2. Unit Operations in Chemical Engg. | W. L. McCabe, J. C. Smith and P. Harriot |

3 Chemical Engineering. Vol - II,

M. Coulson and J. F. Richardson

4 Transport Processes in Chemical Operations

C. J. Geankopolis

CHE 313 CHEMICAL REACTION ENGINEERING 2

Heterogeneous processes: Catalysis and adsorption; Classification of catalysts, Preparation of catalysts. Promoters and Inhibitors, General mechanism of catalytic reactions surface area and pore size distribution Rate equation of fluid solid catalytic reactions, Hougen-Watson & law models, Procurement and analysis of kinetic data, kinetics of catalyst deactivation. External transport processes and their effects on heterogeneous reactions yield and selectivity Reaction and diffusion in porous catalysts, isothermal and nonisothermal effectiveness factors, Effect of intraphase transport on yield, selectivity and 30 poisoning, Global reaction rate. Design of catalytic reactors, Iso thermal & adiabatic fixed bed reactor staged adiabatic reactors, Non-Iso thermal non-adiabatic fixed bed reactors, Fluidized bed reactors, Slurry reactors, Trickle bed reactors. Models for fluid-solid non-catalytic reactions, controlling mechanisms, Diffusion through gas film controls. Diffusion through ash layer controls, Chemical reaction controls, fluidized bed reactors with and without elutriation. V Gas-liquid reactions and liquid-liquid reaction, Rate equation based on film theory, Reaction design for instantaneous reactions ad slow reactions, Aerobic Fermentation, Application to Design Tools for Fast Reactions.

References

- | | |
|---|-----------------------------|
| 1. Chemical Reaction Engineering | O. Levenspiel . |
| 2. Elements of Chemical Reaction Engineering | Fogler, H.S. |
| 3. Chemical Engineering Kinetics | J.M. Smith |
| 4. Chemical Theory – An Introduction to Re-Actors | K.G. Denbig & K.G. Turner |
| 5. Chemical Kinetics and Reactor Engineering | G. Cooper & G.V.J. Jefferys |

CHE 314 MASS TRANSFER LABORATORY

List of Experiments:

1. To Study the flooding and loading of packed columns using different types of packing.
2. To study different types of plates and packing.
3. To prepare the vapor-liquid equilibrium and Boiling point diagram for a binary liquid mixture.
4. Determination of relative volatility of a given system of acetic acid water.
5. To verify Rayleigh equation for differential distillation of binary system.
6. To carry out the steam distillation.
7. To study batch distillation.
8. To study continuous distillation.
9. Studies on packed tower distillation unit.
10. Studies on the sieve plate distillation unit.
11. Studies on bubble cap distillation column.
12. To study the absorption of a gas in a packed column and calculation of NTU and HTU.
13. To perform batch adsorption and verify Freundlich law and Langmir isotherm.

CHE 315 PROCESS CONTROL LAB.

List of Experiments:

Each student should design a complete process plant with mechanical design details of at least three major equipments.

Sixth Semester

CHE 321 PROCESS MODELING AND SIMULATION

The Role of Analysis: Chemical Engineering Problems, basic concepts analysis: The analysis process, A simple example of estimating an order. Source of the model equation: observation equations, constitutive equation, control volumes, Dimensional analysis, System of units, dimensional consistency in mathematical descriptions, Dimensional analysis and constitute relationships, Final observations. Non-reacting Liquid Systems: Introduction, equation of continuity, simple mass balance, application of the model equations, component mass balances. Model behavior: Steady state behavior, Unsteady state behavior, density assumption, Numerical integration methods of ordinary differential equation. Reacting liquid systems: Introduction, basic model equations for a Tank-Type reactor, The reaction rate, The batch reactor, pseudo First-order reactions, Reversible reactions, multiple reactions: consecutive reactions, parallel reactions, complex reactions, constant density assumption, order and stoichiometry. Treatment of Experimental Data: Introduction, criteria for Best Slope-I, Best Slope-II, Best straight line, Physical property correlations, Fitting a quadratic. Simulation examples of gravity fluid flow, heat and mass transfer, monte-carlo simulation. Dynamic modeling of simple processes, sequential, simultaneous modular and equation oriented approaches, partitioning and tearing. Computer programming of various iterative convergence methods such as Newton-Raphson, False position, Wegstein, Muller methods.

References

- | | |
|---|----------------|
| 1. Process Modelling, Simulation and control for Chemical Engineers | Luyben W.L |
| 2. Introduction to Chemical Engineering Analysis | Russell T.W.F. |
| 3. Process plant simulation | Babu, B. V. |
| 4. Chemical Process Modelling And Computer Simulation | Jana, A. K. |

CHE 322 TRANSPORT PHENOMENA

Similarity in momentum, heat and mass-transport – Newton's laws of viscosity, Fourier's laws of conduction and Fick's laws of diffusion, Flux-transport property relationships, Estimation of transport properties measurement and correlations, velocity distribution in Laminar flow of falling film. Flow over an inclined plane, a circular tube an annulus and between two parallel plates. Shell balance approach for developing equations of change for momentum, heat and mass transport, Equations of change and their approximations for transport in one dimension.

Transport equations in turbulent flow and equations for turbulent fluxes. Velocity, temperature and concentration profile for laminar and turbulent flow conditions. Temperature and concentration profiles for conductive and convective transport in solids and fluids. Macroscopic momentum and heat balance equations, Kinetic energy calculation. Constant area and variable area flow problems. Flow through bends. Time determination for emptying of vessels.

References

- | | |
|---|--|
| 1. Transport Phenomena | Bird R.B., Stewart W.E. and Lightfoot EW |
| 2. Transport Phenomena A Unified Approach | Brodkey Rs and Hershey |
| 3. Introduction to Transport Phenomena | Thomson, W.J |
| 4. Transport Phenomena Fundamentals | Plawsky J.L |

CHE 323 PROCESS EQUIPMENT DESIGN 1

Mechanics of materials: Stress, Strain and their relationship. Elastic and plastic deformation, Bending moment, Torsion, creep and fatigue, theories of column; Theories of failures. General design

considerations, Design loads, liquid storage tank codes, design of shell, bottom plates, self supported, and column supported roofs, wind girder, nozzles and other accessories. Unfired pressure vessel, Design of shells under internal and external pressures; Selection and design of flat plate, torispherical, ellipsoidal, and conical closures, compensations of openings. High pressure Vessels designing. Tall vertical & horizontal vessels, Vessel supports; Design of skirt, lug, and saddle supports. Bolted Flanges, Gaskets, Design of non-standard flanges, specifications of standard flanges. Fabrication of equipment; welding, non destructive tests of welded joints, inspection and testing, vessel lining.

References:

- | | |
|---|--------------------------------|
| 1. Process Equipment Design. | Joshi, M.V |
| 2. Process Equipment Design | Brownell, N.E. and Young, H.E. |
| 3. Introduction of Chemical Equipment Design | Bhattacharya, B.C. |
| 4. I.S. : 2825-1969- Code for Unfired Pressure Vessels. | |

CHE 324 CHEMICAL REACTION ENGG. LABORATORY

List of Experiments:

1. To determine velocity rate constant of hydrolysis of ethyl acetate by sodium hydroxide.
2. To study the rate constant of hydrolysis of an ester-catalyzed by acid.
3. To study a consecutive reaction system (hydraulic model)
4. To study a parallel reaction system (hydraulic model)
5. To study a homogeneous reaction in a semi-batch reactor under isothermal conditions.
6. Study of non- catalytic homogeneous saponification reaction in CSTR.
7. To study a non-catalytic homogeneous reaction in a plug flow reactor.
8. To study the residence time distribution behavior of a back mix reactor.
9. To study the RTD behavior of a tubular reactor.
10. To study the RTD behavior of a packed bed reactor.

CHE 325 MODELING AND SIMULATION LAB.

Experiments related modelling and simulation with various software like g-Proms, Aspen Plus, etc.

CHE 326 Minor Project & Seminar

The Project work will involve experimental work, modeling and simulation.

Department Elective

CHE 331 BIO CHEMICAL ENGINEERING

Introduction To Bioscience: Types of Microorganisms: Structure and function of microbial cells. Fundamentals of microbial growth , batch and continuous culture. Isolation and purification of Enzymes from cells. Assay of Enzymes. Functioning of cells and Fundamental Molecular Biology: Metabolism and bio-energetics, Photosynthesis, carbon metabolism, EMP pathway, tricarboxylic cycle and electron transport chain, aerobic and anaerobic metabolic pathways. Synthesis and regulation of bimolecular, fundamentals of microbial genetics, role of RNA and DNA. Enzyme Technology and Kinetics: Applications of enzymes in industry and medicine. Immobilization of enzymes, Kinetics of enzyme catalytic reactions involving isolated enzymes, Reversible inhibition. Reactions Catalysed By Enzymes, Reactors, Analysis: Reactor Design and Analysis for soluble enzyme systems. Cofactor regeneration, Membrane reactor . Effect of mass transfer in immobilised enzyme particle systems. Reactors for immobilised enzyme systems. Bio Reactors, Effect of Transport Processes: Introduction to Bioreactor design: Continuously Stirred aerated tank bioreactors. Mixing power correlation .Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on

oxygen transfer rate, heat transfer and power consumption. Multiphase bioreactors and their applications. Downstream processing and product recovery in bioprocesses.

References

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|--|---------------------------------------|
| 1. Biochemical Engineering Fundamentals | J. E. Bailey and D. F. Ollis |
| 2. Biotechnology | Trevar, Boffey, Goulding and Stanbury |
| 3. Bio Process Engineering: Basic concepts | M. L. Shuler and F. Kargi |
| 4. Biochemical Engineering – Principles and Concepts | Inamdar S.T.A. |

CHE 332 OIL AND PAINT TECHNOLOGY

Chemistry of Oils, Fats and Fatty Acids : i. Glycerides, ii. Fatty Acids, iii. Non Glyceride Components of Oils & Fats iv. Chemical Reactions of Fats and Fatty Acids, Technology and Production of Oils & Fats, Coconut, cotton seed, peanut, palm, sunflower, sesame, softflower, rice bran, rapeseed and mustard seed, linseed, soyabean, tung, castor oil lard and tallow. Minor Oils: Neem Oil and Saffat. a) Mechanical expression of oils, b) Solvent extraction of oilseed and oil bearing material, c) Fat splitting. Refining and Bleaching : Degumming, alkali refining (batch refining), Miscella refining, refining losses – Bleaching by absorption – continuous bleaching ;Hydrogenation : Mechanism – selectivity as applied to the reaction and catalysis, Hydrogenation in practice (Batch & continuous) preparation of Raney Nickel catalyst, Soap manufacture : Raw materials required, selection of raw materials – full boiled process, Nutritional functions of fats, Testing and important analysis of oils and fats in determining the quality and quantity of oils / fats and oilseed; such as moisture, oil content, F.F.A., protein content, color of the raw / refined oil.

References

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|---|-----------------------------|
| 1. Bailey's Industrial Oil and Fat Products | Feireidoon Shahidi |
| 2. Oils & fats Technology | E. Bernardini |
| 3. Outlines of Paint Technology | W.M.Morgan |
| 4. Basics of Paint Technology, Part I & II, | V.C.Malshe & Meenal Sikchi. |

CHE 333 PETROLEUM REFINERY ENGINEERING

Primary Processing of Crude Oil, Classification of crude oil, Atmospheric distillation, Vacuum distillation of residue-Products and distillation practice, Secondary Processing of Crude Oil: FCCU, Hydro cracking, Visbreaking, Thermal cracking, Coking, Reforming, Alkylation, Polymerisation and Isomerisation process. Treatment Techniques:Treatment techniques for removal of objectionable gases, Odours, to improve performance, Storage stability, Extraction of aromatics, Olefins and recovery operations from petroleum products.

References

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|--|----------------------------|
| 1. Petroleum Refinery Engineering | W.L. Nelson |
| 2. Modern Petroleum Refining Processes. | B. K. Bhaskara Rao |
| 4. Modern Petroleum Technology | G. D. Hobson and W. Pohl . |
| 5. Hand book of Petroleum Refining Processes | R. A. Meyers . |

CHE 334 FERTILIZER TECHNOLOGY

Introduction: Plant nutrients, different types of fertilizers and their production in India. Nitrogenous Fertilizers: Different feed stocks. Synthesis gas production by steam-naptha reforming and gas purification. Ammonia synthesis. Urea manufacturing processes. Manufacture of sulphuric acid and ammonium sulphate. Nitric acid and ammonium nitrate manufacture. Phosphatic Fertilizers: Availability and grinding of rock phosphate, manufacturing processes for single and triple super- phosphate and

phosphoric acid. Mixed Fertilizers: Availability and manufacture of muriate of potash. Mixed Fertilizers: Mono and di-ammonium phosphate, urea ammonium phosphates, NPK complex fertilizers, granulation techniques. Engineering Problems: Fertilizers storage and handling. Corrosion problems in fertilizers industries. Fertilizer plant effluent treatment and disposal.

References

- | | |
|---|------------------------|
| 1. Chemistry and Technology of Fertilizers | Slack A.V |
| 2. Chemical Processes Industries | Austin G.T., "Shreve's |
| 3. Phosphoric Acid, Phosphates and Phosphatic Fertilizers | Waggaman W.H., |
| 4 Dryden's Outlines of Chemical Technology | Rao M.G. and Sittig M |

CHE 335 PHARMACEUTICAL TECHNOLOGY

Practice of the following unit operation in pharmaceutical industries: Heat transfer, evaporation, distillation, dry, mixing size reduction, crystallization, filtration, size separation, conveying, humidification, air conditioning and refrigeration, Formulation, development of sterile dosage forms. Production facilities, environmental control and personnel in the production of sterile dosage form, compounding, processing, filtration, sealing, sterilization, packing and labeling of sterile dosage forms. Quality control tests like sterility, pyrogen, clarify, safety and leakage testing, types of tablets. Manufacturing of tablets by wet granulation, dry granulation and direct compression. Tablet processing problems and defects, tablet standardization: hardness, friability, weights variation, disintegration, dissolution and content uniformity tests, Capsules: Hard gelatin capsule, capsule size, formulation and preparation of filled hard gelatin capsules, soft gelatin capsule, soft gel – manufacturing procedures. Quality control of capsule, Cosmetics and Toiletries: Introduction, factors to be considered in the formulation of facial cosmetics, dentifrice's, deodorant, antiperspirants, shampoos, hairdressing and hair removers, Pharmaceutical packing: Packing components, types of packing containers and closures, materials used for and their pharmaceutical specification, method of evaluation, stability aspects of packaging materials.

References

- | | |
|---|-------------------------------------|
| 1. The Theory and Practice of Industrial Pharmacy | Leon Lachman, H.A. Lieberman, J.L.K |
| 2 Unit Process in Pharmacy. . | Ganderton |
| 3 Chemical Engineering in Medicine And Bology . | D. Hershey . |
| 4. Chemical Engineering in Medicine | Chern. Engg. Prpgrer Syrnpr Series |

CHE 336 CORROSION ENGINEERING

Basic concepts: Definition and importance; Electrochemical nature and forms of corrosion; Corrosion rate and its determination. Electrochemical thermodynamics and kinetics: Electrode potentials; Potential-pH (Pourbiac) diagrams; Reference electrodes and experimental measurements; Faraday's laws; Electrochemical polarization; Mixed potential theory; Experimental polarization curves; Instrumentation and experimental procedure. Galvanic and concentration cell corrosion: Basic concepts; Experimental measurements, and determination of rates of galvanic corrosion; Concentration cells, Corrosion measurement through polarization techniques: Tafel extrapolation plots; Polarization resistance method; Instrumental methods and Errors in measurement of polarization resistance; Commercial corrosion probes; Other methods of determining polarization curves. Passivity: Basic concepts of passivity; Properties of passive films; Experimental measurement; Applications of Potentiostatic Anodic Polarization; Anodic protection. Pitting and crevice corrosion: Basic concepts; Mechanisms of pitting and crevice corrosion; Secondary forms of crevice corrosion; Localized pitting, Metallurgical features and

corrosion: Inter-granular corrosion; Weldment corrosion; De-alloying and dezincification. Environmental induced cracking: Stress corrosion cracking; Corrosion fatigue cracking; Hydrogen induced cracking; Some case studies; Methods of prevention and testing; Erosion, fretting and Wear, Environmental factors and corrosion: Corrosion in water and Aaqueous Ssolutions; Corrosion in sulphur bearing solutions; Microbiologically induced corrosion; Corrosion in soil; Corrosion of concrete; Corrosion in acidic and alkaline process streams. Atmospheric and elevated temperature corrosion: Atmospheric corrosion and its prevention; Oxidation at elevated temperatures; Alloying; Oxidising environments, Prevention and control of corrosion: Cathodic protection; Coatings and inhibitors; Material selection and design

References

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|---|----------------|
| 1. An Introduction to Corrosion and Corrosion Inhibition | S.N. Banerjee, |
| 2. An Introduction to Metallic Corrosion and its Prevention | Raj Narayan |

CHE 337 NOVEL SEPARATION TECHNIQUES

Limitations of common separation techniques – sedimentation, screening, filtration, evaporation, distillation, absorption, liquid-liquid and solid-liquid extraction. Principles of membrane separation process classification, characterization and preparation of membrane, Analysis and modelling of membrane separation, Membrane modules and application. Reverse Osmosis and ultra filtration, membrane characteristics and applications, Ion- selective membranes and their application in electrolysis. Per vaporization and gas separation using membranes, Liquid membrane, Industrial applications. Liquid membrane separation, critical extraction, pressure swing adsorption and freeze drying, pervaporation and permeation, nano-separation. Foam and bubble separation, principle, classification, foam and surfactants, Separation techniques, Column Separations. Multi-component separation, Zone melting and Zone refining, electrophoresis, desalting by freezing, centrifugation. Parametric pumping, thermal parametric pumping, batch, continuous pumping, pH-parametric pumping, heatless parametric pumping.

References

- | | |
|---------------------------------------|--------------------------------|
| 1. Separation Process Principles | Seader J. D. and Henley E. J . |
| 2. Textbook of Separation Processes | Suresh S, Keshav A |
| 3. Separation Processes | King C. J |
| 4. Water Purification By Ion-exchange | Arden TV |

CHE 338 CERAMIC TECHNOLOGY

Introduction Definition, classification and scope of ceramics, Ceramics verses metals and organics, Historical perspective on the development of ceramics and ceramic industries. Elementary ideas about the raw materials used in pottery, Heavy clayweres, Refractoriers, Glass, Cement, Industries, Raw materials :clays and their classification, Quartz, Polymorphism of quartz, Feldspar and its classification, Talc, Steatite and Mica. Conventional ceramics – Classification, Elementary ideas about whitewares, Cement, Glass, Refractories, Glaze and Enamels their manufacture and applications. Newer ceramicsclassification and scope of Cermets, Abrasives, Electro ceramics, Bio-ceramics, Space ceramics, Automotive ceramics, Superconducting ceramics, Elementary ideas of their preparation and their applications. Fabrication methods: Classification and scope of various fabrication methods. Brief study of dry semi dry pressing extrusion, Jiggering and jollying, Slip casting HP & HIP, Drying of ceramics, Biscuit firing and glost firing, fast firing technology, action of heat on triaxial body, Elementary ideas of various furnaces used is ceramic industries. Applications of ceramic products in everyday life, in different fields such as Metallurgy, Civil Engineering, Electrical, Electronics, Automobiles, Aerospace and Energy Engineering.

References:

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|---------------------------------------|------------------------------|
| 1. Industrial Ceramics | F. Singer and Singer S.S. |
| 2. Elements of Ceramics | F.H. Norton |
| 3. Introduction to Ceramics | W.D. Kingery |
| 4. Ceramic Technology and Processing, | Alan G. King, William Andrew |

CHE 339 ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL

Interaction of man and environment, overall picture of environmental pollution, environmental air and water quality criteria, standards and acts, effects of pollution. Air Pollution: dispersion of pollutant in the atmosphere, meteorological factors of air, stability and inversion of atmosphere, control of air pollution, air pollution control equipments. Methods of measuring and sampling of gaseous and particulate pollutants in ambient air and industrial waste gases. Water Pollution: Sources, types of pollutants in liquid wastes of chemical industries, methods for the treatment of liquid wastes to control pollution, selection of pollution control equipment, Methods of sampling of waste water. Odour and its control. Solid Waste Disposal: Characterization of solid wastes, problems of collection and handling, various processing techniques used in solid waste management, solid waste as resource material, Noise pollution: noise control criteria, noise exposure index, Control.

References:

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| 1. Environment Pollution Control and Environmental Engg. | C. S .Rao , |
| 2. Environmental Engineering. | Peavy and Row |
| 3. Air Pollution – Engg. Control of Air Pollution Vol IV | A.C. Stern. |
| 4. Environmental Chemistry | J. O .M. Bockris |

Seventh Semester**CHE 411 PROCESS EQUIPMENTS DESIGN & DRAWING 2**

Scale up criteria and scale up of process equipment. Process design calculations for heat exchange equipment shell and tube heat exchangers general description, heat transfer coefficients and pressure drop by Kern's Bell's methods rating on existing unit. Design of a new system having one or more units in series single effect evaporation, multiple effect evaporator with boiling point elevation. Process design calculations for mass exchange equipment plate and packed column for distillation and adsorption including column diameter and height. Detailed process and mechanical design, flash drum, Kettle reboiler, condenser, cooling tower & rotary drier.

References

- | | |
|--|-------------------------------|
| 1. Chemical Engineering Vol-1 | Coulson J.M. Richardson J.F . |
| 2. Chemical Engineering Handbook | Perry, Robert H., Green Don W |
| 3. Applied Process Design in Chemical Petrochemical Plants | E.E. Ludwig |
| 4. Design of Equilibrium Stages. B.D. Smith | |

CHE412 PROCESS EQUIPMENTS DESIGN&DRAWING 2**Prepare drawing sheet & solve design problem****CHE 413 MAJOR PROJECT AND SEMINAR**

The student would be allotted a project in the beginning of the VII semester itself. The project will be based on the industry where he/she has undergone in plant training in industry during summer vacations. He/She would be expected to submit a detailed plant design report later in the (VIII) semester for the project course(CH-428). In this semester he/she will be assessed for the work that he/she does during the seventh semester under the supervision of a faculty of the department.

The students are required to undergo in plant training in some chemical industry for a six weeks period during their summer vacations following VI semester. He/ she is required to collect information's relating to process details and other information's related to process material, utilities and their properties to prepare a report to be submitted to the department. The student would be assessed in the VII semester through a Viva-voce to be conducted by the teacher in charge training of Chemical Engineering Department.

CHE 421 PROCESS ENGINEERING AND COSTING

References:

1. Plant Design and Economics for Chemical Engineers Peters, M.S. and Timmerhaus, K.D
2. Process Engineering Economics Schwery H.E.

The student would be allotted a project in the beginning of the VII semester itself. The project will be based on the industry where he/she has undergone in plant training in industry during summer vacations. He/ She would be expected to submit a detailed plant design report later in this semester for the project course). In this semester he/she will be assessed for the work that he/she does during the seventh and eighth semester under the supervision of a faculty of the department.

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc

Students have to undergo a short or long tour and visit the industry of their interest, prepare a write up and present with suitable demonstration. Evaluation will be based on relevant topic student has studied, communication skill and reporting/documenting procedure.

CH 431MULTIPHASE REACTOR DESIGN

Introduction: reaction kinetics for multiphase reactions, brief idea of multiphase reactors and design. catalyst deactivation and regeneration, Review of reaction kinetics and reactor design. Industrial reactors: Trickle bed, Bubble column, segmented bed, fluidized bed and slurry reactor, models for analysis gas-liquid, gas-liquid-solid reactions, RTD and macro mixing models, brief description of laboratory reactors, Intrinsic kinetics: catalysis, Langmuir-Hinshelwood models, catalyst pellets, effectiveness factors,

1. Gas Liquid Reactor Design Y. T. Shaha .

2. Chemical Reactor Design and Operation Westerterp K. R., Van Swaaij and Beevackers
3. Multiphase Chemical Reactor – Theory, Design, Scale-up Gianetta and Silverton
4. Heterogeneous Reactions Vol-I and II Sharma and Doraiswami

CHE 432 INDUSTRIAL POLLUTION CONTROL

Stream sanitation. Different equations of self-purification, River standards, Effluent standards, Minimal national standards (MINAS). Sources and effects of various pollutants, Disposal of industrial wastes-on land, in creeks and the sea, in inland streams, into impoundments. Importance of planning location of industries and industrial estates, Common effluent treatment plants, their economics and management. Detailed considerations of wastes from industries such as textile (Cotton, wool, rayon, synthetics), sugar, pulp and paper, distilleries, oil refineries, petrochemicals, pharmaceuticals, dairy, food processing, soaps and detergents, mining, iron and steel, pickling, plating, galvanizing, tanning slaughterhouse, fertilizers, pesticides, dyes and dye intermediates, radioactive wastes. Recovery of byproducts, reuse of wastewaters with or without treatment.

References

1. Industrial Pollution Control: Issues and Techniques Nancy J. Sell
2. The Complete Guide on Industrial Pollution Control H. Panda
3. Pollution Control In Process Industries S.P. Mahajan
4. Industrial pollution control handbook, Volume 1 Herbert F. Lund

CHE 433 COMPUTER AIDED PROCESS CONTROL & DESIGN

Hardware: Analog and digital interfacing, sensors and transducers. System software: real time programming, Application software: data logging, filtering, digital control: Z-transforms, discrete time dynamic systems, adaptive control, introduction to MIMO control systems. Laboratory exercises

References

1. Chemical Engineers Handbook Green DW and Malony, perry

CHE 434 PROCESS PIPING DESIGN

Classification of pipes and tubes, IS & BS codes for pipes used in chemical process industries and utilities. Pipes for Newtonian and non-Newtonian fluids, sudden expansion and contraction effects, Pipe surface roughness effects, pipe bends, Shearing characteristics. Pressure drop for flow Newtonian and non-Newtonian fluids through pipes. Resistance to flow and pressure drop. Effect of Reynolds and apparent Reynolds number. Pipes of circular and non-circular cross section – velocity distribution, average velocity and volumetric rate of flow. Flow through curved pipes (Variable cross sections). Effect of pipe-fittings on pressure losses. Non-Newtonian fluid flow through process pipes, Shear stress, Shear rates behavior, apparent viscosity and its shear dependence, Power law index, Yield Stress in fluids, Time dependant behavior, Thixotropic and rheopetic behavior, mechanical analogues, velocity pressure relationships for fluids, line. Pipe line design and power losses in compressible fluid flow, Multiphase flow, gas-liquid, solid-fluid, flows in vertical and horizontal pipelines, Lockhart Martinelli relations, Flow pattern regimes.

References

1. Chemical Engineering – Vol I, Coulson JM and Richardson J.F.
2. The flow of Complex Mixtures In Pipe Govier, G.W. and Aziz K
3. Process Piping Design, , Volume 2, Rip Weaver

CHE 435 FLUIDIZATION ENGG

Introduction: The phenomenon of fluidization; liquid like behaviour of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds. Industrial applications of fluidized beds: Coal gasification; gasoline from other petroleum fractions; Gasoline from natural and synthesis gases; Heat exchange; Coating of metal objects with plastics; Drying of solids; Synthesis of phthalic anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; incineration of solid waste; Activation of carbon; gasification of waste; bio-fluidization. Fluidization and mapping of regimes: Minimum fluidization velocity; Pressure drop vs. velocity diagram; effect of temperature and pressure on fluidization; Geldart classification of particles; terminal velocity of particles; turbulent fluidization; pneumatic transport of solids; fast fluidization; solid circulation systems; Voidage diagram; Mapping of regimes of fluidization. Bubbles in dense bed: Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles, Bubbling Fluidized beds: Experimental findings; Estimation of bed porosities; Physical models: simple two phase model; K-L model. High velocity Fluidization: Turbulent fluidized bed; Fast fluidization pressure drop in turbulent and fast fluidization. Solids Movement, Mixing, Segregation and staging: Vertical movement of solids; Horizontal movement of solids; Staging of fluidized beds. Gas Dispersion and Gas interchange in Bubbling Beds: Dispersion of gas in beds; Gas interchange between bubble and emulsion; Estimation of gas interchange coefficients. Particle to Gas Mass Transfer: Experimental interpolation of mass transfer coefficients; Heat transfer; Experimental heat transfer from the bubbling bed model.

References

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| 1. Fluidization Engineering | Kunii, Diazo and Octave Levenspiel |
| 2. Fluidization | Max Leva. |
| 3. Fluidization Engineering | O. Levenspiel and D. Kunii, |
| 4. Gas-Liquid-Solid Fluidization Engineering | Liang-Shih Fan, |

CHE 436 FUELS AND COMBUSTION

Energy crisis – Present position in India and the world. Origin and Chemical composition, Classification of fuels, Storage and general use of Industrial fuels, Comparison of various types of fuels, Calorific value of a fuel, LCV and HCV, meaning and definition. Determination of HCV and LCV for solid fuels, Bomb calorimeter, Gas calorimeter. Solid fuels: Wood and charcoal, Coals and their characteristics, combustion and availability of coals in India, Coal washing and blending. High and low temperature coal carbonization.

Manufacture of coke and recovery of by products. Pulverized coal and its conduction. Liquid fuels: Petroleum, its origin and occurrence. Distillation, products of distillation, their characteristics and uses. Combustion, Chemistry of combustion, combustion calculations pertaining to different fuels and furnaces used in ceramic industries. Theoretical air / fuel ratio, Excess air, Flue gas analysis calculations. Gaseous Fuels: Classification, merits and demerits of the gaseous fuels. N gas, LPG, coal gas, Oil gas, Produces gas, Water gas, Semi-water gas etc., their chemical composition, Manufacture and uses in detail. Nuclear fuels, their scope and classification, Types of nuclear fuels, method of generation of nuclear energy from the sources, etc., Nuclear reactor – classification and types Accessories and their study in detail. Nuclear fuel roads, Moderators, Heavy water etc., Alternate sources of energy, Renewable energy, Hydroelectric, Solar, Geothermal, Tidal, Wind and other types, Bio-gas, Bio-fuels, etc.

References

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| 1. .Fuels Technology | Himus |
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| 2. Combustion Engineering and Fuels Technology | Shaha |
| 3. Principles of Energy conversion | Gulp Jr. A.W. |
| 4. Energy resources and supply | McMullan, Morgan Murray |

CHE 437 INDUSTRIAL CATALYSIS

Review of Heterogeneous Catalysis: Role of catalyst components and other constituents, characterization of catalyst and its support. Transport Processes: Analysis of external transport processes in heterogeneous reactions in fixed bed, fluidized bed and slurry reactors. Intrapellet mass transfer, heat transfer, mass transfer with chemical reaction and simultaneous mass and heat transfer with chemical reaction. Catalyst Selectivity: Effect of intrapellet diffusion on selectivity in complex reactions, effect of external mass transfer on selectivity. Catalyst Deactivation: Modes of deactivation – poisoning, fouling and sintering. Determination of deactivation routes, combined effect of deactivation and diffusion on reaction rates, effect of deactivation on selectivity. Reactor Design: Design calculation for ideal catalytic reactor operating at isothermal, adiabatic and non-adiabatic conditions. Deviations from ideal reactor performance. Design of industrial fixed-bed, fluidized bed and slurry reactors. Thermal stability of packed bed and fluidized bed reactors, Overview of various areas of Green chemistry, Successful approaches to Green Chemistry education.

References

- | | |
|-------------------------------------|------------------|
| 1. Chemical Engineering Kinetics | Smith, J. M |
| 2. Catalytic Reaction Engineering, | Carberry, J. J . |
| 3. Heterogeneous Catalytic Reactors | Lee, H. H |
| 4. Catalytic Reactor Design | Tarhan, M. O . |

CHE 438 MULTI PHASE FLOW

Introduction to the flow of multiphase mixtures: gas or vapor liquid, liquid-liquid, liquid-solid, gas-solid, solid-liquid-gas and gases carrying solids (pneumatic transport) stratification and dispersion, Flow regimes and flow patterns. Gas (Vapor) and Liquid Flows: Horizontal flow, Vertical flow, pressure, momentum and energy relations, methods of evaluating pressure drop, Lockhard - Martinell, Chisholm correlations, critical flow, non-Newtonian flow. Solid-Gas Flow: Effect of pipeline diameter, inclination, bends, valves and length. Liquid and its physico-chemical properties, rheology, corrosive nature, viscosity, Solid particle size, distribution phase, and density i.e. their factors effecting behavior in a fluid, Concentration of particles and the flow rates of both solids and liquid. Solid-Gas Flow: Horizontal flow, Suspension mechanism, determination of voids, energy requirements for conveying, pressure drop and solid velocities in dilute phase flow, dense phase conveying, vertical transport. Bubble and drop formation: Phase holdups, Interfacial areas, mixing and pressure drops, multiphase (gas liquid solid) operations.

References

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|---|-------------------------------|
| 1. The flow of complex mixtures in pipe | Govier, G.W. and Aziz, K |
| 2. Chemical engineering, Vol I, | Coulson JM and Richardson J.F |
| 3. Multiphase Flow Handbook | Crowe, C.T. |
| 4. Fundamentals of Multiphase Flow | Brennen, C.E |

CHE 439 ADVANCED PROCESS OPTIMIZATION

Objective and Formulation of Optimization, Inequality and Equality Constrains in Models Formulation of the Objective Function, Lower and Upper Bounds, Selecting Functions to Fit Empirical Data, Factorial Experimental Designs, Degrees of Freedom, Economic Objective Functions, Measures of Profitability,

Continuity of Function, NLP Problem Statement, Convexity and Its Applications, Quadratic Approximation, Necessary and Sufficient Conditions for an Extremum of an Unconstrained Function, Optimization of Unconstrained Functions: One-Dimensional Search Numerical Methods for Optimizing a Function of One Variable, Scanning and Bracketing Procedures, Newton and Quasi-Newton Methods of Unidimensional Search, Unconstrained Multivariable Optimization: Linear Programming (LP) and Applications Geometry of Linear Programs, Basic Linear Programming Definitions and Results, Simplex Algorithm, Barrier Methods, Sensitivity Analysis, Linear Mixed Integer Programs, Application of the EXCEL Solver Spreadsheet for Optimisation, Formulation. Introduction to Non linear Programming with Constraints and Mixed-Integer Programming, Application of Optimisation in Chemical Engineering, Examples of Optimization in Chemical Processes like optimizing recovery of waste heat, Optimal Shell and Tube Heat Exchanger Design, Optimal Design and Operation of binary Distillation Column, Optimal pipe diameter etc.

References

1. Optimization of Chemical Processes D M Himmelblau and L S Lasdon
2. Optimization theory and practice G. S. Beveridge and R. S. Schechter
3. Optimization for engineering design: Algorithms and examples K. Deb
4. Mixed Integer and Non Linear Optimization
C. A. Floudas, W D Seider, J D Seader and D R Lewin

CHE 441 CLEANER TECHNOLOGIES IN CHEMICAL PROCESS INDUSTRIES

Introduction to Cleaner Technology (CT), Technology adoption for Cleaner Production (CP), Cleaner Production: The basis, necessity and potential, C.P. tools, techniques, methodology and applications, Overview of Good House Keeping, Process Modification / Changes, Process Technology Innovations, Equipment Modification, Reuse and Recycle. Principles and Concepts of Green Chemistry, Thermodynamics and Reaction Engineering Principles for C.P., Role of Environmental Biotechnology in C.P. Use of Unit Operations – Adsorption, Absorption and Extraction in C.P. Energy Audit and Energy Conservation, Use of clean fuels inclusive of H_2 as a clean fuel of tomorrow, Power Plants, C.P. & C.T. as Remedial Measures for Mitigating Climate Change, Ozone layer depletion and current practices to avoid depletion. Resource recovery / by product recovery from manufacturing process by Cleaner Production Technology (CPT) with special reference to Small Scale Industries. Industrial waste minimization and Waste Minimization Circles, Hazard Prevention by C.P. Technology Alternatives, Designing Cleaner Production – Green Processes, Cleaner Production and Cleaner Technology implementation, Typical case studies.

Reference

1. Cleaner Production: Training Resource Package, UNEP IE, Paris, 1996
2. Engineers Guide to Cleaner Production Technologies Paul M. Randall
3. Green Chemistry : Environmentally Benign Reactions V. K. Ahluvalia
4. Chemical Process Safety: Learning from case Histories, R. E. Sanders, Oxford

CHE 442 COMPUTATIONAL FLUID DYNAMICS

Conservation equations for mass, momentum and energy; Comparison of various numerical techniques for CFD; Review of finite difference and finite element methods; Solution to discretised algebraic equation; Finite-volume method for diffusion problems; Finite-volume method for convection and diffusion problems – pressure velocity coupling; Construction of geometry and discretisation using Gambit-Fluent's manuals; Commercial CFD solvers; Turbulence modeling; Implementation of boundary

conditions; Introduction to multiphase flow; Customizing commercial CFD solver; Unsteady state simulations.

References

1. Computational Fluid Dynamics: The Basics with Application Anderson, J.D
2. Computational Methods for Fluid Dynamics Ferziger, J.H. and Peric, M
3. An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, H.K. and Malalasekera, W

CHE 443 SUSTAINABILITY AND GREEN CHEMISTRY

Introduction to Green Chemistry and Sustainability, The Chemistry Behind Green Chemistry: Green Chemistry and Natural Resources: Energy Relationships: Energy sources, Energy conversions and renewable energy, potential of biofuels, Water: Properties, Life in, and Contaminants, Designing an Environmentally Safe Marine Antifoulant, Green Chemistry and Ecology: The Biosphere, The Geosphere, Soil and Food, The Anthroposphere and Industrial Ecology Consumer products, DuPont Petretec Polyester Regeneration Technology

References

1. Green Chemistry an Introductory Text, Royal Society of Chemistry Lancaster, M.
2. Green Chemistry, Theory and Practice Anastas, P.T.; Warner, J. C.,
3. Introduction to Green Chemistry Matlack, A.S.,

CHE 444 NANOTECHNOLOGY IN CATALYSIS

Introduction to nanotechnology, definition, history. What makes the nanoscale so different from the other lengthscales by considering the underpinning science (i.e. nanoscience) and some key examples of nanotechnology. Methods of synthesis of nanomaterials fabrication-“Top-down” vs. “bottom-up” approaches. Equipment and processes needed to fabricate nanodevices and structures. Fundamental understanding of catalysis at nano-scale. Wet chemical synthesis, preparation and properties of iron, platinum, gold, cadmium, silver, copper and nickel nano-particles. Synthesis and properties of composite nano-particles and coated nano-particles. Characterization of nano particles by Scanning probe microscopes (Atomic Force Microscopy, Scanning Tunneling Microscopy), Transmission Electron Microscopy, Scanning Electron Microscopy.

References

- 1 , Nanotechnology: Principles and Practices, . S. K. Kulkarni .
2. Nano science and technology: novel structures and phenomena, Tang, Zikang and Sheng, Ping, Taylor and Francis,
3. Nanotechnology: Understanding small systems B. Rogers, S. Pennathur, J. Adams
4. Nanotechnology in Catalysis Pinzhan.

33 ELECTRONICS AND COMMUNICATION

Third Semester

MTH211D COMPUTATIONAL TECHNIQUES

Numerical Methods: Solution of algebraic and transcendental equations, Solution of linear Simultaneous Equations, Finite Differences, Interpolation and Extrapolation, Inverse Interpolation, Numerical Differentiation and Integration, Numerical solution of Ordinary & Partial Differential Equations. Statistics: Curve fitting, Correlation and Regression Analysis Probability Distribution, Sampling and Testing of Hypothesis.

References

1. Numerical Analysis by Hildebrand, Mcgraw Hill.
2. Numerical Analysis by Scarborough, Oxford.
3. Numerical Methods by E .Balaguruswamy, TMH

Numerical Methods for scientific and Engineering by M.K.Jain, New

EC 212 ELECTRONIC DEVICES AND CIRCUITS

Study of semiconductors in equilibrium and non-equilibrium conditions; principles of semiconductor device p-n junctions; and junction transistors; device simulation and device modeling for circuit analysis. MOS devices; short channel effects; Device Scaling; NMOS, CMOS and BiCMOS technologies; device modeling and simulation, optoelectronic devices

References

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|---|----------------------|
| 1. Solid State Electronic Devices | Benjamin G Streetman |
| 2. Semiconductor Physics And Devices | Donald Neamen |
| 3. Semiconductor. Devices. Physics and Technology | S. M, SZE |

EC 213 DIGITAL ELECTRONICS AND MICROPROCESSOR

Number system, simplification of Boolean expressions, minimization techniques, Karnaugh map, Quine Mc-clusky method, combinational circuits design, Flip flops, sequential circuits design, Shift registers, Microprocessors (8085) - internal architecture, Instruction set and assembly language programming.

References

- | | |
|--------------------------------------|-----------------------------------|
| 1. Digital Logic and Computer Design | M.Morris Meno, Pearson Education |
| 2. Digital Fundamentals | Floyd and Jain, Pearson Education |
- Digital Electronics Principles and integrated Circuits A.K.Maini, Wiley India.

EC 214 NETWORK ANALYSIS AND SYNTHESIS

Analysis: Review of Kirchhoff's laws and circuit elements, Graph theory, coupled circuits, Network theorems. Differential equations: description of first and second order systems, Laplace transform and its applications in circuit analysis, Two port networks, properties of Network Functions,

Synthesis: Synthesis of passive networks, Hurwitz polynomials, PR functions, realization of LC, RL, RC network by foster and cauer form.

References

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| 1. Network Analysis | Van Vulkenburg, |
| 2. Circuit Theory (Analysis and Synthesis) | A.Chakrabarti, |

EC 215 SIGNALS AND SYSTEMS

Classification of signals and systems, various system representation techniques, Fourier transforms and series, application to analysis of systems, Laplace transform, its properties, and its application to system analysis, Z transforms, its properties and applications, Random variables and random process, characterization of random variables and random process, linear systems and random signals.

References

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| 1. Signals and Systems | A.V. Oppenheim, A.S. Willsky and I.T. Young. |
| 2. Analog and Digital Signal Processing | Ashok Ambardar, |

EC 216 ELECTRONICS INSTRUMENTATION AND MEASUREMENT

Types of Instruments, Types of error, Measurement and error, Static and Dynamic characteristics of measurement. Cathode Ray Oscilloscope (CRO), measurement using CRO, Measurement of voltage, current, impedance and power. Wave Analyzers, signal Analyzers, Signal generators, Amplifier

Measurements, Transducers, Measurement of non-electrical quantities, Digital Measurements, A–D & D–A, conversion, digital voltmeters, and displays devices.

References

- | | |
|---|------------------|
| 1. Electronics Instrumentation & Measurement System | A.K.Shawney |
| 2. Electronics Measurement and Instrumentation | W.D.Cooper, PHI. |
| Electronics Measurement and Instrumentation | Kalsi, PHI. |

EC 217 ELECTRONIC CIRCUIT AND DIGITAL ELECTRONICS LABORATORY

(Selected experiments in the area of Electronic Circuit and Digital Electronics)

EC 218 N/W AND INST. & MEASUREMENT LABORATORY

(Selected experiments in the area of **Network and Instrumentation & Measurement**)

Fourth Semester

EC 221 ANALOG ELECTRONICS CIRCUITS

Introduction to analog integrated circuits., Bipolar and MOS transistor models. Analysis and design of monolithic operational amplifiers., Frequency response, Feedback amplifier theory and design. Applications to specific case studies., such as phase-locked oscillators and wide-band amplifiers. Switched-capacitor filters.

References

- | | |
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| 1. Micro Electronics Circuits | Sedra & Smith |
| 2. Microelectronics Circuit Analysis and Design | Donald Neamen. |
| 3. Electronic Circuit Design | Spencer and Ghausi, |

EC 222 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

Introduction to 8086 microprocessor, internal architecture, pin description, memory segmentation, addressing modes, instruction set and assembly language programming. Basic Interfacing devices: Memory interfacing, 8255, 8253, 8259, 8257, 8251, Interfacing A/D and D/A converters, Case studies of microprocessor based systems. Salient features of advanced microprocessors: 80286,386,486, Pentium Introduction to 8051 microcontrollers, its architecture, pin description, I/O configuration, interrupts, addressing modes, an overview of 8051 instruction set, assembly language Programming, Microcontroller applications.

References

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| 1. Microprocessor and Interfacing | D. V. Hall |
| 2. Advanced Microprocessors and peripherals | A K Ray & K M Bhurchandi |
| 3. The 8051 Microcontroller | Kenneth J Aya |

EC 223ANALOG COMMUNICATION

Review of Fourier Series and Transforms. Hilbert Transforms, Bandpass Signal and System Representation.Amplitude Modulation,DSBSC, SSB, VSB: Signal Representation, Generation and Demodulation.Frequency Modulation: Signal Representation, Generation and Demodulation. Noise: in AM Receivers using Coherent Detection, in AM Receivers using Envelope Detection, in FM Receivers.

References

- | | |
|--|---------------|
| 1. Modern Digital and Analog Communication Systems | B.P.Lathi, |
| 2. Communication Systems | Simon Haykins |

EC 224 COMMUNICATION NETWORK AND TRANSMISSION LINES

Lattice and bridge T networks, Attenuators and their design, Wave filters. Transmission Line Introduction, Transmission Line Analysis, Physical Interpretation of Voltage & Current Solution, Standing Waves on Transmission Line & Impedance Transformation, Loss less Transmission

Line, Impedance Characteristics of Loss less Transmission Line, Graphical Approach for Transmission Analysis, Transmission Line Calculations Using Smith Chart, Transmission Line Analysis in terms of Admittance, Applications of Transmission Lines, Impedance Matching using Transmission Line, Measurement of characteristics parameters of various lines

References

- | | |
|-----------------------------------|-------------|
| 1. Network and Transmission Lines | J.D. Ryder |
| 2. Network and Transmission Lines | G.K.Mithal |
| Network and Transmission line | Umesh Sinha |

EC 225 CONTROL SYSTEMS 1

Control System Components & Transfer Function, block diagram and its reduction procedure, signal flow graph, Mason gain formula. Time response of first, second and higher order systems to various test input signals. Types of systems, steady state error and error constants, effects of proportional, integral, derivative and PID controllers. Stability: Concept of stability, necessary conditions for stability, absolute and relative stability, Routh Hurwitz criterion, Nyquist criterion, construction of root loci and application. Frequency Domain Analysis & Compensation Techniques, Bode plots, gain and phase margin, phase lead, phase lag, lag-lead compensation. State Space Analysis and Sampled Data System.

References

- | | |
|-------------------------------|-------------------------|
| 1. Control System Engineering | Nagrath & Gopal, |
| 2. Linear Control System | B.S.Manke |
| 3. Modern Control System | R.C. Dorf & R.N. Bishop |

EC 226 INTEGRATED CIRCUITS

Introduction to monolithic IC technology, fabrication of monolithic ICs, Logic families : RTL, DTL, TTL, ECL, basic gates, fanout , power dissipation, MOS digital circuits, NMOS, CMOS, CMOS combinational logic gates, BiCMOS, Semiconductor memory cells and memory organization, Monolithic voltage regulators, PLL building blocks.

References

- | | |
|---|--------------------------------------|
| 1. Digital integrated circuits Thomas | DeMassa, Zack |
| 2. Analysis and design of digital integrated circuits | David A Hodges |
| 3. Digital Integrated Circuits | Jan M. Rabaey, Chandrakasan, Nikolic |

EC 227 ANALOG EL CIRCUIT & μ P LAB ORATORY

(Selected experiments in the area of Electronics Circuit & Microprocessor

EC 228 ANALOG COMMUNICATION & CNTL LABORATORY

(Selected experiments in the area of Analog Communication & CNTL

Fifth Semester

EC 311 DIGITAL COMMUNICATION

Matched Filter, Error Rate due to Noise. Intersymbol Interference, Nyquist's Criterion, Duobinary Signaling. Optimum Linear Receiver. Geometric Representation of Signals. Coherent Detection of Signals in Noise, Probability of Error. Coherent and non-coherent Digital Modulation Schemes, Pseudo-Noise Sequences and Spread Spectrum. Information Theory, Entropy, and Source-Coding.

References

- | | |
|--|-----------------------------|
| 1. Principles of communication systems | H. Taub and D.L. Schilling, |
| 2. Modern digital and analog communication systems | B.P. Lathi, |

EC 312 DIGITAL SIGNAL PROCESSING

Discrete time systems, linear time invariant (LTI) systems and important properties. Fourier Transform and Laplace transform, Z-transform, Signal flow graphs and digital system representation Discrete Fourier transform (DFT) and its properties. Fast Fourier transforms, Introduction to transformation matrices in a general form. Digital filters, FIR and IIR. FIR filters, structure, designs. IIR filters, Applications of DSP.

References

1. Digital Signal Processing: S. Mitra,
2. Digital Signal Processing, Algorithm and Applications: John C. Proakis & Dimitrios G. Manolakis,

EC 313 VLSI DESIGN

Introduction, Design and technology. Overview of VLSI, modern CMOS Technology. Semiconductor manufacturing. Crystal growth, Wafer fabrication, Manufacturing methods, Lithography. Thermal oxidation and SiO₂ interface. Dopant diffusion: Ion implantation. Thin Film Deposition: Etching. Metallization MOS based silicon ICs, advanced structures BICMOS and resistors and capacitors.

1. ULSI Technology C.Y. Chang and S.M.Sze,
2. VLSI Fabrication Principles S.K. Ghandhi,
3. VLSI Technology S.M. Sze,

EC314 DIGITAL COMM. & DSP LAB

(Selected experiments in the area of Digital Comm & DSP)

EC315 IC & VLSI LABORATORY

(Selected experiments in the area of IC & Control)

Sixth Semester

EC 321 CONTROL SYSTEMS 2

State variables, state space representation, Transfer matrix, state model for linear continuous time systems. Eigen values, eigen vectors, Diagonalization, Solution of state equation, concept of controllability and observability. Pole placement by state feedback. Introduction to discrete time systems, Time domain, representation & transformation analysis of discrete time systems, time domain approach and z domain approach. Pulse transfer function, Controllability and observability of discrete time systems stability analysis in z plane. Introduction, characteristics limit cycles, singular points, Basic non linear components phase plane methods, Describing functions, Definition, D.F. for basic non linearities, Absolute stability, circle and popov criterion, Liapunov functions.

References

1. Digital Control Engineering M.Gopal
2. Adaptive and Optimal Control A.P.Sage & Landue
3. Optimal Control A.P.Sage

EC 322 OPTICAL COMMUNICATION

Overview of Optical Fibre Communication: Basic concepts, laws and definition, mode theory analysis for optical communication, optical fibre modes and configuration, wave propagation in optical fibre, operating wavelength, single mode and multimode fibres, V-numbers, mode field diameter, numerical aperture, refractive index profiles. Losses in optical fibres. Dispersion in optical waveguides, group delay, Design optimization of advance single mode fibres and dispersion compensating fibre. Trends in fiber design.

Optical Sources & Optical Detectors: Structure, principle and their characteristics, BER. Overview of analog and digital optical link, Point to point link system consideration: Link power budget and rise time

analysis .Line coding Fiber Optic Networks,optical amplifiers, WDM & DWDM Optical System, Optical Networks – SONET/SDH, Optical Layer, future of fiber–optic network

References

1. Optical Fiber Communication G. Keiser
2. Fiber Optic Communication Technique D.F. Mynbacy and L. Scheiner

EC 323 MICROWAVE ENGINEERING

Characteristic, features and applications of microwaves. Rectangular and circular wave guide, wave guide resonators. Microwaves generators. Scattering matrix representation of microwave networks, properties of scattering matrices, S-matrices for directional coupler, E plane H plane and magic tee, isolator, circulators, directional couplers. Ferrite devices, Microwave filters, amplifiers,Tunnel diodes, Gunn effect, Gunn Diode oscillators, Avalanche effect, IMPATT & TRAPATT diodes, PIN diodes and their applications. Planer transmission lines such as stripline, microstrip line, slotline etc., Technology of hybrid MICs, advantages of MICs. VSWR measurement, microwave power measurement, impedance measurement, frequency measurement.

References

1. Microwave Engineering and Applications O. P.Gandhi
 2. Microwaves K.C.Gupta
- Microwave Devices and Circuits Liao

EC324 DIGITAL IMAGE PROCESSING & CONTROL LABORATORY

(Selected experiments in the area of Digital Image processing & VLSI)

EC325 OPTICAL & MW LABORATORY

Selected experiments in the area of Optical & MW

EC326 MINOR PROJECT AND SEMINAR

The student would be allotted a project in the beginning of the VII semester itself. The project will be based on the industry where he/she has undergone in plant training in industry during summer vacations. He/She would be expected to submit a detailed plant design report later in the (VIII) semester for the project course(CH-428). In this semester he/she will be assessed for the work that he/she does during the seventh semester under the supervision of a faculty of the department.

Department electives

EC 331 DIGITAL IMAGE PROCESSING

Digital Image Fundamentals, Sampling and Quantization, Image Enhancement in spatial domain, Image Enhancement in frequency domain, Image denoising, estimation of image degradation, Image segmentation, Thresholding, Region growing , Region splitting, Image Compression, Digital water marking, object recognition.

References

1. Digital Image Processing Gonzalez and Woods
2. Digital Image Processing: A.K Jain

EC 332 PATTERN RECOGNITION

Basics of pattern recognition, Bayesian decision theory, Parameter estimation methods, Hidden Markov models for sequential pattern classification, Dimension reduction methods, Non-parametric techniques for density estimation, linear discriminate function based classifiers, Non-metric methods for pattern classification, Unsupervised learning and clustering

References

1. Pattern Classification R.O.Duda, P.E.Hart and D.G.Stork,

2. Pattern Recognition S.Theodoridis and K.Koutroumbas,
3. Pattern Recognition and Machine Learning C.M.Bishop,

EC 333 SPEECH RECOGNITION

Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing the phasor mode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesis speech Recognition speech in the computer human interface.

References

1. Speech and Audio Processing for multimedia PC's Iain Murray
 2. Fundamentals of Speech Recognition Lawrence Rabiner & Biing-Hwang
- Speech Communication: Human and Machine, Douglas O'Shaughnessy

EC 334 TELECOM SWITCHING SYSTEMS

Basics of switching system, manual switching system, rotary dial telephone, signaling tones, strowger switching components, step-by-step switching, touch tone dial telephone, cross bar switching and exchange organization. Four wire concept, operation of hybrid, echo suppressors. Centralized and distributed SPC, software architecture, application software, enhanced services offered by SPC. Space Division Switching, Time Division Switching, Combination Switching, Traffic Engineering, Telephone Networks, Data Networks, mobile communication.

References

1. Telecommunication Switching Systems and Networks Thiagarajan Viswanathan
2. Digital Telephony John C. Bellamy
3. Telecommunication switching traffic and networks J.E.Flood

EC 335 DIGITAL MESSAGE TRANSMISSION

Examples of analog pulse and digital transmission systems. Performance analysis of analog and pulse modulation systems. Role and review of probability theory and stochastic processes in digital message transmission. Principles of detection theory: Binary and m-ary hypothesis testing. Bayes' likelihood ratio test. Performance analysis of digital communication systems. Spectrum of digital signals: Spectral efficiency of digital communication systems; Nyquist pulse shaping. Correlative coding schemes. Equalization techniques. Synchronization techniques. Carrier, bit and frame synchronization schemes.

References

1. Digital Transmission Theory Benedetto S., Biglieri E. and Castellari V
2. Digital transmission of Information, Blahut R.F
3. Digital Communications Proakis J.J.,

EC 336 DATA COMPRESSION AND CRYPTOGRAPHY

Introduction. Basic motivating scenarios for cryptography. History. Information-theoretic secrecy. Block ciphers. Standard modes of operation. Pseudorandom functions. Pseudorandom permutations. The birthday paradox. Applications. One-way functions. Symmetric encryption schemes. Definitions. IND-CPA. Security of standard modes of operation. IND-CCA2. Message authentication. MACs. Definitions. PRFs as MACs. CBC-MAC. Authenticated encryption. INT-PTXT. INT-CTXT. Non-malleability. Commitment schemes. Hard-core predicates. Goldreich-Levin theorem. Pseudorandom generators. PRG's from OWF's. Blum-Micali-Yao. PRF's from PRG's. Goldreich-Goldwasser-Micali. Basics on number theory. Number-theoretic primitives. RSA. Rabin's function. Definition of

trapdoor one-way functions. Public-key encryption. Definitions. Semantic security. Message indistinguishability. Goldwasser-Micali cryptosystem. Hybrid encryption. Digital signatures. Trapdoor signatures. RSA. Random oracles. Full-domain hash. PSS. Zero knowledge proofs. Proofs of knowledge. Foundations. Constructions of signatures based on any one-way function. Oracles and separations.

References

1. Cryptography and Network Security: Principles and Practice, E William Stalling,
2. Understanding Cryptography: A Textbook for Students and Practitioners, Christof Paar, Jan Pelzl, Springer

EC 338 DESIGN OF ANALOG ICs

Review of sequential circuits, Mealy & Moore Models, Analysis & Synthesis of Synchronous sequential circuits Digital system design Hierarchy, ASM charts, Reduction of state tables, State Assignments Analysis and synthesis of Asynchronous sequential circuits, critical and non-critical races, Essential Hazard Digital system design implementation options: ASICs – Full custom, gate array based, standard cell based and Programmable ASICs Antifuse, SRAM, EEPROM/EPROM Technologies for Programmable ASICs. Combinational and sequential circuit design with PLD's, Introduction to CPLD's & FPGA's Digital system modeling: Behavioral, structural and physical domains Fault Modeling.

References

1. Digital principles and design Donald D. Givone
2. Digital Design Morris Mano

EC 339 LOW POWER VLSI DESIGN

Modeling and sources of power consumption Power estimation at different design levels (mainly circuit, transistor, and gate) Power optimization for combinational circuits Power optimization for sequential circuits Circuit and layout level for low power Software design for low power Low power random access memory circuits Leakage power consumption in deep sub-micron technologies Power analysis and design at system level Case studies.

References

1. Low Power Design in Deep Sub-micron Electronics W. Nebel and J. Mermet, Kluwer
2. Practical Low Power Digital VLSI Design Gary Yeap
3. Low Power CMOS VLSI Circuit Design Kaushik Roy, Sharat Prasad

EC 341 INDUSTRIAL ELECTRONICS

DC amplifiers. Series and Shunt type Linear Voltage Regulators. Switched Mode voltage regulator. Fixed and Adjustable IC Voltage regulators. Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and F, Ratings of SCR. Chopper circuits – Principle, methods and Configurations, Diac and Triac, Triacs – Triggering modes, Firing Circuits, Commutation.

References

1. Industrial and Power Electronic G.K. Mithal and Maneesha Gupta,
2. Integrated Electronics J. Millman and C.C. Halkias,
1. Electronic Devices and circuits Theodore H. Bogart
2. Thyristors and applications M. Rammurthy

EC 342 ELECTRONIC SENSORS AND DISPLAY DEVICES

Sensor Fundamentals, Application Considerations, Instrument Selection, Data Acquisition and Readout, Installation, Sensor Signal Conditioning, Sensor Applications, Magnetic Field Sensors, Microphone

sensors, Wireless Sensor Networks , Photosensors, Liquid crystals, Twitted Nematic Liquid Crystal, LCD, Principle of emission of light from p-n junction, LED and its colors and material Gas-discharge display devices, CRO as display device. Thermal Sensing and FAX printing.

References

- | | |
|---|---------------------|
| 1. Sensor Technology Handbook | Jon S. Wilson |
| 2. Cvd Diamond for Electronics Devices and Sensor | Ricardo S. Sussmann |

Seventh Semester

EC411 ANTENNA AND WAVE PROPAGATION

Radiation, radiation field from current element antenna, radiation power and radiation resistance of short dipole and half dipole antenna, field and phase of point sources, directivity and gain, direction and gain calculation of short and half wave antenna. Introduction to antenna as an aperture, effective length, resonant and traveling wave antenna for different wave length, antenna arrays of point sources, two element array, end fire and broad side arrays, uniform linear arrays of N elements, patterns and principal of pattern multiplication, loop and helical antennas, Yagi-Uda antenna, folded dipole, turn side, rhombic antenna. Huyggen's principle, Babinet's principles & complimentary antenna, horn antennas, reflector antennas, log periodic antenna, slot antenna, polarization measurements, field strength measurement, Feeders for exciting resonant antenna, center fed and end fed, Ground wave propagation surface wave propagation, space wave propagation, reflection of wave by earth's surface, reflection coefficient of vertically and horizontally polarized wave, space wave propagation, range of propagation, propagation beyond the line of sight, duct propagation. Troposphere, scatter, field strength of tropospheric wave, ionosphere, virtual heights, critical frequencies, refractive index of ionized region, reflection and refraction of radio waves in ionosphere, influence of earth's magnetic field, loss of energy in ionosphere, single hop and multiple hop transmissions, skip distance and maximum usable frequency (MUF).

References

- | | |
|--|-----------------|
| 1. Antennas | John D Krauss |
| 2. Electromagnetic waves & Radiating Systems | Jordan & Balman |
| 3. Antenna & Wave Propagation | K.D. Prasad. |

EC412 ANTENNA & ADVANCE COMM. LABORATORY

Selected experiments in the area of Antenna & Advance Communication Laboratory

EC413 MAJOR PROJECT AND SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by department committee formed by HOD.

EC414 INDUSTRIAL TRAINING

Student has to select the industry for his/her training program. After the training , student has to submit a report about the training. Based on the report and presentation, student will be evaluated by department committee formed by HOD.

Eighth Semester

EC421 MOBILE COMMUNICATION

Concepts of cellular communication, System design fundamentals, Geometry of hexagonal cells; Co-channel interference, Cell splitting, Frequency allocation in mobile, Handoff , Frequency Reuse, Mobile radio wave propagation; reflection, diffraction, fading. Path loss prediction. Multipath propagation. Statistical characterization of multipath fading. Diversity. Link design. Design parameters for base

station. Antenna location, spacing, heights and configurations. Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum. Power control. WCDMA. CDMA network design. GSM. 3G systems. WLAN technology. WLL. HiperLAN. Ad hoc networks. Bluetooth. OFDM and MC-CDMA

References

- | | |
|--------------------------------------|-----------------|
| 1. Wireless Communication Principles | T.S.Rappaport,. |
| 2. Mobile Communication Engineering. | W.C.Y.Lee, |
| 3. Wireless Communications | A.F.Molisch, |

EC428 MAJOR PROJECT & SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by department committee formed by HOD

EC429 GENERAL PROFICIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc.

Department Electives

EC431 SATTELITE COMMUNICATION

Introduction, History of Satellites, Kepler's law, Elements of orbital mechanics. Equations of motion. Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Geostationary Satellites, Satellite System Parameters Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.

Multiple access techniques. FDMA, TDMA, CDMA. Random access techniques. Satellite onboard processing.

Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, Intelsat and Inmarsat. Satellite - based personal communication.

Earth station design. Configuration. Antenna and tracking systems. Satellite broadcasting.

References

- | | |
|--------------------------------------|------------------------|
| 1. Satellite Communication | D.Roddy, |
| 2. Satellite Communication | T.Pratt & C.W.Bostain, |
| 3. Design of Geosynchrone Spacecraft | B.N.Agrawal, |

EC432 WIRELESS COMMUNICATION

Radio Propagation And The Atmosphere, Basic Propagation Mechanisms, Radio Propagation Categories, AWGN. Model Showing Reflection, Scattering And Diffraction Of Radio Waves For Mobile Systems/Multipath Effect, Fading, Delay Spread Effect, ISI, Doppler Shift/Spread, Doppler Power Spectrum.

Channel Models, Equalization Techniques And Diversity Techniques

Spread Spectrum Modulation Concepts, ML, Walsh-Hadamard, Gold Sequences, Code Properties, Correlation, DSSS Transmitter, Rake Receiver, PN Signal Characteristics, Spectral Density, Bandwidth And Processing Gain, Interference Rejection, Antijam Characteristics, Energy And Bandwidth Efficiency, Near Far Problem And Power Control, Frequency Hopping Spread Spectrum.

OFDM Multicarrier Modulation, Pulse Shaping And Windowing In OFDM, Synchronization In OFDM, Pilot Insertion In OFDM Transmission And Channel Estimation, Amplitude Limitations FFT Points Selection Constraints, CDMA Vs OFDM, Hybrid OFDM

References

- | | |
|--|---------------------|
| 1. Wideband Wireless Digital Communication | Molisch Andreas F., |
|--|---------------------|

2. Wireless Communications, Rappaport, T.
3. Theory And Applications Of OFDM And CDMA - Wideband Wireless Communications, Schulze Henrik and Luders Christian,

EC433 ACTIVE RF DEVICES AND CIRCUITS

IC Technology Review for RF Applications, Complex Modulation; Receiver Architectures, Amp Design for Power Gain, High Frequency BJT and MOS Distortion, Fundamental of Mixers; Active Current Commutating Mixers, Discrete Time Transceiver Architectures, Quadrature VCOs.

References

1. Analysis and Design of Integrated Circuits
Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer,
2. The design of CMOS radio-frequency integrated circuits, Thomas H. Lee.
3. RF microelectronics, Behzad Razavi. .

EC434 RADAR AND NAVIGATION SYSTEMS

Introduction to Radar, Radar Equation, Radar Block Diagram, Radar Frequencies, Applications of Radar. Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, Pulse Repetition Frequency, Radar system losses. Introduction to Doppler and MTI Radar, Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance, MTI from a Moving Platform (AMIT) – Pulse Doppler Radar, Tracking with Radar – Monopulse Tracking, Conical Scan and Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking, Tracking Range, Comparison of Trackers, Automatic Tracking with Surveillance Radars (ADT). The Radar Antenna, Reflector Antennas, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency-Scan Arrays, Radar Transmitters and Receivers, Receiver noise Figure, Radar Displays. Radio Direction Finder, An Aural Null Direction Finder, The Goniometer, Adcock Direction finder, Errors in Direction Finding, Automatic Direction Finders, The Commutated Aerial Direction Finder, Hyperbolic Systems of Navigation (Loran and Decca), Loran-A, Loran-A Equipment, Range and precision of Standard Loran, Loran-C, The Decca Navigation System Decca Receivers, Range and Accuracy of Decca, DME and TACAN – Distance Measuring Equipment, Operation of DME – TACAN Equipments, Satellite Navigation System, Navstar Global Positioning System (GPS)

References

1. Introduction to Radar Systems Merrill I. Skolnik
2. Elements of Electronic Navigation Systems N.S.Nagaraja,

EC435 BROADBAND OPTICAL NETWORKS

Fundamentals of telecom systems, Principles of communication and signaling, Fundamentals of transmission; mathematical models for networks, Protocols, Architectures for Broadband Networks, Access and Hybrid Networks; All optical networks. SDH, SONET; Fiber-optic LAN architectures and protocols- ring, star and bus architectures, DQDB, FDDI; High speed bus protocols- RATO-net, WDM networks- LAMBDA-net, coherent star, PASS-net, shuffle-net. Photonic Switching: Switching architectures single and multistage switching, space switching, time switching, combinations of space and time switching, SEED arrays WDM Network design - Lightpath Topology, Optical Line Terminal, Optical Add / Drop multiplexers, Optical Cross connects, Wavelength conversion.

References

1. High Speed Networks & Internet William Stalling
2. Optical Networks Rajiv Ramaswamy and Kumar N. Sivarajan

EC436 TV ENGINEERING

Theory of scanning standards, Principles of Monochrome and colour T.V. system (PAL, SECAM, NTSC). Composite video signal analysis. T.V Cameras: Image orthicon, plumbicon, vidicon. CCD camera tubes. Types of Monochrome and colour picture tubes, set-up adjustments. LCD and Plasma displays. Block diagram of T.V. transmitters. TV transmission & reception antennas. Introduction to radar, radar frequencies, radar block diagram, radar equations and its performance factors. Doppler effect, CW Radar, frequency modulated and multiple Doppler frequency radar, moving target indication radar, delay line canceller, blind speed, duplexer, scanning and tracking radars, lobe switching, mono pulse, conical scan, Adcock antenna, ILS, GCA, PSR, PAR.

References

1. Television Monochrome & Colour Gulati, .
2. Television Engineering Grobs
3. Introduction to Radar Engineering Skolynik,

EC437 DESIGN OF COMMUNICATION NETWORK

Introduction to layered architecture overview. Packet switching and Fast packet switching. Point to Point Protocols and links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard Data Link Control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks. Multiaccess Communication and multiple access protocols: ALOHA, slotted ALOHA, CSMA, CSMA/CD. Performance modelling and analysis. Local Area Networks: Ethernet, Token Ring and FDDI. Design and analysis. Internetworking issues: Bridges, Routers and Switched networks. Routing and Flow Control algorithms in data networks. Broadband Networks: ATM, Frame relay and Gigabit Ethernet. Traffic Management in ATM networks. Network planning for digital microwave network, optical communication, satellite networks, design aspects of LAN, MAN and WAN

References

1. Analog & Digital Communication Systems Martin S. Rodess,
2. Data Communications and Distributed networks U.D Black

EC438 FUZZY LOGIC

Classical sets and fuzzy set, classical relation and fuzzy relation, properties of membership functions, fuzzification and defuzzification, logic and fuzzy systems, development of membership functions, fuzzy classification, decision making with fuzzy information, fuzzy optimization.

References

1. Fuzzy Logic with Engineering Applications T. Ross,
2. , Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and B. Yuan
3. Introduction to Fuzzy Sets and Fuzzy Logic M. Ganesh.

EC439 COMPUTER VISION

Filtering, Image Representations, and Texture Models, Color Vision, Multi-view Geometry, Projective Reconstruction, Bayesian Vision; Statistical Classifiers, Clustering & Segmentation; Voting Methods, Tracking and Density Propagation, Visual Surveillance and Activity Monitoring, Medical Imaging, Image Databases, Image-Based Rendering.

References

1. An Introduction to 3D Computer Vision Techniques and Algorithms, Boguslaw Cyganek, J. Paul Siebert
- 2 Three-Dimensional Computer Vision-a geometric viewpoint, Oliver Faugeras

EC441 BIOMEDICAL IMAGE PROCESSING

Introduction to digital image: Signal input, image matrix, digital image quality, digital image processing, picture archiving and communication system (PACS). X-Ray computed tomography: Principles of sectional imaging, data acquisition system, image formation principles, conversion of x-ray data in to scan image. 2D image reconstruction techniques: back projection, iterative and analytical methods. Viewing system, image quality and artifacts. Ultra Sound In Medicine: production of ultrasound, acoustic impedance, ultrasonic transducers and types, transmitter and detector principles. Display system: principles of A-mode, B-mode and M-mode display. Principles of scan conversion (real time imaging), image processing, Doppler Ultra sound and Color flow mapping. Application of diagnostic ultra sound. Magnetic Resonance Imaging, principles of MRI, MRI instrumentation, magnets, gradient system, RF coilsreceiver system. Relaxation processes, pulse sequence, image acquisition and reconstruction techniques, Functional MRI - Application of MRI. Radio isotope imaging / Nuclear medicine: Radio nuclides for imaging, radionuclide production: cyclotron production, reactor production, generator production. Rectilinear scanners, Linear scanners, SPECT, PET, Gamma Camera, tomographic techniques.

References

1. Biomedical Signal and Image Processing Kalyan Najarian and Robert Splinter
2. Biomedical Image Processing (Biological and Medical Physics Thomas M. Deserno
3. Advanced Biomedical Image Analysis Mark Haidekker

EC442 CAD OF DIGITAL SYSTEMS

Introduction to VLSI CAD: VLSI design methodologies, use of VLSI CAD tools, Algorithmic Graph Theory, brief concept of Partitioning and placement, floorplaning and routing.Static Timing Analysis.

References

1. Algorithms for VLSI Physical Design Automation N.A. Sherwani,
2. Algorithms for VLSI Design Automation S.H. Gerez

EC443 MICRO ELECTRO MECHANICAL SYSTEMS

MEMS Overview, Dimensional analysis and scaling, complex 3D microstructure, technology considerations, material requirements, measured signal and performance. Patterning Technology, Micro Machining Technology, Packing and Integration Future Trends: Mechanical, Optical Transducers, Biomedical and Chemical Transducers

References

1. The MEMS" handbook M.Gad-el-Hak,
2. An Introduction to Microelectromechanical systems engineering N. Maluf,

34 COMPUTER SCIENCE AND ENGINEERING

CSE211 DATA STRUCTURE

Introduction to Data Structures, Algorithm Evaluation, Arrays, Multi-dimensional, Sparse Matrices, Structure, Pointers.Stacks: applications of Stacks, Prefix, Postfix and Infix notations and conversion, Recursion, Tail Recursion, Towers of Hanoi.Queues: Types of Queue and its application.Linked lists: Types of Linked list, implementation of Stack and Queue using Linked list, Josephus Problem, Polynomial representation and Arithmetic.Trees: binary tree, n-ary Tree, Tree Traversal, Huffman Coding, Binary Search Tree, AVL Tree.Graphs: Representation, Traversing, Shortest path, Minimum SpanningTree.earching: Sequential Search, Binary Search, Hashing, Other search techniques.Sorting:

External and Internal Sort, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort, Radix Sort, Bucket Sort.

References:

1. Data Structure Using C

Tanenbaum

CSE212 DISCRETE STRUCTURES

Set Theory, Principle of inclusion and exclusion, Logic, Mathematical Induction, Discrete Probability, Graph Theory, Relations, Partially ordered sets and lattices, Boolean algebra and Boolean Function, Discrete Numeric functions, Recurrence Relations.

References

2. Elements of Discrete Mathematics

Liu C. L.

3. Discrete Mathematics for Computer Scientists and Mathematicians

Mott J. L. , Kandel A. and Baker T. P

4. Graph Theory

Harary F.

5. Introduction to Algorithms.

Thomas H. C., Leiserson C. E.; Rivest R. L.; Stein C

6. Discrete Mathematics with Applications

Thomas Koshy

CSE213 DIGITAL ELECTRONICS

Number system, radix conversion, Binary codes, Boolean algebra, Logic gates, simplification of Boolean expressions, minimization techniques. Combinational circuit: Full and half adder, Full and half subtractor, Parallel adder and subtractor, BCD adder, Excess 3 adder, Magnitude comparator, Look-ahead carry generator, Multiplexer and Demultiplexer, Encoder and Decoder. Flip-Flop: RS, clocked RS, T, D, JK, race-around problem, master – slave JK, Sequential circuits: State diagrams, Designing of sequential circuit, Minimization of sequential circuit, Synchronous and Asynchronous system, Synchronous Counter designing, Asynchronous counter, Registers, Shift registers, Serial and parallel registers, Johnson and rings counter.

References

1. Digital Electronics

Morris Mano

CSE214 DIGITAL COMMUNICATION

Characterization of communication signals, Sampling , signal space representation, equalisation, matched filtering, binary PSK, QPSK, FSK, QAM & M-Ary modulation techniques and their representation. Coherent & noncoherent detection, carrier & symbol synchronization, bits vs symbol error probability, bandwidth efficiency, Spread spectrum modulation: Pseudo noise sequences, DS & FH spread spectrum, Noise in Communication Systems

References

1. Digital Communications

Simon Haykin,

2. Principles of Communication Systems

Herbert Taub & Donald L Schilling

CSE215 COMPUTER GRAPHICS

Introduction to raster & random graphics fundamentals, Display devices & comparison Point plotting, line drawing & circle drawing & their algorithm like DDA & Bresenham's, Video Basics- Graphics input/ output devices techniques, Mouse, tablets, stylus, light pen, digitizers, and plotter Devices independent graphics systems, positioning constraints, rubber band technique, dragging, inking & painting, 2-D Transformation, Clipping, Windowing , View port, 3-D transformation, clipping , viewing transformations, projection, curve generation methods. Graphics packages, segmented files, geometric models, Picture Structure. Raster graphics, Character Displaying, Natural images Solid Area

Scan Conversion, Raster display hardware, Filling areas, aliasing & anti-aliasing Hidden surface elimination, Shading.

References

- | | |
|--|--------------------------|
| 1. Principles of Interactive Computer Graphics | William M. Newman |
| 2. Computer Graphics | D. Hern and M.P. Baker . |
| 3. Computer Graphics Multimedia and Animation | Malay k Pakhira. PHI |

CSE216 PRINCIPLES OF PROGRAMMING LANGUAGE

Priliminary concepts of programming language, Issues in Language Translation: Syntax, Semantics, Stages, analysis and synthesis, Data types, Expressions and Statements, Subprograms and Blocks, Abstract Data types, Exception handling, Logic Programming Language, Functional Programming Languages, Object-oriented programming

References

- | | |
|--|----------------------|
| 1. Concepts of Programming Languages | Robert .W. Sebesta |
| 2. Programming Languages | Louden, |
| 3. Programming languages | Ghezzi |
| 4. Programming Languages Design and Implementation | Pratt and Zelkowitz, |

CSE217 DS LABORATORY

CSE 218 PPL LABORATORY

CSE219 CG LABORATORY

CSE221 PROBABILITY AND QUEUEING THEORY

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye’s theorem. Random variables – Discrete and continuous – Distribution – Distribution function. Distribution. Binomial and poison distributions Normal distribution – related properties. Classification, Stationary process, Markov process, Binominal process, Poisson process, Birth and death process, Renewal process , Markov chain, Transition probabilities, Limiting distributions, Concepts of reliability, Hazard function, Series Classification, Stationary process, Markov process, Binominal process, Poisson process, Birth and death process, Renewal process Markov chain, Transition probabilities, Limiting distributions, Concepts of reliability, Hazard function, Series

References

- | | |
|--|--------------------------|
| 1. Probability and Statistics with reliability, Queuing and Computer Science | Trivedi K.S |
| 2 Reliability Engineering | Balagurusamy .E |
| 3 Fundamentals of Queuing Theory | Gross D, and Harris C.M, |
| 4 Probability Statistics and Queuing Theory | Allen, A.O. |

CSE222 COMPUTER ARCHITECTURE

Central processor organizations: basic building blocks, bus organized computer memory, address structure, register transfer languages, instruction formats and addressing modes. Control unit organization: hardwired control & micro-programmed control organization, control memory, address sequencing micro-instruction formats, micro-program sequencer, micro-programming. Arithmetic processor design: addition and subtraction algorithm, multiplication algorithm, division algorithm, processor configuration, and floating point arithmetic. Input-Output organization: Asynchronous Data Transfer, Asynchronous Communication Interface, Modes of Transfer: Interrupt-Initiated, Direct Memory Access (DMA). Memory Organization: Main Memory, Auxiliary Memory, Associative Memory: Hardware Organization, Cache Memory: Mapping Schemes, Virtual Memory: Address Space and Memory Space, Address Mapping. Structure of multiprocessors: parallel processing, pipeline processing.

References

1. Computer Organization and architecture
2. Computer Architecture
3. Computer Organisation & Architecture

William Stallings
Morris Mano,
T.K. Ghosh,

CSE223 THEORY OF COMPUTATION

Finite State Systems, Basic Definitions Non-Deterministic finite automata (NFA), Deterministic finite automata (DFA), Equivalence of DFA and NFA Finite automata with E-moves, Regular Expressions, Equivalence of finite automata and Regular Expressions, Regular expression conversion and vice versa, Myhill-Nerode Theorem and minimization of finite Automata. Concept of basic Machine, Properties and limitations of FSM. Moore and Mealy Machines, Equivalence of Moore and Mealy machines, Properties of Regular Sets: The Pumping Lemma for Regular Sets, Closure properties of regular sets. Context free grammar and Ambiguity, Reduced forms, Removal of useless Symbols and unit production, Chomsky Normal Form (CNF), Greibach Normal Form (GNF). Introduction to Pushdown Machines, Application of Pushdown Machines, context free grammar to PDA and vice versa, Closure properties of CFL. Deterministic and Non-Deterministic Turing Machines, Design of T.M, Halting problem of T.M., PCP Problem. Chomsky hierarchies of grammars, Context sensitive grammar, Unrestricted grammars, Context sensitive languages, Relation between languages of classes. Computability: Basic concepts, Primitive Recursive Functions.

References

1. Introduction to automata theory, language & computations Hopcroft & O.D. Ullman, R. Mohr, R. Mohr,
2. Theory of Computer Sc. (Automata, Languages and computation):
K.L.P. Mishra & N. Chandrasekaran,
3. Introduction to formal Languages & Automata Peter Linz,
4. Fundamentals of the Theory of Computation- Principles and Practice
Ramond Greenlaw and H. James Hoover

CSE224 DATABASE MANAGEMENT SYSTEMS

Fundamentals of DBMS, different data models. Relational database systems, SQL. ER modelling, Enhanced ER Model, ER to Relational Mapping. Relational Database Design, integrity constraints, functional dependency constraints, assertions, triggers, Normalization in relational approach. Data storage and indexing in database systems, overview of query processing and cost estimation. Overview of advanced databases: object oriented databases, object relational model, distributed databases, parallel databases, temporal databases, spatial databases, web & multimedia databases.

References

1. Fundamentals of Database Systems Elmasri & Navathe
2. Database System Concepts Silberschatz, Korth & Sudeshan .

CSE225 ANALYSIS AND DESIGN OF ALGORITHMS

Fundamentals of algorithm, asymptotic complexity, recursive algorithms, recurrence relation, disjoint set structure. Algorithm Design Techniques their control abstractions and related problems: Divide and conquer, Greedy strategy dynamic programming, Backtracking, Branch and bound, least cost search. Introduction to lower-bound theory, Introduction to NP-Complete and NP Hard problems.

References

1. Computer algorithms Horowitz and Sahani.
2. Introduction to algorithms Cormen and Rivest

CSE226 SOFTWARE ENGINEERING

Introduction to software engineering, software process & process models, capability maturity model (CMM). Software metrics and measurements, software project planning, scheduling and tracking, cost estimation methods and quality assurance. Requirements analysis: Principles, complexity, methods, structured analysis, SRS Documentation. Design principles: abstraction, refinement, modularity, control hierarchy, Structured partitioning, design types and methods. Software coding: coding style, coding efficiency. Software testing: Software testing techniques, choice and classification of test data, verification & validation methods. Software maintenance, configuration management, system documentation, software reusability.

References

1. An Integrated Approach to Software Engineering Pankaj Jalote,
2. Software Engineering: A Practitioner's Approach R S. Pressman,

CSE227 DBMS LABORATORY

CSE228 ADA LABORATORY

CSE229 SE LABORATORY

Fifth Semester

CSE311 COMPILER DESIGN

Compilers and translators, need of translators, structure of compiler :its different phases, Compiler construction tools. Role of lexical analyzer, design of lexical analyzer, regular expressions , Specification and recognition of tokens, input buffering, A language specifying lexical analyzer. Implementation of lexical analyzer.

Role of parsers, context free grammars, definition of parsing. Shift- reduce parsing, operator precedence parsing, top down parsing, predictive parsing. Syntax directed definition, construction of syntax trees, syntax directed translation scheme, implementation of syntax directed translation, three address code, quadruples and triples. Symbol tables, its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase error, semantic error. Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables.

References

1. Compilers Principle, Techniques & Tools Alfreed V. AHO, Ravi Sethi & J.D. Ullman
2. Theory and practice of compiler writing Tremblay & Sorenson
3. System software Dhamdae

CSE312 OPERATING SYSTEMS

Operating system functions and characteristics, design issues, Process abstraction, process management, system calls, threads, process hierarchy, cpu scheduling, comparative study of scheduling algorithms Process synchronization and inter-process communication, message passing mechanisms, Process synchronization constructs Deadlock Characterization, prevention and avoidance, deadlock detection and recovery. Memory management techniques, overlays, dynamic linking, virtual memory concept. Disk structure, Disk scheduling, File System, file access and allocation methods, directory system, file protection mechanisms, implementation issues, Device Management: Hardware organization, device scheduling policies, device drivers. Case Studies: Windows, Unix, Linux.

References

1. Operating system Silberschatz and Galvin
2. Operating system Deital
3. Operating system Andrew S. Tanenbaum

CSE313 MICROPROCESSORS

The processor: 8086/8088-Architectures, 8086/8088 instruction set and Addressing modes, Assembly language programming with 8086/8088, Special Architecture feature: interrupts and interrupt programming, Basic peripherals and their interfacing with 8086/8088, Special purpose programmable peripheral devices and their interfacing, DMA Floppy Disk and CRT controllers, An overview of RISC & CISC processors, An introduction to microcontroller 8051.

References

- | | |
|--|-------------------------|
| 1. Advanced Microprocessor and peripherals | A K Ray, K M Bhurchandi |
| 2. Microprocessor | D.V Hall |
| 3. 8051 Microcontroller | K.J Ayala |

CSE315 CD LABORATORY

CSE316 μ P LABORATORY

CSE 317 OS LABORATORY

Sixth semester

CSE321 COMPUTER NETWORK

Introduction to TCP/IP and OSI reference model, polling techniques, multiplexing, and concentration , transmission media used in physical layer. MAC protocols ALOHA, CSMA/CA, CSMA/CD Ethernet, token bus, token ring, (IEEE 802.3, IEEE 802.4, IEEE 802.5) DLL protocols, error correction and detection codes, flow control protocols performance evaluation with error or without error, protocol specification and verification, framing, HDLC. Switching techniques, Routing and congestion in network layer, routing and congestion control algorithms. Connection management in transport layer, protocols of transport layer, TCP , UDP etc. Data security and cryptography techniques, concepts of public key and private key cryptography, world wide web(www), electronic mail(E-mail), Queuing theory, Study of high speed fiber optic networks, FDDI, SONET, ATM, X.25 network, ARPANET, USENET etc.

References

- | | |
|---------------------|------------------------|
| 1.Computer Network | Tannenbaum. |
| 2. Computer Network | W.Stalling. |
| 3. Data network | Dimitris and Galliger. |

CSE322 DATA WAREHOUSING AND MINING

Introduction to data mining - kinds of data, relational databases, traditional databases, advanced database systems. Data Mining functionalities and patterns generated. Data Preprocessing: - Data Cleaning, Data Integration and Transformation, Data Reduction Data Discretization, Concept Hierarchy Generation Data Warehouse and OLAP Technology - A Multidimensional Data Model Stars, Snow flake and Fact Constellations Schemas for Multidimensional Databases, OLAP operations, Data Warehouse Architecture Associations and Correlations- The Apriori Algorithm, Finding Frequent Item sets Using Candidate Generation Mining, Frequent Item sets without Candidate Generation Mining, Frequent Item sets Using Vertical Data Format Classification- Classification by Decision Tree Induction, Bayesian Classification Rule-Based Classification, Associative Classification Prediction- Linear Regression and Non linear Regression Clustering- Portioning and hierarchical Methods Mining Social Network, spatial databases, multidimensional databases, text databases and World Wide Web.

References

- | | |
|--|--|
| 1.Data Mining: Concepts and Techniques | Jiawei Han, Micheline Kamber and Jian Pei, |
| 2.Data Mining Introduction and Advance Topic | Margaret H. Dunham and S. Sridhar |

CSE323 ARTIFICIAL INTELLIGENCE

Meaning and definition of artificial intelligence, Production systems: types, characteristics, study and comparison search techniques:BSF, DSF,hill climbing, best first search, A* algorithm, AO* algorithm etc,types of control strategies. Knowledge representation: Problems faced, propositional and predicate logic, resolution and refutation, deduction, theorem proving. Reasoning: introduction, reasoning methods, Baye's theorem, Bayesian network, fuzzy logic. Slot and filler structures: semantic networks, frames, conceptual dependency,scripts etc. Game playing and its techniques, planning techniques, study of blocks world problem in robotics, understanding, natural language processing and common sense. Learning and its techniques, neural networks and its applications, expert systems.

References:

- 1.Artificial Intelligence Elaine Rich and Kevin Knight .
- 2.Introduction to Artificial Intelligence Eugene Charniak and Drew McDermott

CSE325 NETWORK LABORATORY

CSE326 UNIX LABORATORY

CSE 327 MINOR PROJECT

Department electives

CSE331 ADVANCE COMPUTER ARCHITECTURE

Pipeline processor principles and design, Instruction set architecture; Memory addressing; Instruction composition; Instruction-level parallelism; Hazards: dynamic scheduling, branch prediction; Memory hierarchy; Processor case studies; Multiprocessor introduction: Shared-memory architectures and their synchronisation and consistency issues, Advanced multi-core topics; Transactional Memory; Interconnection networks.

References

- 1.Computer Architecture and parallel processing Kai Hwang, Briggs
- 2.Advanced Computer Architecture: Parallelism, Scalability, Programmability Kai Hwang,
3. Computer Architecture: A Quantitative Approach, . J. L. Hennessy and D. A. Patterson
4. Parallel Computer Architecture: A Hardware/Software Approach David Culler, J.P. Singh and Anoop Gupta

CSE332 SOFTWARE REUSABILITY

Software Engineering Process, Software Reuse Factors, Reuse driven Software Engineering Business, Overview of software reuse metrics.Architectural Style: Object oriented software engineering Application and component systems, Use Case Components, Object components, Layered architecture.Approaches for software reuse - Patterns, Frameworks and Components.Pattern and Framework Approaches: Design patterns, Analysis patterns, Organizational patterns, Anti-patterns. Creational Patterns, Structural Patterns, Behavioural Patterns, Architectural Patterns.Component System Engineering & Application System Engineering: Requirement analysis, Robustness analysis, Designing, Implementing, Testing and Packaging of the Component system.Case Studies.

References

- 1 Reusability and Software Construction: C and C Jerry D. Smith.
- 2.Design Patterns: Elements of Reusable Object-Oriented Software Richard Helm, Erich Gamma, John Vlissides and Ralph Johnson.
- 3.Reuse-Based Software Engineering: Techniques, Organizations, and Controls HafedhMili and Sherif M. Yacoub.
- 4 Software Reusability Wilhelm Schafer , Diaz Prieto and Wilhelm Shafer .

CSE333 VLSI DESIGN

Digital Systems And VLSI, Basic Electrical Properties Of Cmos, Data Structure in VLSI design, Fabrication And Devices, Logic Gates, Combinational Logic Networks, Sequential Machines, Subsystem/ Peripheral Design, Validation And Testability, Floor planning And Architecture Design

References

1. Modern VLSI Design: IP-Based Design

Wayne Wolf

2. Basics VLSI Design

Pucknell and Eshraghian

CSE334 PARALLEL AND DISTRIBUTED ALGORITHMS

Introduction to parallel algorithm, data parallel and control parallel approach, models of parallel computation, dense matrix algorithm, sorting searching, selection and graph algorithms. Introduction to distributed algorithms, synchronous algorithms network model, leader election algorithm, minimum spanning tree, shortest path, distributed consensus k agreement problem, two phase commit, three phase commit, mutual exclusion algorithms, applications of distributed algorithm.

References

1. Parallel algorithms

Michael . J . Quinn

2. Distributed algorithms

Nancy Lynch

CSE335 DISTRIBUTED DATABASE

Introduction to Distributed Database Systems, Distributed DBMS Architecture, Distributed Database Design, Semantic Data Control, Overview of Query Processing, Introduction to Transaction Management, Distributed Concurrency Control, Parallel Database Systems, Distributed Object Database Management systems, Database Interoperability

References

1. Principles of Distributed Database Systems

M. Tamer Ozsu Patrick Valduriez

2. Distributed Databases Principles and Systems

Stefano Ceri and Giuseppe Pelagatti,

CSE336 EMBEDDED SYSTEMS

Introduction, Hardware & electronics fundamentals, Peripherals Program Design and Analysis, Processes and Operating system, Real time **Operating system** Memory, Interfacing Examples of Embedded systems: Digital Camera Examples, Smart card application, Embedded database applications, etc. State Machine and Concurrent Process Models, Control Systems Verilog programming, Programming of mobile and Hand-held devices **IC Technology** Full-Custom (VLSI) IC Technology, Semi-Custom (ASIC) IC Technology, Programmable Logic Device (PLD) IC Technology, FPGA Hardware Software Partitioning, Hardware/Software Co-Simulation, Intellectual Property Cores, Low Power design

References

1. Embedded system Design

Frank Vahid, Tony Givargis

2. Computer as Components

Wayne Wolf

3. 8051 Microcontroller & Embedded Systems

Rajiv Kapadia

4. The 8051 Microcontroller & Embedded Systems,

Mazidi & Mazida

CSE337 CRYPTOGRAPHY

Introduction to cryptography. Security Attacks, mechanism and Services. Cryptosystems, Conventional encryption model and techniques, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers. Block ciphers principals, feistel structure, SPN, DES, triple DES, AES, IDEA encryption and decryption, key distribution. finite field: Introduction to group, ring and field, modular arithmetic, Fermat's and Euler's theorem, Euclid's Algorithm, Chinese Remainder theorem, Entropy and Huffman's coding, Comparison of symmetric and public-key cryptographic systems, Principals of public key crypto systems, RSA algorithm, Diffie-Hellman key exchange

algorithm, Message Authentication and Hash Function: security of hash functions and MACS, MD5 message digest algorithm, secure hash algorithm (SHA). Digital Signatures.

References

- 1.Cryptography and Network Security: Principles and Practice William Stallings,
- 2.Cryptography Theory and Practice Douglas R. Stinson.

CSE338 HETEROGENEOUS COMPUTING

Heterogeneous computing: Overview, Types of system, Areas of heterogeneity, Shortcomings of Homogeneous System.

Heterogeneous computing by multiple CPUs: Grid, Cluster and Other multi-core architectures.

Heterogeneous computing using CPU-GPU: Overview of GPUs, Introduction of GPGPU, Architecture, Features, Programming model, Thread Organization, Memory management, GPU-CPU load balancing, Optimization, Floating Point Performance, Multiple GPUs.

Case study: GPGPU based Heterogeneous computing by OpenCL and CUDA.

References

- 1.State-of-the-art in heterogeneous computing Andre R. Brodtkorb
- 2.Heterogeneous Processing: a Strategy for Augmenting Moore's Law, Amar Shan,
- 3.Heterogeneous Computing with OpenCL Benedict Gaster

CSE339 DIGITAL IMAGE PROCESSING

Introduction to Image Processing Systems, Digital Image Fundamentals:- Image model, Relationship between Pixels, Imaging geometry, Camera model. Image Sensing and Acquisition.Sampling and quantization.Image Enhancement and in spatial Domain: Point processing, NeighbourhoodProcessing,High pass filtering , High boost filtering, zooming. ImageEnhancement based on Histogram medelling.Image Enhacement in frequency domain: 1D& 2D Fourier transform, Low pass frequency domain filter, High pass frequency domain filters, Homomorphics filtering.Image Segmentation:- Detection of discontinuation by point detection, line detection, edge detection. Edge linking and boundary detection:- Local analysis, global by graph, theoretic techniques. Thresh-holding.orphology,Representation and description.Discrete image transform.ImageCompression.Wavelet transformation.

References

- 1.Digital Image Processing Gonzalez & Wood
- 2.Digital Image Processing A.K.Jain
- 3.Image Processing Dhananjayk.

CSE341 E-COMMERCE AND E-GOVERNANCE

Introduction: Electronic Commerce, Technology and Prospects, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, E-Commerce Strategy, E-Commerce emerging Issues and implementation issues, E- Commerce Law, Govt. policies and Agenda. Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce. E-payment security.E-Government, theoretical background of e-governance, issues in e-governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e-governance, e-governance models- broadcasting, critical flow, comparative analysis, mobilization and lobbying ,interactive services / G2C2G.E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nation wide networking in e governance, e-seva.E-Government systems security: Challenges and

approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

Seventh semester

CSE411 SOFT COMPUTING

Introduction to neural networks, Working of an artificial neuron, Perceptron, Back propagation algorithm, Adalines and Madalines. Supervised and unsupervised learning, Counter-propagation networks, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Neocognitron, **Associative memory**, Bidirectional Associative Memory. Introduction to fuzzy logic and fuzzy sets, fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules, Process control using fuzzy logic, Decision-making fuzzy systems, Applications of fuzzy logic, Hybrid systems like neuro-fuzzy systems. Evolutionary Computation: Population-based Search: genetic algorithms and evolutionary computation, Genetic Programming. Search techniques like Simulated Annealing, Tabu search etc.

References

- | | |
|--|---------------------------|
| 1. Soft Computing and Intelligent Systems Design | F.O.Karray and C.DeSilva, |
| 2. Neural Networks, Fuzzy Logic and Genetic Algorithms | Rajsekaran and Pai |

CSE412 SOFT COMPUTING LABORATORY

CSE413 MAJOR PROJECT AND SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by department committee formed by HOD

CSE414 EDUCATIONA TOUR / INDUSTRIAL TRAINING

Student has to select the industry for his/her training program. After the training , student has to submit a report about the training. Based on the report and presentation, student will be evaluated by department committee formed by HOD

Eighth Semester

CSE421 NETWORK SECURITY

Introduction to Network security: Network security needs. Threats to network security, kind of computer security. security policies, security mechanisms, Attacks, security tools and Basic Cryptography, Transposition/Substitution, Block Cipher Principles, Introduction to Symmetric crypto primitives, Asymmetric crypto primitives, Secret Key Cryptography , Data Encryption Standard (DES), Message Digests, MD5, Message Authentication and Hash Functions, Hash And Mac Algorithms, RIPEMD , HMAC, Principles of Public Key Cryptosystems, Diffie Hellman Key Exchange , Elliptic Curve Cryptography, Cryptanalysis, SHA-1, RSA, Selection of public and private keys. Key distribution centers and certificate authorities, digital signature standards (DSS), proof of digital signature algorithm. Kerberos, Real-time Communication Security, IPsec, Electronic Mail Security . Firewalls and Web Security, Intruders and Viruses, trusted system, password management. Cyber crime

References

- | | |
|--------------------------------------|-------------------|
| 1. Cryptography and Network Security | William Stallings |
| 2. Introduction to network security | Krawetz, Cengage |

CSE422 MAJOR PROJECT AND SEMINAR

The student has to select a project work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts in seventh semester and continues through eighth semester. The end of each semester student will be evaluated by department committee formed by HOD

CSE423 GENERAL PROFICIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc.

Department electives

CSE431 SOFTWARE TESTING

Software Testing Principles, Quality, Testing flow process. Defect Classification: Origin of Defects, Classes, Repository and Design, Developer/Tester Support for Developing a Defect Repository. Test Case Design Strategies: Black Box Approach, Random Testing, Equivalence Class Partitioning, Boundary Value Analysis, COTS, White Box approach, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Additional White Box Test Design Approaches, Evaluating Test Adequacy Criteria. Unit testing, Integration testing, System testing, Regression testing and Acceptance testing, Test Plan Writing. Testing Tools. Criteria for Test Completion.

References:

1. Software Testing in the Real World – Improving the Process Edward Kit
2. Effective Software Testing Elfriede Dustin

CSE432 CLOUD COMPUTING

Cloud Computing: Introduction, Working of cloud computing, benefits; Understanding Cloud Computing: Developing cloud computing services, Discovering cloud services; Cloud Computing for Everyone: Centralizing email communications, Cloud computing for community; Cloud Computing for the Corporation: Managing Schedules, Managing Projects; Using Cloud Services: Collaborating on Calendars, Schedules, and Task Management, Collaborating on Project Management Outside the Cloud: Other Ways to Collaborate Online: Collaborating via Web-Based Communication Tools, Collaborating via Social Networks and Groupware.

References

1. Cloud Computing Michael Miller,
2. Implementing and Developing Cloud Computing Applications David E., Y. Sarna,

CSE433 DISTRIBUTED COMPUTING

Distributed Computing: Introduction, Types, Various system models. Communication and Processes: RPC, RMI and others, Client and Server threads. Clock Synchronization: Types of clock and their synchronization, Introduction to distributed mutual exclusion, Election of a process, Consensus and related problems; Consistency: Various types of consistency, Consistency protocols, Fault tolerance: Introduction to fault tolerance, Process resilience; Protection and security in distributed systems: Various types of security techniques, Cryptography; Examples of distributed systems: Distributed file systems, Distributed shared memory and others.

References

1. Distributed Systems Principles and paradigms Andrew S. Tanenbaum and Maarten
2. Distributed systems, concepts and design, George Colouris, Jean Dollimore and Tim Kindberg.

CSE434 PATTERN RECOGNITION

Introduction to Pattern Recognition, Regular Pattern, Irregular Pattern, Approaches to Pattern Recognition, Parametric, Non-Parametric Approaches. Parzen window method for density estimation, Feature selection, Search methods, Pattern Recognition Applications., Discriminant functions, Decision surfaces, Classification algorithms: Naive Bayes, Random Tree, Random Forest, , Multiple Polynomial Regression, Classification using SVM. Classifier Ensembles, , Linear Regression, Introduction to hidden Markov models (HMMs), Discrete HMMs and Evaluation problem, Forward method for evaluation problem, Backward method for evaluation problem, Parameter estimation for HMMs, Continuous density

HMMs (CDHMMs), Types of Clustering, K-Mean Clustering, Iso-data Clustering, Clustering Metrics, Clustering applications, Fuzzy K-Mean, Clustering tendency, Semi Supervised learning. Fuzzy variants of classification and clustering algorithms, Neural networks fundamentals, Genetic Algorithms, Neural and Genetic based approaches for Pattern recognition, Self organizing maps, Advantages/Disadvantages of Neural based approaches for Pattern Recognition.

References

- | | |
|---|-------------------|
| 1. Pattern recognition and image processing | Earl Gose |
| 2. Pattern classification | Duda ,Hart,stork. |

CSE435 COMPUTER VISION

Introduction to computer vision, computer imaging system, Image formation and sensing CVIP tools, Image representation. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization. Image Enhancement in the Spatial Domain, Image Enhancement in the Frequency Domain, Homomorphic Filtering. Image Restoration, Color Image Processing, Segmentation, Thresholding, The Use of Motion in Segmentation, Image Compression, Error-Free Compression, Lossy Compression, Image Compression Standards, Wavelets and Multiresolution Processing, Multiresolution Expansions, Wavelet Transforms.

References

- | | |
|--------------------|-----------------|
| 1. Computer Vision | Young, Tzay Y. |
| 2. Computer vision | Dana H. Ballard |

CSE436 RANDOMIZED ALGORITHMS

Introduction to randomized algorithms. Game Theoretic Techniques. Probabilistic Method, Markov Chains and Random Walks. Randomized Data Structures: Treaps, skip lists, Hash tables. Geometric algorithms and linear programming, Graph algorithms, Approximate Counting, Online Algorithms.

References

- | | |
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| 1. Randomized Algorithm | Motwani and Raghavan |
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CSE437 NATURAL LANGUAGE PROCESSING

Regular Expressions and Automata, N-grams, Part-of-Speech Tagging, Hidden Markov and Maximum Entropy Models, Formal Grammars of English, Syntactic Parsing, Statistical Parsing, Features and Unification, Language and Complexity, The Representation of Meaning, Computational Semantics, Computational Lexical Semantics, Information Extraction, Question Answering and Summarization, Machine Translation

References

- | | |
|---|---------------------------|
| 1. Speech and Language Processing: An Introduction to Natural Language Processing,
Computational Linguistics, and Speech Recognition | D. Jurafsky and J. Martin |
| 2. Foundations of Statistical Natural Language Processing | C. Manning and H. Schutze |

CSE438 MOBILE COMPUTING

Introduction to Mobile Communications and Computing, novel applications, GSM: Mobile services, System architecture, and new data services. (Wireless) Medium Access Control :Motivation for a specialized MAC, DMA, FDMA, TDMA, CDMA. Mobile Network Layer :Mobile IP, IP packet delivery, Dynamic Host Configuration Protocol (DHCP). Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP. Database Issues: client server computing with adaptation, transactional models, and quality of service issues. Mobile Ad hoc Networks (MANETs): Properties of a MANET, spectrum of MANET applications, routing and various routing

algorithms, security in MANETs. Protocols and Tools: Wireless Application Protocol-WAP. Bluetooth and J2ME.

References

- 1.Mobile Communications Jochen Schiller
- 2.Handbook of Wireless Networks and Mobile Computing Stojmenovic and Cacute
- 3.Fundamentals of Mobile and Pervasive Computing
Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren

CSE439 QUANTUM COMPUTING

Quantum Computing: Overview of traditional computing and Quantum computing, Church-Turing thesis, Circuit model of computation, Quantum physics and Computation, Dual vectors, Operators; Qubits and Quantum model of computation: State of a quantum system, Time evolution of a closed system, Composite systems, States and general quantum operations, Quantum gates, Universal sets of quantum gates; Quantum Algorithms: Superdense coding, quantum teleportation, probabilistic versus quantum algorithms, phase kick-back, the Deutsch algorithm, Quantum phase estimation and Quantum Fourier Transform, Shor's algorithm for order finding, Quantum search algorithm; Quantum computational complexity and error: Computational complexity, Black-box model, Lower bounds for searching, General black-box lower bounds, Classical error correction, Fault tolerance, Quantum error correction.

References

- 1.Quantum Computing V. Sahni,
2. An introduction to Quantum Computing P. Kaye, R. Laflamme, and M. Mosca,

CSE441 SENSOR NETWORKS

Introduction of ad-hoc/sensor networks: key definitions, advantages, unique constraints and challenges, applications, and wireless communications/radio characteristics. Media Access Control and routing protocols for Ad-Hoc wireless networks: issues, classification and protocols. Networking Sensors: features, deployment of sensor networks, sensor tasking and control. Sensor Network platforms and tools: Berkeley Motes, Sensor network programming challenges, Embedded Operating System. Transport layer, QoS issues and security protocols for ad hoc and sensor networks. Simulators for wireless ad hoc and sensor networks. Applications of Ad-Hoc/Sensor Network and Future Directions.

References

- 1.Ad hoc Wireless Networks C. Siva Ram Murthy & B. S. Manoj
- 2.Wireless Sensor Networks: An Information Processing Approach Feng Zhao and Leonidas J. Guibas,

CSE442 WEB SEARCH & MINING

Introduction, Document Representation, Tokenization, term-document matrix, Query languages and query, operation, Indexing and searching, clustering, ranking, Ontology, domain specific search, Parallel and distributed information retrieval, Text and multimedia languages, Social networks.

References

1. An introduction to Information Retrieval Manning, C., Raghavan, P., and Schutze, H
2. Mining the web: Mining the Web: Discovering knowledge from hypertext data. Chakrabarti, S

Open electives for third years

CE351 REMOTE SENSING AND GIS

Definitions and introduction to remote sensing, components of remote sensing system, active and passive remote sensing, electromagnetic radiations and their interactions with the earth features and atmosphere. Spectral windows and spectral signatures and their significance in remote sensing. Radiometric quantities used in the collection of spectral signatures. Remote sensing satellite orbits, image acquisition process, receptivity, row/path and ground swath and coverage.

Various remote sensing platforms like ground based, air borne and satellite based. Passive and active remote sensors.

Geometry, radiometry and pre-processing of remotely sensed imagery. Ground truth collection and geo-referencing of imagery. Characteristics of photographic images, colour, tone and texture, photo-interpretation keys, techniques of photo-interpretation. Digital image classification techniques and extraction of thematic information. Raster to vector data conversion, coordinate systems for the mapping, datums, map projection, analytical transformation, rubber sheet transformation, rectification and registration, manual digitizing and semi-automatic line following digitization

Geographic Information System (GIS) – Definition of GIS, Geographical concepts and terminology, Components of GIS, Data acquisition, Raster and vector formats, scanners and digitizers. Methods of digitization, different types of maps used in engineering projects and their conversion into digital form using digitization and scanning. Introduction to GPS technology and its role in GIS data input, GPS receivers, GPS observation methods and their advantages over conventional methods.

Attribute database: scale and source of inaccuracy. GIS data storage and data retrieval through query, generalization, classification, Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Application of GIS in various natural resources mapping and management and various Civil Engg. projects.

References:

1. Remote Sensing and image interpretation Lillesand T.M. and Kiefer R. W
2. Introduction to remote sensing J. B. Campbell.
3. Principles of Geographic Information Systems for land Resources Assessment P.A. Burrough

CE352 ENVIRONMENTAL MONTORING

Environmental Acts - Their need, historical background, National and International Acts and Agreements. Major National Acts – The Water (prevention and control of pollution) Act, The Air Act, The Environment (protection) Act, Hazardous waste Rules, Biomedical Waste (Management and Handling) Rules,, Municipal Solid Waste Rules, Batteries (Management and Handling) Rules, e-waste (management and handling) Rules, Prevention of Cruelty to Animals (Slaughter House) Rules, Slaughter Act. ISO: 14000 - its need, procedure and significance, ISO: 14000 Certification, National Certifications, Role of BIS. Role of Public Hearing, Non Governemntal Organisations and their role, Role of Civil Society, and Judiciary. Amendments to various Acts from time to time.

References

1. Environmental Legislation in India K.R. Gupta
2. Environmental Law DS Sengar

3 ISO 14001 and beyond: environmental management systems in the real world

CE353 RENEWABLE ENERGY SYSTEMS

Global and National energy scenario, Conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Solar energy system, introduction to wind energy conversion, Wind turbines, Wind farms, Bio energy system, design and constructional features.

Hydel energy system, Types of Hydro power plant, Importance of small hydro power plants, and their Elements, types of turbines for small hydro, estimation of primary and secondary power. tidal and wave energy its scope and development, Scheme of development of tidal energy, thermal renewable energy systems, appropriate energy technology for rural development, energy conservation, environmental aspects of renewable energy systems.

References

- | | |
|-------------------------------------|---------------------|
| 1. Energy conservation systems | Rakosh das begmudre |
| 2. Non conventional energy sources | GD Das: |
| 3. Solar Energy by Padmashree | S.P. Sukhatme |
| 4. Solid waste Conversion to Energy | Harvey A., Dunn J.J |

CE354 RAINWATER HARVESTING

Concept and characteristics of watershed, planning and management watershed, ground water, need for artificial recharge and rainwater harvesting, wells - drilling technology - design, construction and development

Selection of artificial recharge zones, estimation of probable runoff from an area including from roof tops, artificial recharge structures: ponds, pits, wells, bore wells.

Rainwater harvesting in urban areas: Roof top rain water harvesting structures - design - construction maintenance and monitoring of RWH structures

Effect on local groundwater environments - remedial measures. Recycling of domestic water - sources of water for recharge in urban areas.

References

- | | |
|---|-----------------------------|
| 1. Groundwater Hydrology | David Keith Todd |
| 2. Rainwater Harvesting Techniques to augment Groundwater | Ministry of Water Resources |
| 3 Groundwater and Wells | Edward E.Johnson |

CE342 ENVIRONMENTAL QUALITY MONITORING

Principals of instrumentation: advantages, applications and limitations of the analytical techniques- Spectrophotometry, Atomic absorption and emission spectrophotometry, Flame photometry, Nephelometry, inductively coupled plasma spectrometry, mass spectrometry, FTIR, NMR Electrochemical methods: Polrography, ionselective electrodes

Chromatography: Classification, general ideas about absorption, partition and column chromatography, paper and thin layer chromatography, Gas chromatography, High performance liquid chromatography, ion chromatography

Remote Sensing Application: Basics of remote sensing, Application of remote sensing in environmental monitoring – landforms, soil, vegetation, land use and wetland mapping Monitoring of Air Quality Parameters: Methods, Equipments, Standards Monitoring of Water and Soil Quality Parameters: Methods, Equipments, Units and Standards Environmental quality modeling, Environmental quality indices, Noise pollution and its monitoring.

References

- | | |
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| 1. Quality assurance in environmental monitoring: Instrumental methods | _G. Subramanian |
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ME351 OPERATIONS RESEARCH

Introduction: Definition and scope of operations research, problem formulation and model construction. Linear Programming: Concept of optimality, graphical solution, simplex method, duality, sensitivity analysis, degeneracy. Transportation and assignment model: Transportation and assignment problems as special cases of linear programming, balanced and unbalanced transportation problem, assignment problem, Integer programming, Gomory cut plane method, Branch and bound Algorithm. Inventory System: Definition, structure of inventory system, EOQ, deterministic models and their relation, multi item inventory problem, Markov's chain analysis.

Replacement analysis: Replacement of capital equipment, discounting cost, replacement in anticipation of failure, group replacement, Game theory: Pay off matrix, competitive games with pure strategy, minimax criteria, principles of dominance and mixed strategies, Network analysis: Project planning, difference between PERT and CPM, crashing of network, resource leveling, probability calculations in PERT analysis.

Queuing theory: Introduction to probability theory, queuing problem, case of poisson arrivals and exponential service time for single channel system, simulation, Montecarlo methods Applications of simulation in engineering, Introduction to dynamic programming, solution methods, goal programming, examples, Introduction to non linear programming, unconstrained optimization, genetic algorithms, simulated annealing, particle swarm optimization methods.

References

- | | |
|-------------------------------------|--------------------------|
| 1. Operation Research | P.K. Gupta & D.S. Hira |
| 2. Operation Research | Sesiani, Arkoff & Arkoff |
| 3. Principles of Operation Research | Wagner |
| 4. Operation Research | A.P.Verma |

ME354 STATISTICAL QUALITY CONTROL (SQC)

Introduction to Quality Control, Fundamentals of statistical concepts and techniques in quality control and improvement, graphical methods and data representation. Statistical process control using control charts, Control charts for variables and attributes, Process capability analysis. Acceptance sampling plans for attributes and variables, operating characteristic curves, A & L system for Lot by Lot acceptance sampling, Sampling plans, MILSTD411, Dodge -Romig sampling plans, LTPD, AOQL.

Chain sampling, Continuous sampling, Skip lot, Economic design of sampling plans. Life testing, Life cycle curve and probability distributions in modelling reliability, system reliability. Experimental Design and Taguchi Methods, Factorial designs, Signal to noise ratio, Taguchi definition of Quality

References

- | | |
|-----------------------------------|------------------------|
| 1. Statistical quality control | Douglas C. Montgomery, |
| 2. Statistical quality control by | Grant Leaven worth |
| 3. Quality planning and analysis | J.Juran |

ME355 INDUSTRIAL SAFETY ENGINEERING

Training for Safety: Industrial training, training in workshop and laboratories, schools, colleges and universities, communicating the safety message, Safe Practices in Industry and Chemical Handling: Commercial vehicles, compressed air, entry into confined spaces, fire control manual, automatic, static electricity, grinding operations, ionizing radiation, mechanical safety and electrical control,

gear manual handling, mechanical handling, running pipes, steam boilers and pressure vessels welding operations.

Provisions for safe working: Commercial occupations, construction industry, port transport industry, getting standards for safe equipment, working with machinery. Creating a safe environment, ergonomics as an aid to safety. Lighting for safety. Noise control. Safety colors, signs and codes, Personal Protection and welfare: Medical services, first aid and causality treatment, eye protection, personal equipment and protection, respiratory equipment, skin care, Some view on Safety: The role of factory inspectorate, safety organization in the works, trade unions and safety, legal aspects of industrial safety, the cost of industrial injuries.

References

- | | |
|--------------------------------------|------------------------------|
| 1. Safety Management | John V. Grimaldi & Rollin H. |
| 2. Industrial Safety Hand Book | William Hand ley |
| 3. Safety Security & Risk Management | V.K. Singh |

ME356 ADVANCED MECHANICS OF MATERIALS

Shear force and bending moment diagram in Fixed and Continuous Beams. Area moment method. Clapeyron's theorem.

Unsymmetrical bending. Stresses in beams of unsymmetrical cross sections. Stresses in curved beams. Castiglano's theorem.

Thin rotating rings. Thin rotating disc and cylinders. Disc of uniform strength. Thermal stresses in rotating disc and cylinders.

Torsion of non-circular shafts. Elliptical, rectangular etc. sections. Problems of stress concentration. Methods of reducing stress concentration. Residual stresses. Methods to find residual stresses.

Experimental Stress Analysis. Determination of strains through strain gauges. Resistance strain gauge, Theory of photoelasticity.

References

- | | |
|---|-----------|
| 1. Mechanics of Materials Vol.1 & Vol.2 | E.J.Hearn |
| 2. Strength of Materials | Rajput |

EE351 COMPUTER APPLICATIONS IN POWER SYSTEM

Introduction to Electric supply industry structure under Deregulation, Regulatory and policy Developments, Power system components and representation, Load Flow Studies, Optimal Load Flow Study, Power System Restructuring, Transmission pricing, Role of FACTS in competitive Power Market.

Reference

- | | |
|---|---|
| 1. Computer Methods in Power system Analysis | A.H.El.Abiad |
| 2. Electricity Market Investment Performance and Analysis | B. Murrey |
| 3. Power System Restructure Engineering & Economics | M.Ilic, F.Faliana and L.Fink, Kluwer |
| 4. Restructured Electrical Power System Operation Trading and Volatility by | Mohammad Shahidhpour and Muwaffaq Almoush |

EE352 ENGINEERING ECONOMICS: MODELLING AND POLICY ANALYSIS

Models and modeling approaches; input-output analysis; energy aggregation; factor decomposition analysis; mathematical optimization techniques for energy modeling; energy system models; modeling energy-economic and environmental interactions; model applications in energy technology assessment, alternative energy resource assessment and energy and environmental policy analysis.

References

1. Modeling Energy Markets and Climate Change Policy, Energy Modeling Forum
H.G. Huntington and J.P. Weyant,
2. Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report, 2007.
3. Hybrid Modeling of Energy-Environment Policies: Reconciling Bottom-Up and Top-Down,
J.C. Hourcade, M. Jacard, C. Bataille, and F. Gheri
4. Principles of Macroeconomics, J.B. Taylor, 5 .N. G. Mankiw,

EE353 DEMAND SIDE MANAGEMENT

Concepts and Methods of DSM: Load Control, Energy Efficiency, Load Management, DSM Planning, Design, Marketing, Impact Planning, Customer Load control: Direct, Distributed and local control, Interruptible load, Assessment of Impact on load shape, Strategic conservation and Load management technologies: strategic Conservation, Improving Building envelope, Air-conditioning, Lighting, Electric motor, and other Industrial processes and equipments, Customer Incentives, Program Marketing Design and Assessment of Program Penetration, Hierarchical process for assessment of customer acceptance and program penetration, Impact of DSM Programs on load shapes in Customer's group categorized in economic sub-sectors, and by geographical location, Cost/Benefit analysis and feasibility of DSM programs, Integrated Electric Utility Service under deregulated situation.

EE354 BIO-MEDICAL ENGINEERING

Introduction to the physiology, sources of biomedical signals, Medical instrumentation system, Potential, Electrodes, Cardiovascular measurement, Measurement of Blood Pressure, Blood Flow, ECG, Phonocardiography, Plethysmography, Pace-maker, Defibrillator, Measurement of Electrical Activities in Muscles and Brain, EMG, Measurement of Respiration rate, Instrumentation for Clinical Laboratory, Medical Imaging-Ultrasound Imaging, Radiography, MRI, Electrical Tomography and Applications, Biotelemetry, Aspect of patient care monitoring, Electrical shock hazards and prevention.

References

1. Handbook of Biomedical Instrumentation R. S. Khandpur
2. Biomedical Instrumentation and Measurements, L. Cromwell, F. J. Weibell and E. A. Pfeiffer

EE355 NETWORK SYNTHESIS

Positive Real Functions: Driving point functions, Brune's Positive Real Function, Hurwitz Polynomial, Driving point synthesis with LC element, Foster and Cauer Form of RC and RL network, Foster and Cauer Form of LC network, Series and parallel realizations, symmetrical Lattice and Constant-Resistance Network.

References

1. Introduction to modern network synthesis M.E. Van Valkenburg,
2. Network Analysis and Synthesis Pankaj Swarnkar

CHE 351 RISK ANALYSIS AND HAZARD

Origin of process hazards, Laws Codes, Standards, Case Histories, Properties of Chemicals, Health hazards of industrial substances. Toxicology: Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation. Fire & explosion: Fire and explosion hazards, causes of fire and preventive methods. Flammability characteristics of chemical, fire and explosion hazard, rating of process plant. Propagation of fire and effect of environmental factors, ventilation, dispersion, purifying and sprinkling, safety and relief valves. Other Energy Hazards: Electrical hazards,

noise hazard, radiation hazard in process operations, hazards communication to employees, plant management and maintenance to reduce energy hazards. Risk Analysis: Component and plant reliability, event probability and failure, plant reliability, risk analysis, HAZOP AND HAZAN, event and consequence analysis (vapour cloud modelling) Designing for safety, measurement and calculation of risk analysis. Hazard Assessment: Failure distribution, failure data analysis, modeling for safety, safety training, emergency planning ad disaster management, case studies.

References

- | | |
|--|---------------------------|
| 1. Chemical process safety fundamentals with applications, | Crawl D.A. and Louvar J.A |
| 2.. Safety health and environmental protection, | Wentz, C.A |
| 3.. Design of equilibrium state process, | Smith, B.D |
| 4. Distillation | Van Winkle |

CHE 352 ENVIRONMENTAL IMPACT AND ASSESSMENT AND ENVIRONMENTAL AUDIT

Environmental acts - Their need, historical background, national and international acts; Genesis of environmental acts - General procedure followed in changing a bill into an act; implementation of an act using judiciary, executive and legislative powers and their limitations. Main national acts - Environmental protection agency, air act, water act, water and sewerage Board's Factory act, Municipal acts, acts dealing with hazardous and infections wastes. Environmental impact assessment, environmental audit, general procedures followed in preparing reports incorporating EIA ES and EA. Case laws - Principles of case laws, statutory interpretations, site selection, land use planning, town planning act. ISO: 14000 - its need, procedure to be followed to obtain ISO:14000 certification, implications of ISO. Environmental management plan, environment management cells, rehabilitation and remediation, NGOs and their role. Environmental and occupational health, industrial hygiene, risk assessment disaster management plan, epidemiology. Assessment of existing effluent treatment plants, trouble shooting, remedial measures.

CHE 353 PETROCHEMICAL TECHNOLOGY

Chemicals from methane and synthetic gas: Ammonia, Methanol and Hydrogen Cyanide, Chemicals from olefins: Ethylene derivatives, Propylene derivatives and Butylenes derivatives, Chemical from Aromatics, synthetic fibres, Plastics and rubber.

References

- | | |
|--|---------------|
| 1. Petrochemical Process Technology | Mall, I D |
| 2. Modern Petroleum Refining Processes | Bhaskar Rao, |
| 3. Chemistry & Technology of Petroleum | Speight J., |
| 4. Handbook of Petroleum Refining Processing | Robert Mayer, |

CHE 354 POLYMER TECHNOLOGY

Polymerization Chemistry: Chain, Step and miscellaneous polymerization reaction and polymerization technique. Polymerization kinetics: Free radical, cationic and polymerization, poly condensation and polymerization. Polymerization Processes : Bulk Solution, emulsion and suspension polymerization, thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermoset composites resins, fillers, additives. Polymer reactions: Hydrolysis, acidolysis, hydrogenation, addition and substitution reactions, reactions of various specific groups, cyclization and cross linking reactions, reactions leading to graft and block copolymer. Manufacturing processes of important polymer: Plastics – Polyethylene polyvinylchloride & copolymer, polystyrene. Phenol – formaldehyde, epoxides, urethane, teflon, elastomers, robbers, polymeric oils – silicon fibers – cellulosic (Rayon), polyamides (6:6 Nylon), Polyesters (Dacron). Acrylic olefin. Composite materials – Ceramic and other fiber reinforced plastics,

polymer degradation – Thermal, Mechanical, Ultrasonic, Photo, High energy radiation, Ecology and environmental aspects of polymer industries. Rheological Sciences, Uncoelastic models – Maxwell.

References:

- | | |
|----------------------------------|-----------------------|
| 1. Principles of Polymer Systems | Rodriguez |
| 2. Textbook of polymer science | Billmayer Jr. Fred W. |
| 3. Polymer Science & Engineering | David J. Williams |
| 4. Polymer Processing | Mc. Keley, J.H. |

CHE 355 FOOD TECHNOLOGY

Introduction: Current status of the Indian a) agriculture b) Food Industry c) Food processing industry. Basic Food Biochemistry and Microbiology: Food Constituents, Water activity enzymes, Ambient Temperature Processing: Raw material preparation, Size reduction of solid fibrous foods and in liquid foods, Emulsification and Homogenization, Theory and equipment, Mixing and Forming, Extraction and expression, Membrane concentration Fermentation: Theory, Types, Equipment Effect on foods. Heat Processing using Heat or water: Theory, Equipment, Effect on foods, blanching, extrusion, pasteurization, Heat Sterilization, In-container Ultra high temperature (UHT)/aseptic processes. Heat Processing using Hot air: Theory, Equipment, Effect on foods, Dehydration, Baking and Roasting.; Heat Processing using Hot oils: Theory, Equipment, Effect on foods Frying; Heat Processing by direct & radiated energy: Theory, Equipment, Effect on foods Dielectric heating microwave. Processing by removal of heat, Food Preservation & Storage Food contamination Modified Atmosphere Storage (MAS) Hurdle Technology; Post Processing Applications Packaging

- | | |
|--|-----------------|
| 1. Preservation of Fruits and Vegetables. | Vijaya khader, |
| 2. Food Processing and Preservation | Viyaya khader |
| 3. (a) Food science, (2nd edition)., (b) Food science & Nutrition. | Srilakshmi. B |
| 4. Essentials of Food and Nutrition , Vol. I & II. | Swaminathan. M. |

EC 351 QUEUING THEORY

Queuing Models: Data Traffic Characteristic: Poisson process; Birth-Death Processes: Markov Chain Models; M/M/1Queues: Delay and Little's Formula; M/M/S/K Queues: Average Queue Length, Delay and Waiting Time, Blocking Probability; M/G/1 Queues- Imbedded Markov Chains, Pollaczek-Kinchin Transform Formula, Delay Formula Using Residual Service Time; Network of Queues and Jackson's Theorem.

Queuing Theory: Introduction, Queuing system, Elements of a Queuing System, Operating Characteristics of Queuing system, Probability distributions in Queuing system, Probability distributions in Queuing systems, Distribution of arrivals, Distribution of Inter – arrival times, Distribution of Departures, Distribution of Service Times, classification of Queuing Models, Definition of transient and steady states, Poisson Queuing systems.

References

- | | |
|--|---------------------------------|
| 1. Probability & Statistics with Reliability, Queuing, and Computer Science Applications | Kishor S. Trivedi |
| 2. Fundamentals of Queueing Theory | Donald Gross and Carl M. Harris |

EC 352 AI AND ROBOTICS

Artificial Intelligence, Intelligent Agents, Problem Solving, Knowledge and Reasoning, Knowledge Representation. Uncertain Knowledge and Reasoning, Quantifying Uncertainty, Probabilistic Reasoning, Decisions Making. Learning: Overview of different forms of Learning,

Learning Models, Reinforcement Learning. Introduction of robotics, Serial Robots, Robot Subsystems, Robot Classification and Application Actuators and Sensors, Vision System. Kinematics, Statics, Dynamics, Control Techniques, Robotic Joints, Motion Planning, Computers for Robots.

References

- | | |
|---|----------------------------------|
| 2. Artificial Intelligence: A Modern Approach | Stuart Russell and Peter Norving |
| 3. Introduction to robotics: | S.K. Saha |
| 4. Introduction to robotics: | Appu Kuttan KK |

EC353 TCP-IP

Introduction to TCP/IP, TCP/IP Architecture, OSI Reference Model, The TCP/IP Model vs. the OSI Model, IP and TCP protocols, TCP and UDP packets, How TCP Handles Connections, IP Addressing (IPv4 and IPv6), Allocation of IP Address for Private Networks

ARP, RARP, and Proxy ARP, Internet Control Message Protocol (ICMP). Basic TCP/IP Services, Domain Name System (DNS), The Dynamic Host Configuration Protocol (DHCP), Securing TCP/IP Environments, Routing the IP Environment, Monitoring and Managing IP Networks, NETBIOS, and WINS, Ports and Sockets

References

- | | |
|--|--------------------|
| 1. TCP/IP Illustrated 3 Volume Set | W. Richard Stevens |
| 2. Internet Routing Architectures, 2nd Edition | Sam Halabi |
| Interconnections, 2nd Edition: Bridges, Routers, Switches, and Internetworking Protocols | Radia Pe |

EC 354 COMPUTER NETWORKS

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model .Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling. Issues in the data link layer - Framing – Error correction and detection – Link-level Flow Control. Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling. Wireless LAN – Bridges and Switches, Network Layer, Transport Layer, Application Layer, Other application. Example Networks - Internet and Public Networks.

References:

- | | |
|--------------------------------------|----------------|
| 1. Data Communication and Networking | Forouzen |
| 2. Computer Networks | A.S. Tanenbaum |
| 3. Data and Computer Communication | W. Stallings, |

EC 355 B ISDN AND ATM

A conceptual view of ISDN - ISDN standards - Service capabilities. - ISDN protocol architecture - ISDN connections - Terminal adaptation - Addressing – Internetworking. ISDN Physical layer: Line coding techniques - Basic user Network Interface - Primary user role - Network Interface. ISDN Network layer ISDN call control, Frame relay connection control. Signaling system no. Z: SS-Z architecture, Signaling - datalink level, link level, network level, Signaling connection control part-ISDN user part.ATM Networking Capabilities. ATM's position in the OSI model - B-ISDN protocol reference model - ATM functions and layers. The net and its features : main internet features, Data Encryption Techniques:

References

- | | |
|--|-------------|
| 1. Telecommunications Transmission Systems | R.G. winch, |
|--|-------------|

2. isdn and B. isdn
3. Internet 101 Computing

W. Stallings,
A. Glossner

EC 356 INTERNET TECHNOLOGY

Internetworking: - Concept, Architecture and Protocols. IP Addressing scheme, Routers and IP addressing principles, Binding protocol address (ARP). IP Datagrams and Datagram forwarding. IP encapsulation. Fragmentation and reassemble, IPv6- motivation, frame format and addressing. Internet Control Message Protocol :-Introduction and usage for testing reachability, route tracking, MTU determination, TCP introduction, application, segment format. Domain name system:- Introduction, DNS Client server Model, Server hierarchy, server architectures, optimization of DNS performance, DNS entry types, electronic mail paradigm, message format, SMTP, Mail Gateways, Mailbox access, FTP commands, Filename translation examples, TFTP, NFS.

World Wide Web:- Introduction, HTML format, Client-server interaction, Browser architecture, CGI, Java techniques for Dynamic Web documents, Network Management :- SNMP, NMS. Network security, protocol startup procedure, BOOTP, DHCP, Intranet contents, security aspects, hardware software features, setting up internet site and troubleshooting, Extranet.

References

1. Computer Networks and Internet
2. Internet"

D.E. Comer
Coleman & Dyson

CSE351 MULTIMEDIA

Introduction to multimedia, Multimedia system design, data and file format standards, data compression and decompression techniques, lossy and lossless compression. Multimedia input and output technologies, storage and retrieval technologies. Multimedia Communications, multimedia communication protocols (UDP, RTP, RTCP, XTP, TELNET, IP Multicast etc), network performance parameters, streaming. Multimedia Applications and Design issues, hypermedia message, integrated multimedia message standards. Multimedia authoring system and tools user interface design.

References

1. Multimedia system Design
2. Multimedia Communications

Prabhat K Andleigh and Kiran Thakrar
Fred Halsall

CSE352 OBJECT ORIENTED PROGRAMMING

Object Orientation, OMT Methodology, Object and Class, Link and Association, Generalization, Aggregation Multiple Inheritance, Packages, Object Meta modeling, Metadata and Metamodels, Functional Modeling Pseudocode, Pseudocode with the Object Navigation Notation, ONN Constructs, combining ONN Constructs, Analysis:-Object Model, Data Dictionary, Dynamic Model, Functional Model System Design- Devising an Architecture, Database Management Paradigm, Object Identity, Policies for Detailed Design Dealing with temporal data. Detailed Design:- Object Model Transformations, Elaborating the Object Model, Elaborating the Functional Model, Evaluating the Quality of a Design Model.

References

1. Object-Oriented Modeling and Design

Michael Blaha / William Premerlani,

CSE353 SIMULATION AND MODELING

Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation. Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers, concepts of Queuing theory. **Design of simulation experiments:** Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation. **Simulation languages:** Comparison and selection of simulation languages,

study of these simulation language. **Case studies:** Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis.

References

1.System Simulation

Geoffrey Gordon

2.System Simulation with Digital Computer

NarsinghDeo

CSE354 UNIX INTERNALS AND SHELL PROGRAMMING

Architecture of the UNIX OS, the buffer cache, internal representation of files(inode, accessing blocks, releasing blocks, structure of regular files, conversion of a path name to an inode, inode assignment to a new file, allocation of disk block). System calls for the file systems, OPEN, READ, WRITE, and CLOSE, PIPES, the pipe system call , opening a named pipes, reading and writing pipes, closing pipes, DUP, mounting and amounting file system, LINK ,UNLINK, SYSTEM call for TIME and CLOCK. The structure of processes, process states and transitions, layout of system memory, the context of a process, saving the context of the process, manipulation of the process address space. Process control, process creation, signals, process termination, awaiting process termination, the user id of a process, changing the size of the process, the system BOOT and INIT process. Shell programming, study of different type of shell like C shell, Bourne shell etc. shell script, shell command, looping and making choices, for Loop, while and until, passing arguments to scripts, programming in different shells. Inter process communication, process tracing, network communication, sockets multiprocessor system, problem of multiprocessor systems, solution with master a slave processor, solution with semaphores, study of distributed UNIX system.

References

1.The Design Of UNIX Operating System

Maurice J Bach.

MAN357 ENGINEERING ECONOMICS & BUSINESS ORGANIZATION

Fundamentals of economics, concepts of micro and macro economics, Money and Banking functions, Engineering and economics. Broad features of Indian Economy, Issues in Indian economic policy with regard to population and human resource development; growth, unemployment and poverty; macroeconomic stabilization: trade, fiscal and monetary policy; agriculture, industry, services and trade. Financial institutions and SEBI, Free trade Vs. Protection, Balance of payments, Indian currency system and foreign exchange, Foreign capital investment and FEMA. Concept, nature and scope of business, Growth strategies of business and its environment, Stages of company formation, Forms of business Organization, Role and problems of small business, multinationals. Time value for money, Concept and methods of depreciation.

References

1 Modern Economic Theory

K. K. Dewett; .

2 Indian Economy

Rudar Dutt & K. P. M. Sundhram.

3 Business Organization and Management

Shukla-S.

MAN358 ENTREPRENEURSHIP DEVELOPMENT

The Entrepreneurship revolution, equity creation, The Timmons model, The Opportunity- Creation, Shaping, Recognizing and Seizing, Entrepreneurship and the INTERNET, Creation of New Business, Entrepreneurial Thinking, Leadership and human behaviour, manager, Principal and theories, management competencies, Team building, Issues of Integrity, Entrepreneurial approaches, business Plan, market surveys, preparation and planning, the business plan process and strategies. Developing a business plan, business borrowing, banking, legal issues and taxes, Entrepreneurial finance, cash flow, financial strategy framework, financial life cycle, Valuation, structure and negotiation of venture creation skills and

deals. Venture growth and management, organizational paradigms, importance of Culture and organizational climate, new developments in entrepreneurial management, gestation period crisis, threats diagnosis, intervention, the turnaround plan, ESOP, Merger, Acquisition and Strategic Alliance.

Reference

1. New Venture Creation Timmons, Jeffry A
2. The Young Entrepreneur's Guide to Starting and Running a Business Mariotti, Steve.
3. Entrepreneurship Development and Management EDI Ahmedabad. Vasant Desai,
4. Dynamics of Entrepreneurial Development and Management .

ME359 INDUSTRIAL MANAGEMENT

Fundamentals of Management,(MBO), (MBE) , Organizational Behavior, Human behavior management information system, Introduction to Personnel Management:

Personnel Management practices, methods, recruitment, selection, development, wages and salary administration, Marketing and Sales Management, Financial Management, Financial Planning.

References

- 1.Principle of Marketing Philip Kotler and Armstrong
- 2.Industrial Management K.K. Ahuja

Open electives for fourth years

List of open electives

CE451 HYDRAULIC MEASUREMENT SYSTEMS

General characteristics of a measurement system: Sensors and transducers, transmitters, converters, Input-Output relationship of measuring instruments, classification of errors and methods for reducing errors, calibration, sensitivity, hysteresis, resolution, drift, linearization, choice of instrument for a specific application

Manometers, mechanical pressure sensors electrical pressure measuring devices, pressure transmitters and vacuum measurement systems.

Variable head flow meters, variable area flow meters, positive displacement flow meters, hot wire anemometer, open channel flow meters, mass flow measurement, liquid level, solid level and continuous level measurement.

Elastic elements for force measurement, torque measurements, electrical resistance. strain gauges and measuring circuit, temperature compensation, strain gauge rosettes, standard test procedures, ISO 9000 requirements for calibration procedures, recent developments in process measurements.

References

1. Instrumentation, Analysis and Measurement Nakra and Choudhary
2. Industrial Instruments A.L. Seutko, Thomas Delmer
3. Measurement and Instrumentation Systems W. Bolton

CE452 FLUID MACHINES AND HYDRAULIC SYSTEMS

Type of prime movers, their selection criteria, positive displacement pumps, rotary pumps, air lift pumps, compresors, hydraulic ram, hydraulic accumulator, hydraulic intensifier, press and lift, hydro kinematics, hydraulic coupling, cavitation in hydraulic machines

References

- 1.Hydraulic Machines Jagdish Lal and Churchill
- 2.Fluid Mechanics and Hydraulic machines Modi & Seth\

CE453 ROAD SAFETY ENGINEERING

Introduction, road safety scenario etc

Causes of accidents and measures to reduce accident

Accident studies and record, Analysis of Accident etc

Road Safety Audit: advantages, procedure. checklist etc.

Safety during construction of road projects

References

- | | |
|---|------------------------------|
| 1. Principles of Transportation Engineering | Chakroborti and Das |
| 2. Traffic Engineering and Transport Planning | L.R. Kadiyali |
| 3 . Principles of Pavement Design | E.J. Yoder And M.W. Witzczak |
| 4. Highway Engineering | S.K.Khanna & C.E.G. Justo |

CE454 COMPUTATIONAL FLUID DYNAMICS (CFD)

Introduction and overview of CFD, need, accuracy, consistency, stability, convergency, mathematical models of fluid dynamics, finite difference methods, explicit and implicit formulations, finite element methods, finite volume method, turbulence models, boundary conditions, coordinate transformations, numerical integration, grid generation, element geometries, structured and unstructured mesh, mesh refinement, conformal mapping

References

- | | |
|--|--------------------------------|
| 1. An Introduction to Computational Fluid Dynamics | Versteeg H.K., Malalasekera W. |
| 2. Computational Techniques for Fluid Dynamics | Fletcher C.A.J |
| 3. Computational Methods for Fluid Flow | Peyrate R., Taylor T.D. |
| 4. Fluid Dynamics-Theoretical and Computational Approaches | Warsi Z.U.A. |

CE455 OPERATION RESEARCH

Development – Definition– Characteristics And Phases – Types of Operation Research Models–

Applications, Allocation Problem, Transportation Problem, Assignment Problem, Sequencing, Waiting Lines, Dynamic Programming, Simulation Problems, Inventory and Queuing Problems

References

- | | |
|--|---|
| 1. Operations Research | S.D.Sharma-Kedarnath |
| 2. Operations research | A.M.Natarajan,P . Balasubramani, |
| 3. Operations research: methods & problems | Maurice Saseini, Arhur Yaspan & Iawrence Friedman |

CE456 DIGITAL PROCESSING OF REMOTELY SENSED DATA

Basic Concepts of Digital images: Commercial image processing system software. Image rectification and restoration: Geometric and radiometric correction, establishing, spatial transformation, model using GCP's, intensity interpolation techniques (nearest neighbour, bilinear and cubic convolution.

Image Enhancements: Contrast manipulation: Grey Level thresholding, level slicing and contrast stretching. Spatial feature manipulation: spatial filter, edge enhancement and Fourier analysis. Point, local and regional operation –Fourier transform, scale- space transform, wavelet transform –principle component analysis- Multi image manipulation: Multi-band rationing and differencing principal components, vegetation indexes, color composition and Intensity Hue Saturation (IHS).

Initial statistics extraction from digital images: Image histogram, mean, standard deviation, variance, covariance matrices. Image display alternatives: mono and color, composites of MSS, Band Combination and optimum index factor (OIF), Variance-Covariance and correlation matrices. Pattern recognition,

boundary detection and representation, textural and contextual analysis, Image Classification and thematic information extraction, General steps for land cover information extraction, classification levels and supervised and unsupervised classification techniques, selection of appropriate algorithms for classification: Parallel piped, Minimum distance, Maximum likelihood, Isodata, fuzzy classification, classification accuracy assessment. Hybrid training, Non-parametric, and sub-pixel classification, Hyper-spectral image analysis.

References

- | | |
|--|---------------------------------------|
| 1. Physical Principles of Remote Sensing, | W.G.Rees |
| 2. Remote sensing models & methods for image processing, | Robert Shcwebgerdt |
| 3. Digital Image Processing (3rd Edition) | Rafael C. Gonzalez , Richard E. Woods |
| 4. Remote Sensing Digital Image Analysis | John A.Richards |

CE457 ENVIRONMENTAL IMPACT ASSESSMENT

Role of EIA as a tool for Sustainable Development. Concept of Carrying Capacity and Limits to growth in terms of population, Food, Resources, Capital, Energy, Land Services etc.

Impact Assessment: Environmental, Social and Economic issues, Issues in collection of baseline data, preliminary concept of Natural Resource Accounting, Concept of Screening, Initial environmental examination (IEE), Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS).

Rapid and Comprehensive EIA. Methodologies: Including Checklists, Matrices and Networks.

EIA: Case studies and Issues. Procedures for Environmental Clearance by the Government of India.

Mitigation Strategies, Environmental Management, Appropriate Siting of Industries and Projects for minimising impacts. Concept of Zoning Atlas,

References

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|---|------------------------------|
| 1. Introduction to environmental impact assessment | John Glasson, Riki Therivel, |
| 2. Methods of environmental impact assessment | Peter Morris, Riki Therivel |
| 3. Environmental impact assessment: theory and practice | Peter Wathern |

CE458 FINITE ELEMENT METHOD

Basic concepts of mathematical models and numerical simulation, Initial and boundary value problems, classification of partial differential equations, features and steps of FEM analysis.

Weak formulation, Ritz method, weighted residual methods, discretisation of domain, coordinate systems, interpolation functions, element matrix, assembly of element matrices, application of boundary conditions, solution of algebraic equations, numerical integration, parametric formulations, serendipity elements, Jacobians, application of FEM to simple discrete system and continuous domain problems of civil engineering

References

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|---|----------------------|
| 1. An Introduction to The Finite Element Method | Reddy J.N. |
| 2. Finite Element Analysis- Theory and Programming, | C.S. Krishnamoorthy, |
| 3. Finite Element Handbook | H. Kardestuncer |

CE459 DIGITAL MAPPING AND CARTOGRAPHY

Definition of GIS, Cartography and GIS, GIS database: spatial and attribute data; Spatial models: Semantics, spatial information, temporal information, conceptual models of spatial information, representation of geographic information: point, line and area features, topology, raster and vector data, raster to vector data conversion, map projection, analytical transformation, rubber sheet transformation, manual digitizing and semi-automatic line following digitizer; Remote sensing data as an input to GIS

data; Attribute database: scale and source of inaccuracy; GIS functionality; data storage and data retrieval through query, generalization, classification, containment search within a spatial region; Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Network analysis; Applications of GIS in planning and management of utility lines and in the field of environmental engineering, geotechnical engineering, transportation engineering and water resources engineering.

References

1. Geographic Information Systems: A Management Perspective, Stan Arnoff
2. Fundamentals of Spatial Information Systems Robert Laurini and Derek Thompson,
3. Geographical Information Systems, Vo. I and II Paul Longely, M.F. Goodchild, et.al,

ME451 SOLAR ENERGY

Solar energy perspectives and prospects.

Solar system - solar radiation - solar constant - isolation on the surface of earth measurement data and estimation. Utilization of solar energy, potential uses of solar energy, technical and economic viability, low and high temperature solar energy devices. Solar Collectors: Flat plate type: Flat plate collectors- characteristics of flat plate collectors, loss coefficient and heat transfer to the flowing medium. Flat plate collectors: design and performance of solar water heaters- optimization of tilt. Solar Collectors: Focussing type: Various type of focusing collectors, materials and performance characteristics. Design of focussing collectors, Energy storage-need for storage - thermal and physico chemical storage -solar ponds.

Applications: Solar air heaters-design, analysis and performance. Solar refrigeration - Ammonia water and ammonia sodium thiocyanate systems food preservation.. Space heating/cooling, solar heating systems-solar cooling systems.. Solar drying-agriculture and industrial drying, cabinet type dryer-general considerations. Solar stills-portable and large units, theoretical consideration performance.. Use of solar energy in bio-gas production Photovoltaic conversion Solar power generation - system analysis, design and economic considerations

References

1. Solar Engg. Thermal Procession Buffa & Buckman
2. Solar Energy G.D. Rai
3. Engg. Technology S. Rao & D.B Parulkar
4. Solar Energy Sukhatme

ME452 INDUSTRIAL ORGANISATION & MANAGEMENT

Industrial Evolution in India: Downfall of early industries, evolution of modern industry, effects of partition, industrial policy and progress after independence.

Forms of Industrial Organization: Single Proprietorship, Partnership, Joint Stock companies., Cooperatives and State Enterprises.

Growth of Industry and Management: Meaning of industrial management, functions and tools of management, growth of management concepts. Principles of Management: Management, different functions of management: Planning, organizing, coordination and control., Structure of an industrial organization., Functions of different departments. Relationship between individual departments. Human and Industrial Relations, Human relations and performance in organization. Understand self and others for effective behavior, Behaviour modification techniques, Industrial relations and disputes, Relations with subordinates, peers and superiors, Characteristics of group behaviour and trade unionism., Mob psychology, Grievance, handling of grievances, Agitations, strikes, lockouts, picketing and gherao, Labour welfare, Workers' participation in management.

Professional Ethics: Concept of ethics, Concept of professionalism, Need for professional ethics. Code of professional ethics, Typical problems of professional engineers, Professional bodies and their role.. Motivation: Factors determining motivation, Characteristics of motivation, Methods for improving motivation, Incentives, pay, promotion, rewards, Job satisfaction and job enrichment..Leadership: Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader. Human Resource Development: Introduction, Staff development and career development, Training strategies and methods. Accidents and Safety: Classification of accidents; according to nature of injuries i.e. fatal, temporary; according to event and according to place. Causes of accidents-psychological, physiological and other industrial hazards. Effects of accidents. Accidents-prone workers. Action to be taken in case of accident with machines, electric shock, road accident, fires and erection and construction accidents. Safety consciousness & publicity., Safety procedures, Safety measures-Do's and don'ts & good housekeeping (5S)., Safety measures during executions of Electrical Engineering works. Environmental Management: Basics of environmental pollution, various management techniques for control of environmental pollution, various control acts for air, water, solid waste and noise. Objectives of Industrial Management: Defining management objectives, managerial activity and objectives, tests of management of objectives, primary, secondary personal and social objectives of management.

References

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|---|---------------------------------------|
| 1. Industrial Organization | Pepall L., Richards D., and Norman G. |
| 2. The Theory of Industrial Organization. | Tirole, J. |
| 3. Industrial Engineering and Management | TR Banga. |
| 4. Industrial Engineering and Management | OP Khanna, |
| 5. Industrial Management | VK Sharma, OP Harkut. |

ME453 COMPOSITE MATERIALS

Introduction, definition and classification of composite materials, Types of reinforcements, Types of Matrix, Interface, Wettability, Polymer and Metal matrix composites: Types, lamina, laminate, orthotropy, anisotropy in composites, Processing of Composites: Primary and Secondary Manufacturing-Lay-up, Autoclave Molding, Filament Winding, Pultrusion, Compression Molding, RTM and RIM, Interface and Applications. Introduction of ceramic matrix composites, Nano-composites.

Micromechanics of composites, Density of composites, Predication of elastic constants, strength and stiffness, Load transfer in fiber and particulate reinforced composites, Macro-mechanics of composites, Elastic constants of an isotropic material and a lamina, Analysis of laminated composites, Constitutive classical laminate theory, Stress and strain in laminate composites, Tensile and compressive strength of unidirectional fiber composites, Introduction to fracture mechanics, failure mechanics and crack propagation in composites, Design consideration for composite materials, Performance of composite under fatigue and impact loading.

References

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| 1. Composite Materials: Science and Engineering | Krishnan K. Chawla |
| 2. Mechanics of Composite Materials | Autar K. Kaw |
| 3. Composite Materials | S. C. Sharma. |
| 4. Composite Manufacturing: Materials, Product & Process Engineering | Sanjay K. Mazumdar |

ME454 MATERIALS MANAGEMENT

Forecasting & Purchasing: Forecasting in purchase and sales, methods of purchasing, Functions,

organization of purchase department, mass production purchasing and its procedure, Functions and organization of purchase department source selection, negotiation, make or buy decision how much to buy. Inventory planning (MRP) and Spare parts Management : Types of Inventory, Computer control in materials planning, factors affecting ordering quantity, in process inventories, raw materials supplies, The problem of spare parts, pattern of failure, Reliability and variety, reduction, classification of spares replenishment, service level, work-in-process.

Inventory Controls and its Various Models: Ordering procedures, re-ordering, reorder point and quantity, economic lot size, economic ordering quantity, quantity discount, influence of uncertainty, continuous supply. Selection Control, ABC, XYZ, HML, VED, FSN, SDE, and SOS analysis. Spare parts management of spares Reliability and Quality of spares. Spare parts procurement , spare parts marketing and pricing. Management of absolute spares. Store keeping and Management Codification: Objectives of storekeeping, function of store organization, store organization, location of storekeeping department, factor affecting location, centralized and decentralized storing. Store Planning: Methods of store-keeping, moving materials into and out of stock, protection of stores, codification, materials requisition. Preservation of stores, disposal of surplus & scrap.

References

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|--|---------------------------------|
| 1. Materials Management | S.C. Sharma |
| 2. An Integrated Concept of Materials Management | N.M. Shah |
| 3. Maintenance & Spare parts Management | P. GopalKrishnan,, K. Bannerjee |

ME455 MAINTENANCE ENGINEERING & MANAGEMENT

Introduction -Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000 Maintenance Management - types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations , computer aided maintenance, maintenance scheduling, spare part management, inventory control, organisation of maintenance department.

Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants - types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings. Machine Health Monitoring - Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

Reliability, availability & maintainability (RAM) Analysis - Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems, Improvement in reliability , reliability testing, reliability prediction, utilisation factor, system reliability by Monte Carlo Simulation Technique.

References

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|---|------------------|
| 1. Maintenance Engineering Hand Book | Higgins |
| 2. Maintenance & Spare parts Management | Gopal Krishnan |
| 3. Industrial Maintenance Management | S.K. Shrivastava |

ME456 COMPUTATIONAL FLUID DYNAMICS (CFD)

Introduction: Mathematical Background: Classification of differential equations, representative differential equations for heat transfer and fluid flow; Boundary and initial condition; Integral forms. Survey of Numerical Methods Used in Heat Transfer and Fluid Mechanics

Finite Difference Methods: Basic concepts, Direct approximation approach, Taylor series, Control Volume approach, Truncation error, Discretization and round off errors; convergence, numerical stability, Solution of simultaneous equations, Transient diffusion. Finite Element Methods: Steps for FEM solution, Fundamentals, Interpolation functions, Galerkin method, Elements, Assembly, Steady Diffusion, Transient Diffusion Finite Volume Methods: Problem formulation for one-dimensional convection diffusion equations. Simulation of Transport Process Conduction Heat Transfer: Steady and unsteady state one & two dimensional problems. Explicit, Implicit and Crank-Nicolson scheme, ADI and ADE methods. Convection Heat Transfer: Boundary Layer Flows, Similarity solutions, Derived Variables, Patankar/Spalding Methods for two-dimensional flows. Elliptic Solutions: Control Volume formulation. Energy and other scalar equations, Momentum equations, Segregated Solution method; SIMPLE & SIMPLER schemes, Stream Function – Vorticity Transport method. Turbulence: Examples of turbulent flows, Stress relations, Reynolds stresses, turbulence model computations, Analogy between Heat Transfer and Momentum, Linearization of source terms. Working knowledge of Ansys Fluent will also be provided under the following topics: ICEM-CFD Geometry import, Geometry creation in ICEM-CFD, ICEM-CFD Tetra Meshing, ICEM-CFD Hexa Meshing

ME457 TECHNOLOGY ENTREPRENEURSHIP

The Entrepreneurial Perspective Introduction to entrepreneurship, need and importance of entrepreneurship, charms of becoming entrepreneur, evolution of entrepreneurship, characteristics of an entrepreneur, barriers of entrepreneurship, achievement motivation to become entrepreneur, creativity & innovation, decision making and other behavioral aspects of entrepreneurship, Opportunity Recognition and Planning to establish SSI Opportunity identification process, opportunity evaluation process, market research, market survey, Identification of relevant resources, Steps in establishing an enterprise / industry, procedure and formalities to establish a SSI or business enterprise, Incentives and benefits available to SSI units and new entrepreneurs, Information about various support agencies.

Formulation of Business Plan Preparation of market survey report, techno economic feasibility assessment, preparation of preliminary and detailed business plan. Marketing Management Marketing and sales management, demand forecasting, advertising, product mix, characteristics of a good sales person, Govt support in marketing, Financial Management of small scale industries Sources of finance, Debt financing, Venture capital sources, Lease finance, Banking policies & incentives available to entrepreneurs, Loans-types and benefits, Book keeping and accountancy, working capital management, various financial ratios, Costing, Break-Even-Analysis

References

1. Managing innovation and entrepreneurship in technology-based firms
Martin, Michael J.C
2. Technological entrepreneurship: enterprise formation, financing and growth
Cardullo, Mario W.
3. Growing new ventures, creating new jobs
Rice, Mark P
4. Entrepreneurship development programme in India and its relevance to developing

ME458 VIBRATIONS

Elements of a vibrating system, Free vibration of single-degree of freedom linear systems, Methods of vibration analysis: Energy method, Newton's method & Rayleigh method, Differential equations of motion for first order and second order linear systems.

Damped free vibration, viscous, coulomb damping, dry friction, logarithmic Decrement.

Forced Vibration of single degree of freedom linear systems. Response of first orders systems to harmonic excitation. Frequency response. Response of second order systems to harmonic excitation.

Harmonic motion of the base, vibration isolation, transmissibility, force transmission to foundations. Vibration measuring Instruments eg. Scismic mass, vibrometer, Accelerometer. Energy dissipation. Forced vibration with coulomb hysteresis or structural & viscous damping.

Torsional vibration of one, two and three rotor system. Equivalent shafting. Torsional vibration of a geared system. Transverse vibration of beams

References

1. Theory of Vibrations W.T.Thomson
2. Theory of Vibrations Grover & Nigam

ME459 EXPERIMENTAL STRESS ANALYSIS (ESA)

Types of strain gauges, resistance wire strain gauges, materials and cementing methods, temperature compensation, circuits and measuring techniques, strain gauge rosettes, testing and selection of gauges, mounting and installation of electrical resistance gauges

Photoelasticity, polariscope and its elements, isoclinics and isochromatics, stress optic law, compensation techniques, methods to evaluate principal stresses, photoelastic materials, three-dimensional photoelasticity, stress freezing and slicing method. Brittle coating methods and its application in evaluation of stresses

References

1. Experimental Stress Analysis Dally and Riley.
2. Experimental Stress Analysis A.Mubeen.

ME461 ADVANCED PRODUCTION ENGINEERING

Metal Cutting Theory: Geometry of cutting tools, metal machining, chip formation, types of chips, force analysis, velocity relationship, stress and strain analysis, power and energy relationships, thermal aspects, dynamometers for turning and drilling. Evaluation of machinability, tool wear and tool life, cutting forces, surface finish, economies of metal machining and cutting fluids, Machine Tools System: Design analysis of machine tools, elements, structure, slideways and guides, spindle unit drives in machine tools, layout of gear box, stepped regulators, stepless regulators, and hydraulic regulators. Tool Design of CNC machines Tooling principles and tool layouts for turrets, automates, operation planning considerations, designing of cams. Tooling for CNC machines, Design of single point cutting tools, rigidity, design of chip breakers, dynamic chip breaking, design of press dies, component of die, cutting action in a die, clearance, cutting forces, shear, center of pressure, Usefulness of jigs and fixtures, principles of design, locating and clamping, diamond pin locator, jig bushes, drill jigs, milling, turning, boring and broaching fixtures, assembly fixtures, welding fixtures, indexing devices, materials for jigs and fixtures, economics of jigs and fixtures.

Unconventional Machining Processes: Mechanical Processes: Ultrasonic Machining, Elements of USM, Acoustic Head and Design etc., Abrasive Jet Machining, Variables effecting AJM, Water Jet Machining, Equipment and process details, Electrochemical Processes: elements of process, electrolytes & their properties, chemistry of process, metal removal rate. Thermal aspect, temperature rise & pressure-flow rate, tool design, accuracy & surface finish, advantages, application & limitations of the process, Thermal processes: Electrical discharge machining, mechanism of metal removal, accuracy and surface finish, application & future trends, Plasma Arc Machining, mechanism of metal removal, accuracy and surface finish, economics and application of plasma jets, Electro/Laser Beam Machining: Electro beam machining: generation and control of electron beam, process capability and limitations. Laser beam machining: Principles of working, thermal aspect, material removal, cutting speed and accuracy, advantages & limitations.

References

- | | |
|-----------------------------|---------------|
| 1. Tool Design | Donaldson |
| 2. Production Technology | R.K. Jain |
| 3. Metal Cutting Principles | Bhattacharya |
| 4. Manufacturing Processes | Ghosh Amitabh |

ME 462 ADVANCED MACHINE DESIGN

Residual stresses, causes, manufacturing process causing thermal gradient, impact etc. Contact stresses and Hertzian stresses. Optimization in design, economic consideration, human considerations, stiffness and rigidity considerations in design, shock and impact considerations in design, Design against fracture. Wear consideration in design, tribology, concept of friction, wear and lubrication, effect of surface films, designing for wear life, erosive and corrosive wear. Creativity in design and alternative design. Product design, different modules of design theory. Aesthetic form, shape and colour. Detailed design and working drawing: Petrol Engine/Diesel Engine, Lathe/Milling/Drilling Machine, computer aided design of one assembly from the above.

References

- | | |
|----------------------------------|----------------------------|
| 1. Engineering Design | G.E. Dieter |
| 2. Handbook of Mechanical Design | G.M.Maitra and L.V. Prasad |
| 3. Machine Tool Design | N.K. Mehta |
| 4. Machine Design | Robert L. Norton |

EE451 NEURAL NETWORKS

Neuron models, Network architectures, Learning Processes. Single layer and Multi layer perceptrons , Backpropagation Algorithm, Generalization, Function Approximations, Network pruning techniques. Radial Basis Function (RBF) Networks, Regular ization theory, Generalized RBF Networks, Estimation of the Regularization parameters, Approximation properties of RBF networks, Comparison of RBF and Multi layer perceptrons. Recur rent Neural Networks, Computational power of recurrent neural networks, learning algorithms, back propagation through time, Real time recurrent learning. Engineering applications of ANN, System identification, Adaptive filter design, solving interpolation and extrapolation problems using ANN, Classification, Function approximation and pat tern recognition problems.

Reference

- | | |
|--|---------------|
| 1. Neural Networks: A Comprehensive Foundation | Simon Haykin |
| 2. Fundamentals of artificial Neural Networks | M.H. Hassoun, |

3. Introduction to artificial Neural Networks
4. Neural Networks,

J.M. Zurada,
Satish Kumar

EE452 MICROCONTROLLER

Comparison of Microprocessors and Microcontrollers, Architecture of 8-bit Microcontroller (viz Intel 8051 family), Basic Assembly Language Programming, Interfacing and Microcontroller Design, Applications, Architecture of Atmel Microcontrollers (89CXX), PIC Microcontroller

Reference

- | | |
|---|---------------|
| 1. The 8051 Microcontroller | K J Ayala |
| 2. Programming and Customizing the 8051 Microcontroller | Myke Predko, |
| 3. Microcontrollers – Theory and Applications | A V Deshmukh, |

EE453 DIGITAL SIGNAL PROCESSING

Architectural overview, components of CPU, Memory map, circular buffer and Harvard CPU Arch., Memory interface, Architecture, CPU Registers, Multiply and shift operations, CPU Interrupts and Reset, maskable & non maskable interrupts, Hardware Reset, Pipelining : Concepts and pipeline protection, Addressing modes. Types and alignment of 32 bit operation, Assembly language instruction, Emulation features.

Reference

- | | |
|---------------------------------------|----------------|
| 1. Digital Signal Processing | W.D.Stanley |
| 2. Analog & Digital Signal Processing | Ashok Ambardar |

EE444 EMBEDDED SYSTEMS

Introduction embedded systems, their characteristics, modeling of systems, system specifications, specification languages, study of specification example. Specification translation, translation of various features such as state transition, message passing communication, concurrency, exception handling etc. System partitioning- Introduction, partitioning issues, partitioning algorithms, functional partitioning, hardware/software partitioning algorithms, functional partitioning for systems. Design quality estimation- Quality metrics, hardware estimation, software estimation. Specification refinement- Refining variable grouping, channel refinement, resolving access conflict, refining incompatible interfaces, refining hardware/software interfaces. Study of a system design methodology and study of generic synthesis system.

Reference

- | | |
|---|--|
| 1. Specification and design of embedded systems | David D Gajski, Frank Vahid S. Narayan, J Garg |
| 2. Embedded system design | Heath Steve and Newns |
| 3. Art of programming Embedded Systems | J. Gassle |

EE 455 SOLAR PHOTOVOLTAIC TECHNOLOGIES

World energy scenario, Renewable energy resources, Fundamentals of semiconductors, P-N Junction diode and solar cells, Design of solar cells, DC_DC Converter, Solar cell and its I_V characteristics, Solar cell Technologies, PV systems components, PV module, array, design of a solar PV systems. Maximum Power point tracking Schemes, Balance of solar PV system, Solar PV system design and Applications. Solar Photovoltaic's: Fundamental Technologies and applications Chetan Sing Solanki PHI

EE456 ENERGY CONSERVATION & MANAGEMENT

Global and National Energy Scenario, Challenges and Future Options. Energy use patterns, laws of Thermodynamics. Cogeneration technology. Energy conservation methods in power plants, conservation

of energy in energy intensive industries. Importance of energy management. Energy auditing, methodology, analysis of past trends (plant data), closing the energy balance, case studies. 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. Energy efficient electric drives, V.S.D. power factor improvement in power system. 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, Energy economics - discount rate, payback period, internal rate of Return,

Reference

1. Industrial Energy Management and Utilisation, . L.C.Witte, P.S.Schmidt, D.R.Brown ,
2. The Efficient Use of Energy I.G.C.Dryden
3. Energy Management Handbook W.C.Turner, .
4. Energy Conservation and Audit - Thumman
5. Energy Audit and Conservation - TERI

EE457 VLSI DESIGN

Review of IC manufacturing, Basics of CMOS technology, well and pwell process, twin tube process, ASIC's, PLA & PAL., MOS transistor theory, basic physical design of simple logic gates, CMOS logic structure, circuits and system representations, inverters, power dissipation in CMOS, Design strategies, CMOS Chip design opt ions, program logic, program logic structure, Program interconnect, reprogrammable, gate arrays, Design Method behaviral synthesis, Flow diagram, clocked system, latches and registers, set-up and hold time, metastability, clock skew, timing issues, constraints, static timing and dynamic timing analysis, FSM. Need of testing, manufacturing test principles, design strategies for test , chip level test techniques, system level test techniques.

References:

1. VLSI Technology Wyne wolf .
2. CMOS design Allen & Homberg.
3. Principles of CMOS VLSI design Neil H.E. Weste & Kamraneharghian
4. Design of MOS VLSI circuits for telecommunication P.Antoynelli and V T Sivides.
5. CMOS Circuit design Jacob baker, Harrywili , David Boyce.

EE458 DIGITAL IMAGE PROCESSING

Introduction, Digital Image Representation, fundamentals steps in Image processing, Elements of Image processing system, simple Image model, Sampling and Quantization, Basic relationship between pixels, Imaging geometry. Manipulation on image, image transformation: introduction to Fast Fourier transformation, Walsh transformation, Hadmard transformation, Hotelling transformation, DCT transform. Image Enhancement: Spatial domain method, frequency domain method, Enhancement by point processing. Image Restoration: Degradation model, effect of diagonalization on degradation models, Algebraic approach to restoration. Least mean square filter, interactive restoration, Geometric Transformation. Image Compression: Fundamentals, image compression model, lossy compression, loss-less compression, image compression standards. Image segmentation: Detection of discontinuation by point detection, line detection edge detection. Edge linking & boundary detection, Thresholding, Region oriented segmentation. Simple methods of representation : Representation Schemes, Signatures,

boundary segments, skeleton of a region. Polygonal approximation, chain codes, Boundary descriptors and regional descriptors, recognition and interpretation.

References:

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| 1. Digital Image Processing | R.C.Gonzalez Richard E woods, |
| 2. Digital Image Processing | W.K. Part, |
| 3. Digital Image Processing & Analysis | Chanda & Majumdar |

CHE451 BIO ENERGY TECHNOLOGY

Sources and Classification. Chemical composition, properties of biomass. Energy plantations. Size reduction, Briquetting, Drying, Storage and handling of biomass. Feedstock for biogas, Microbial and biochemical aspects- operating parameters for biogas production. Kinetics and mechanism- High rate digesters for industrial waste water treatment. Thermo chemical conversion of lignocelluloses biomass. Incineration, Processing for liquid fuel production. Pyrolysis -Effect of particle size, temperature, and products obtained. Thermo chemical Principles: Effect of pressure, temperature, steam and oxygen. Fixed and fluidized bed Gasifiers- Partial gasification of biomass by CFB. Combustion of woody biomass-Design of equipment. Cogeneration using bagasse- Case studies: Combustion of rice husk.

References

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|--|------------------------------------|
| 1. Biotechnology and Alternative Technologies for Utilization of Biomass | Chakraverthy A |
| 2. Biogas Systems: Principles and Applications | Mital K.M |
| 3. Biomass Energy Systems | Venkata Ramana P and Srinivas S.N |
| 4. Gasification Technologies, A Primer for Engineers and Scientists | Rezaian. J and N. P. Cheremisinoff |

CHE452 SOLID WASTE MANAGEMENT

Introduction- Philosophy and organization, Status of solid waste management, Computation an integrated waste management strategy. Evolution of solid waste management, Legislation and Government agencies, Planning solid waste management progress. Generation of solid waste, Onsite handling, Storage and processing, Transfer and transport, Processing techniques and equipment. Recovery of resources- Conversion, Chemical and Biological methods. Disposal of solid waste- Landfilling, Ocean disposing, Source reduction, Recycling, Composting. Hazardous waste and their management, Process management issues, Planning. Case studies on major industrial solid waste generation units- Coal fired power plant, Textile industry, Brewery, Distillery, Oil refinery, Radioactive generation units. Case studies on spills, Sludge lagooning and incineration.

References

- | | |
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| 1. Handbook of Solid Waste b | Frank Krieth |
| 2. Solid Wastes, | Martell |
| 3. Solid Wastes, George Tchobanuglour, | H.Theisen and R.Eliassen. |
| 4. Solid Waste Management, | Luis F. Diaz, George M. Savage, Linda L. Eggerth, Larry Rosenberg |

CHE453 OPTIMIZATION TECHNIQUES

Optimal problem formulation, Single variable optimization algorithms, Multi variable optimization algorithms including simplex search method; Cauchy"s steepest descent method; Levenberg Marquardt"s method, constrained optimization algorithms including Khun-Tucker conditions, transformation methods; direct search methods; liberalized search techniques; feasible direction method, Specialized algorithms

including Integer programming; geometric programming. Nontraditional optimization techniques including simulated annealing, genetic algorithms (GA), introduction to multi objective optimization problems. Application of all the aforesaid techniques with the help of the frequently used benchmark functions for engineering design. ; Scope & Objective: ; Optimization has become a part of computer aided design activities where the goal is not only to achieve a feasible design but also a design objective. The course provides basic knowledge of deterministic algorithms as well as algorithms which are stochastic in nature with probabilistic transition rules, new methods in computational intelligence or „soft computing“ inspired by evolutionary processes in nature, such as genetic algorithms. The course consists of lectures and a project component, which includes both model building and programming. This course also provides an opportunity to get conversant with optimization toolbox of MATLAB by the Mathworks, Inc.

References

- | | |
|---|--------------------------------|
| 1. Engineering Optimization Theory & Practice, | S. S. Rao, |
| 2. Multi-Objective Optimization Using Evolutionary Algorithms | K. Deb, |
| 3. Process Plant Simulation, | B.V. Babu |
| 4. Optimization of Chemical Processes, | T. F. Edgar, D. M. Himmelblau, |

CHE 454 ADVANCED ANALYTICAL TECHNIQUES

Introduction to spectroscopic methods of analysis, electromagnetic radiation and quantitative spectroscopy, Molecular Spectroscopy, UV, IR, Atomic Spectroscopy: AAS, Electrometric Methods of Analysis, XRD Analysis, Thermal Methods: DSC, DTA, Chromatographic Methods: GC, HPLC

References

- | | |
|---|--|
| 1. Instrumental methods of analysis | Willard, H.H., Merritt. I.I., Dean J.a., and Settle, F.A |
| 2. Instrumental Methods of Analysis | Sharma, B.K., |
| 3. Absorption spectroscopy of organic molecules | Parikh V.M., |
| 4. Fundamentals of Analytical Chemistry | Skoog D.A. and West D.M., |
| 5. Fundamentals of molecular spectroscopy | Banwell, G. |

CHE 455 INDUSTRIAL SAFETY & HAZARD MANAGEMENT

Introduction: Safety program, Engineering ethics, Accident and loss statistics, Acceptable risk, Public perception, Toxicology: How toxicants enter biological organisms, How toxicants are eliminated from biological organisms. Industrial Hygiene: Government regulations, Identification, Evaluation, Control. Fires and Explosions: The fire triangle, Distinction between fire and explosions; Definitions, Flammability characteristics of liquids and vapors, MOC and inerting, ignition energy, Auto ignition, Auto oxidation, Adiabatic compression, Explosions. Designs to prevent fires and explosions: Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems, Introduction to Reliefs: Relief concepts, Definitions, Location of reliefs, Relief types, Data for sizing reliefs, Relief systems. Relief Sizing: Conventional spring operated relief's in liquids, Conventional spring operated relief's in vapor or gas service, Rupture disc relief's in liquid, vapour or gas service. Hazards Identification: Process hazards checklists, Hazard surveys, Hazop safety reviews.

References

- | | |
|--|--------------------------|
| 1. Chemical Process Safety (Fundamentals with applications), | D.A.Crowl & J.F.Louvar |
| 2. Industrial Hygiene and Chemical safety | |
| 3. Safety and Accident Prevention in Chemical Operations, | H.H.Fawcett and W.S.Wood |
| 4. Chemical engineering Vol.6, | Coulson and Richardson's |

EC451 NEURAL NETWORKS

Introduction of artificial neural networks, fundamental models of artificial neurons, artificial neural network architectures, feed forward and feedback neural networks, neural networks learning methods, radial basis function networks, Hopfield network, self organizing map (SOM), application of neural networks.

References

- | | |
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| 1. Neural Networks: A Comprehensive Foundation | Simon Haykin,. |
| 2. Fundamentals of Artificial Neural Networks | Mohamad H. Hassoun |
| 3. Neural Networks: A class room approach | Satish Kumar, |

EC452 BIOMETRIC SIGNAL PROCESSING

Discrete Time signal processing, Discrete Fourier transform, theory of Z-Transform, Neurological Signal processing, Sleep ECG, Adaptive Interference, Noise Cancellation, Cardiological Signal Processing, ECG Data Reduction Technique, Prony's Method.

References

- | | |
|---|-----------------|
| 1. Biomedical Signal Processing: Principle and Techniques | D.C. Reddy |
| 2. Biomedical signal processing and Signal Modeling | Eugene N. Bruce |

EC453 NANO TECHNOLOGY

Introduction to nanoscale systems. Length energy and time scales. Top down approach to Nano lithography. Spatial resolution of optical, deep ultraviolet, X-ray, electron beam and ion beam lithography. Single electron transistors, coulomb blockade effects in ultra small metallic tunnel junctions. Quantum confinement of electrons in semiconductor nano structures. Two dimensional confinement (Quantum wells), Band gap engineering, Epitaxy, Landauer, - Buttiker Formulism for conduction in confined geometries, one dimensional confinement, quantum point context, quantum dots and bottom of approach, introduction to quantum methods for information processing. Molecular Electronics, Chemical self assembly, carbon nano tubes, self assembled mono layers , Electomechanical techniques, Applications in biological and chemical detection, Atomic scales characterization techniques, scanning, tunneling microscopy, atomic force microscopy.

References

- | | |
|---|-------------------------|
| 2. Quantum Transport in Semiconductor Nanostructures in solid state Physics | Beenaker and van Houten |
| 3. Transport in Nano structures | David Ferry |
| 4. Introduction to Mesoscopic Physics | Y.Imry |

EC454 MODELING AND SIMULATION TECHNIQUES

Introduction to Modeling and simulation concepts. Levels of simulation for digital, analog & mixed mode circuits. IC CAD Overview. Device Simulation. Electrical simulation techniques. Relaxation based simulation techniques. Gate level simulation, Switch level timing simulation. Mixed mode interface, simulation and implementation, analog multi-level simulation. Discrete time models, Event driven simulation, Logic simulation, timing verification in ICs, setup and hold times for clocked devices.

References

- | | |
|---|-------------------------------|
| 1. Mixed mode simulation and analog multilevel simulation | R. Saleh, S. Jou & A.R.Newton |
| 2. VLSI circuit simulation & Optimization | V.Litovski & M. Zwolinski,. |
| 3. CMOS Circuit Design & Simulation | J Baker, Li & Boyce, |

EC455 EMBEDDED SYSTEMS

Introduction to embedded systems, their characteristics, Hardware and Software Architectures, Standard peripherals, Common Interfacing techniques and protocols, Specification models and languages, Design Automation

References:

1. Embedded System Design: A unified Hardware / Software Introduction
Frank Vahid , Tony Givargis
2. Specification and design of Embedded Systems
David D Gajski, Frank Vahid, Sanjiv Narayan , Jie Gong,

EC456 REAL TIME SYSTEMS

Real time models, language & operating systems, Real time Kernel, OS tasks, task states, task scheduling, interrupt processing, communication and synchronization. Fault Prevention, Fault tolerance, Test generation for digital systems, fault simulation. Synchronous and asynchronous fail-safe circuits.

References

1. Real Time Systems :Design For Distributed Embedded Applications Hermann Kopetz
2. Real-Time Systems C.M.Krishna, K.G.Shin
3. Real-Time Systems: Theory and Practice Rajib Mall

EC457 STATISTICAL SIGNAL PROCESSING

Power Spectrum Estimation-Parametric and Maximum Entropy Methods, Wiener, Kalman Filtering, Levinson-Durban Algorithms Least Square Method, Adaptive Filtering, Nonstationary Signal Analysis, Wigner-Ville Distribution, Wavelet Analysis. Power Spectrum Estimation, model order selection, Prony, Pisarenko, MUSIC, ESPRIT algorithms, least square estimation, cholesky, LDU-OR, SV decomposition. Transversal & reasnic least square lattice filters, Signal Analysis with Higher order Spectra, Array processing, Beamforming, Time-delay estimation.

References

1. Statistical Digital Signal Processing and Modelling, M. Hays
2. Statistical Signal Processing with Applications
M.D. Srinath, P.K. Rajasekaran and R. Viswanathan,

CSE451 GRAPH THEORY

Definition of a graph and directed graph, simple graph. Degree of a vertex, regular graph, bipartite graphs, subgraphs, complete graph, complement of a graph, operations of graphs, isomorphism and homomorphism between two graphs, directed graphs and relations. Walks, paths and circuits, connectedness of a graph, Disconnected graphs and their components, Konigsberg 7-bridge problem, Around the world problem, Euler graphs, Hamiltonian paths and circuits, Existence theorem for Eulerian and Hamiltonian graphs. Trees and their properties, distance and centre in a tree and in a graph, rooted and binary trees, spanning trees and forest, fundamental circuits, cut sets, connectivity and separability, 1-isomorphism, 2-isomorphism, breadth first and depth first search. Incidence matrix and its sub matrices, Reduced incidence matrix, circuit matrix, fundamental circuit matrix, cut set matrix, fundamental cut set matrix, path matrix, adjacency matrix of a graph and of digraph. Planar graphs, Euler's formula, Kuratowski's graphs, detections of planarity, geometric dual, combinatorial dual. Chromatic number, independent set of vertices, maximal independent set, chromatic partitioning, dominating set, minimal dominating set, chromatic polynomial, coloring and four colour problem, coverings, machings in a graph. Network flows, Ford-Fulkerson algorithm for maximum flow, Dijkstra algorithm for shortest path between two vertices, Kruskal and Prim's algorithms for minimum spanning tree.

References

1. Graph Theory with Applications to engineering and computer science Deo Narsingh.

2. A first Look At Graph Theory
3. Graphs and Applications: An Introductory Approach
4. Graph Theory

Clark John and Holton D.A.,
Aldous and Wilson,
Reinhard Diestel,

CSE452 OPTIMIZATION TECHNIQUES

Engineering application of Optimization, Formulation of design problems as mathematical programming problems, General Structure of Optimization Algorithms ,Constraints, The Feasible Region, Branches of Mathematical Programming ,Gradient Information, The Taylor Series, Types of Extrema, Necessary and Sufficient Conditions for Local Minima and Maxima, Classification of Stationary Points , Convex and Concave Functions, Optimization of Convex Functions, General Properties of Algorithms ,An Algorithm as a Point-to-Point Mapping,An Algorithm as a Point-to-Set Mapping Closed Algorithms , Descent Functions, Global Convergence, Rates of Convergence. Unconstrained Optimization: One dimensional optimization techniques: Dichotomous Search, Fibonacci Search ,Golden-Section Search, Quadratic Interpolation Method ,Cubic Interpolation, The Algorithm of Davies, Swann, and Campey, Inexact Line Searches , Multidimensional Gradient Methods ,Steepest-Descent Method, Newton Method Gauss-Newton Method, Conjugate-Direction Methods: Conjugate Directions, Basic Conjugate-Directions Method, Conjugate-Gradient Method, Minimization of Non-quadratic Functions, Fletcher-Reeves Method, Powell's Method, Partan Method. Quasi-Newton Methods: The Basic Quasi-Newton Approach, Generation of Matrix S_k ,Rank-One Method, Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method, Hoshino Method, The Broyden Family, The Huang Family, Practical Quasi-Newton Algorithm,Applications of Unconstrained Optimization,Nonlinear Least Squares Problem and Algorithms. Linear Programming: Graphical method, Simplex method, Duality in linear programming (LP),Sensitivity analysis, Interior-Point Methods, Primal-Dual Solutions and Central Path, Primal Affine-Scaling Method, Primal Newton Barrier Method, Primal-Dual Interior-Point Methods. Nonlinear Constrained Optimization: Constrained Optimization, Constraints, Classification of Constrained Optimization Problems, Simple Transformation Methods ,Lagrange Multipliers , First-Order Necessary Conditions, Second-Order Conditions, Convexity , Duality Quadratic And Convex Programming: Convex QP Problems with Equality Constraints, Active-Set Methods for Strictly Convex QP Problems , Interior-Point Methods for Convex QP Problems, Cutting-Plane Methods for CP Problems, Ellipsoid Methods. Minimax Methods: Minimax Algorithms, Improved Minimax Algorithms,

References

- 1.Practical Optimization Algorithms And Engineering Applications, Andreas Antoniou
- 2.An Introduction To Optimization Edwin K., P. Chong & Stanislaw h. Zak

CSE453 CYBER CRIME AND INFORMATION WARFARE

Introduction of cyber crime, challenges of cyber crime, categorizing cyber crime, cyber terrorism, virtual crimes, perception of cyber criminals: hackers, insurgents and extremist group, interception of data, surveillance and protection, criminal copy right infringement, cyber stalking, hiding crimes in cyber space and methods of concealment. Anonymity and markets, privacy and security at risk in the global information society, privacy in cyber space, war fare concept, information as an intelligence weapon, attack and retaliation attack and defense. An I-WAR risk analysis model, implication of I –WAR for information managers, perceptual intelligence and I-WAR, handling cyber terrorism and information warfare, Jurisdiction.

References

1. Principle of cyber crime Jonathan Clough
2. Information warfare: Corporate attack and defense in digital world William Hutchinson, Mathew Warren

CSE454 WIRELESS NETWORKS

Introduction to wireless communication, and future trends, Wireless Generations and Standards, Wireless Physical Layer Concepts, fundamentals of antennas, Cellular Concept and Cellular System Fundamentals. Spread Spectrum Modulation Techniques, Coding and Error Control, Multiple Access Technique for Wireless Communications, OFDM. Wireless LAN Technologies, Wireless IEEE Standards, Mobile Network Layer (Mobile IP). Mobile Transport Layer (Mobile TCP), Mobile Data network (GPRS), WAP Model and architecture, Introduction to Ad hoc networks, Sensor networks, Bluetooth networks and Wireless Mesh networks.

References

- | | |
|--|---------------------------------|
| 1. Wireless communication Principles and Practice, | T. S. Rappaport |
| 2. Mobile Communications | Schiller |
| 3. Principles of Wireless Networks: A Unified Approach | Pahalvan, K. and Krishnamurthy, |
| 4. Wireless Communications and Networking | William Stallings |

CSE455 INTERNET TECHNOLOGY

Inter networking:- Concept architecture, protocols and devices like bridge (spanning tree concept), switch (switching technique) and hub. IP (v4), IP Addressing scheme ARP, RARP, IP routing, IP datagram and datagram forwarding, IP encapsulation. ICMP error message and ICMP query message, TCP, UDP, three way handshaking, segment format, fragmentation and reassembly, timer and retransmission, concept of MTU (maximum transmission unit), MSS (maximum segment size), RTT (round trip time), ISN (initial sequence number), the transport layer congestion management (congestion window & threshold value). Application layer protocols firewalls, digital signature, http, DNS, SMTP, POP, FTP command, file translation, TFTP, NFS, concept of virtual terminals, browser architecture, HTML, XML, basic concepts of client-server computing, CGI techniques for Dynamic Web documents, network Management:- SNMP, NMS. Network security, protocol startup procedure, BOOTP, DHCP, Intranet contents, security aspects, Internet site and troubleshooting, world wide web.

References

- | | |
|----------------------------------|-----------------|
| 1. TCP/IP vol 1 | Richard Stevens |
| 2. Computer Network and Internet | D.E. Comer |
| 3. Internet | Coleman & Dyson |

CSE 456 ETHICAL HACKING

Ethical hacking Overview, TCP/IP Concepts Review, network and computer Attacks, Foot printing and social engineering, port scanning enumeration, Programming for security professionals Password hacking, windows hacking, network hacking, anonymity and email hacking. web Servers hacking, session hijacking, Surveillance, desktop and server OS Vulnerabilities, Database attack, hacking wireless networks, cryptography, network protection systems, Trojan and backdoor applications, legal resources, virtualization and Ethical Hacking

References

- | | |
|--|--|
| 1. Ethical Hacking and Network Defense. | Michael T. Simpson, Kent Backman, James Corley |
| 2. Hacking Exposed—Network Security Secrets & Solutions, | Stuart McClure Joel Scambray, George Kurtz |
| 3. Network Security, A Hacker Perspective | Ankit Fadia |

EE451 INTELLECTUAL PROPERTY RIGHTS

Introduction to IPR: Introduction to IPR, Importance, need of IPR, Intellectual assets and value realization, Forms of IPR, Patent, Copyright, Trademarks, Protection of IC layout designs, Geographical

Indicators, Protection of undisclosed information, control of anti competitive practices and industrial design. Patents: Concept of property and history of patents, Indian Patent Act and rules, Novelty, Inventiveness and usefulness, Patent application procedure, patent able and non-patent-able inventions including product vs process patents. Industrial Designs: Registration, concept of novelty, originality, utility, obviousness, rights, obligations and limitations of registration of design, offences and penalties. Trade Marks & Copy Rights: Introduction, registration, concept of deceptive similarity, rights and limitations of trade marks, offences and penalties. Copyright introduction, nature of copyright, subject matter of copyrights (literary works, dramatic works, musical works, cinematography films, records, tapes etc.) rights, obligations and limitations, registrations. International Treaties: Introduction to international treaties, conventions and organizations, TRIPS, PCT, Berne Convention, WIPO, EPO, UPOV, Introduction to WTO, Introduction to dispute settlement procedure (technical & legal), Indian position in global IPR structure, Facilitating technology transfer and Capabilities building.

Reference

1. Intellectual Property Rights, Ganguly P.,
2. WIPO handbook/ notes - Law Relating to Patents, Wadehra B.L.,
3. Profiting from Intellectual Capital: extracting value from Innovation Sullivan & Patrick H
4. Intellectual Property Rights, the WTO and Developing Countries: the TRIPS Agreement and Policy Options, Correa, Carlos M.,

MAN452 ENTREPRENEURSHIP DEVELOPMENT

Fundamentals of Entrepreneurship, Achievement Motivation Training, Self Rating, Business game, Entrepreneurship Development Programs, fundamentals of business, Human Resource and Marketing, Techno economic Feasibility Assessment ,Preliminary Project Report, Project Appraisal, Financing & Accounting: , Capital structure, Financial Institutions, Management of working capital, Costing Break Even Analysis, Network analysis Techniques of PERT/CPM - Taxation ,Income Tax, Excise Duty, Sales Tax.

Support to entrepreneurs: Sickness in small ,Government Policy for small Scale Enterprise ,Growth strategies in small Industry.

References

1. Entrepreneurial Development , S.S. Khanka,.
2. EDII - "Faculty & External experts - A Hand Book

Entrepreneurship Development

MAN453 PROJECT MANAGEMENT

Fundamentals of Management, (MBO), (MBE), Organizational Behaviour, Human behaviour management information system, Introduction to Personnel Management:

Personnel Management practices, methods, recruitment, selection, development, wages and salary administration, Marketing and Sales Management, Financial Management, Financial Planning.

References

1. Principle of Marketing Philip Kotler and Armstrong
2. Industrial Management K.K. Ahuja

35 DEPARTMENT OF PLANNING (B.Plan)

PLA 111 INTRODUCTIONS TO PHYSICAL PLANNING

Planning as a discipline, multidisciplinary nature, role of a planner, fields of planning- Urban, regional, environmental, transport and infrastructure.

Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning; Arguments for and against planning

Economics and social planning as bases of physical planning, Types of plans: Definition of development plan; Types of development plans: master plan, city development plan, structure plan, district plan, action area plan, subject plan. Hierarchy of plans: regional plan, sub-regional plan; Sector plans and spatial plans; Town planning schemes.

The City in History, Settlement size, pattern and structure as a function of socio- cultural, economic, military and religious factors. Variations in civilizations- Egyptian, Mesopotamian, Greek, Roman

Town planning in medieval times and in Renaissance Europe, Origin and evolution of civic planning; Impacts of Industrial Revolution on town and regional planning.

Concepts of garden City, City beautiful, Linear city etc., contributions of all leading masters in planning, Socio-economic impacts of growth of urban areas; rural-urban migration.

Impact of technology on urban forms, Urban structure and form- land use distribution.

Theories of urbanization including Concentric Zone Theory; Sector Theory; Multiple Nuclei Theory and other latest theories; Land Use and Land Value. Theory of William Alonso on location and Land use; City as an organism: a physical entity, social entity and political entity.

References

1. Urban land use planning Albert J
2. Urban problems and community Ronald F Ferguson

PLA 112 PLANNING THEORY 1

Definitions of theory in general and planning in particular, Definition of paradigm and its various stages of development by Kuhn; Significance of planning theory; Espoused theories and theories in use.

Public interest and its forms; History and significance of public participation; Methods of public participation; Impediments to public participation and conditions for effective public participation; Public participation and empowerment; Participation, policy formulation and implementation

Sustainability and rationality in planning; Components of sustainable urban and regional development; Globalization, internationalization, modernism and postmodernism debate; Pragmatism in planning; Regime theory and urban politics

Compact city approach: concept, advantages and limitations; Forms of cities in developing world, Forms of cities in the developed world; Forms of cities in the former and present socialist countries Need for evaluation; Inseparability of planning and evaluation; Planning theories and evaluation; Methods of evaluating development plans; Theories of implementation of planning policies and development plans .

References

PLA 113: STATISTICAL METHODS 1

Statistical data and methods; collection of data, record, file, sources of data; questionnaire design, design of sample surveys; simple random sampling, stratified sampling, etc.; data coding, data verification

Statistical tables; types of tables, comparisons, methods of presentation, graphic presentation; types of charts; plotting a curve, rules for drawing curves; bar charts, pictography, pie charts, histograms/ use of presentation software.

Raw data, frequency distribution, selecting number of classes, class limits, curves, cumulative frequency distribution, measures of central tendency; arithmetic mean, median, mode, geometric mean and harmonic mean; measures of absolute dispersion, range, quartile deviation, average deviation, standard deviation, skewness and kurtosis.

Degree of correlation, correlation coefficient, methods of concurrent deviation, coefficient of rank correlation, partial correlation analysis and multiple correlation, Probability and Sample distribution Introduction, addition rule, conditional probability, multiplication rule, random variables

and probability distribution, mathematical expectation; Binomial distribution and normal distribution

Note: Assignments shall be done using software packages for graphic presentations and software packages for statistical analysis such as Statistical Programme for Social Sciences (SPSS) genstat, systat and statistica and its application for statistical methods.

References

1. Mathematical statistical methods

Ray & Sharma, Goyal

PLA 114 GRAPHICS 1

Introduction to drawing equipments and mediums, Importance of graphics and visual presentations

Orthographic, isometric and perspective projections of one, two and three dimensional objects

Study of elementary two dimensional geometrical shapes such as points, lines, polygons; with varying line thicknesses and intensities; Texture, color and tone in materials and graphics; Shapes and forms. Free hand sketching of human figures, activities, natural and man-made elements; Concept of scales and proportions; Graphic scales; Lettering

Graphics codes and symbols

Fundamentals of photography composition in photography and exercises based on photography of objects, activities, interiors and exteriors of buildings.

Study of two and three dimensional geometrical forms and objects, study of structure form and space relation.

References

1. Engineering drawing

ND Bhatta, & Rangawala

PLA 115 HISTORY OF SETTLEMENTS

Fundamentals of art; definition, scope, different art forms, materials and techniques; cave art in Europe and India; Indus Valley, Mesopotamia, Egyptian, Greek and Roman art; art of Gandhara, Byzantine, Hindu, Buddhist, Islamic and Medieval period.

Gothic, trabeated, corbelled, arch, domical etc

Revolutions; from renaissance to industrial revolution; India and other civilizations upto 17th century, colonial, industrial, American and French; theory of evolution; artists of the renaissance; Botticelli, Raphael, Leonardo da Vinci and Michael Angelo; impressionism and post- impressionism.

Art from 1900 to 1920; art in India and West from 1920 to the present century art

Print-making, photography, pottery, weaving, action painting, mobiles, etc

References

1. Urban Pattern

Gallion

2. The city in history

Lewis Mumford

PLA 116 COMMUNICATION SKILL

Spoken English and grammar Technical composition (e.g., reports, papers essays) writing, Making sequences and framework for presentation, importance of posture, gesture, pronunciation, tone etc. on Presentation quality, Presenting simple, complex architectural concepts and proposal with the help of text, drawings, transparencies, slides, video, photographs, models etc Preparing simple and interactive slide shows and presentations using computer software, Article review, presentations and seminars.

PLA 117 PLANNING STUDIO 1

Anthropometrics, Human Activity and Space Use; Furniture Layout of a room; Building circulation/ flow diagrams; Concepts of Space, Form and Function.

Factors and concepts related to building design - Climate, Site Characteristics, Land Form, Visual Elements, Behavioral Factors, Space Utilization.

Introduction to Architectural Space Standards, Preparation of Design Briefs; Design of simple Residential, Commercial, Institutional Buildings

Appreciation of simple Buildings and Drawings; Rendering of Architectural Drawings; Project presentation modes through physical models, oral, digital and manual sketches

Appreciation and design of Logo and Insignia of geometric merits and format of presentation drawings

Second Semester

PLA 121 GRAPHICS 2

Graphic presentation of statistical data

Preparation of Base Maps at the levels of Site, Area, Zone, City, Region, etc; Preparation of Key Maps, Composition of Drawings, Proportions of Lettering and Line thickness, Standard symbols, Line-styles, Colour-coding; Legend, Drawing Formats; Appreciation of Thematic Maps of various levels of Planning; Introduction to Photography, Basic Principles, Composition for Architectural Building Photographs and Planning! Site Photographs

Graphic presentation and communication skills; Use of Power Point and Multi-Media Projections

Appreciation studies of Residential, Commercial, Institutional areas in small urban and/ or rural settlements

PLA 122 SURVEYING

Definitions, classifications, use, objectives and basic principles of surveying; Classifications of measurements and units, concepts of scales, maps and plan and use of conventional symbols; Stages in surveying works - field works, office works, care and adjustment of the instruments; Errors in surveying - sources and kinds.

Definition, application, advantages and disadvantages, principles; Instruments used, steps in chain survey; Plotting chain survey to prepare a plan with practical examples. Definition of compass surveying, traversing, types of traversing, applications, advantages and disadvantages, principles and instruments used in compass surveying; Concept of bearings, meridian and angles, designation of bearing, fore bearing and back bearing, local attraction; Plotting of compass survey data to prepare a plan of a small area

Definition, application, advantages and disadvantages of plane table survey; Preparation of map of a small area with plane table survey

General methods of determining area; Instrument used and their principles for computing area; Determination of area from the plotted map with different methods and comparing them; Use of Digital Planometer

Definition, principle, methods and application of leveling; Instruments used and the principles of their work; Definition and application of contouring; Characteristics and interpretation of contour lines; Methods of locating contours

Photogrammetry as an Alternative Tool for Surveying; Introduction to Aerial Remote Sensing and Aerial Photographs,

References

1. Surveying Punmia

PLA123 STATISTICAL METHODS 2

Linear and non-linear regression, lines of regression, coefficient of regression.

Variation in time series, trend analysis, cyclical variation, seasonal variation, irregular variation, time series analysis forecasting.

Defining an index number, types and use of index numbers; construction of index number; simple aggregate method etc. cost of living index number and its construction.

Types of estimation; point, interval, testing of hypotheses, statistical hypothesis, simple and composite tests of significance, null hypothesis, alternative hypothesis, types of errors, level of significance, critical region

Test for single proportion; test of significance for single mean, chi-square distribution applications of chi-square distribution; test of goodness of fit.

References

1. Mathematical statistical methods

Ray & Sharma &by Goyal

PLA 124 APPLIED GEOLOGY & HYDROLOGY

Composition of the earth; the earth processes; geological cycles, igneous activities, volcanoes, minerals and their properties; rock types and their character; bedding, outcrop and strikes; rock cycle-, geological and time scale; Indian stratigraphy.

Description and classification of folds, faults, joints, unconformities, fault planes, geometrical destruction, etc. land form types; erosional, depositional fluvial, glacial, deolian and marine; rock weathering and climate; mechanical and chemical processes, soil formation, landslides, sources and causes of crystal displacements, types, characters and effects, instability of hill slopes, prevention.

Historical account, tectonic behavior and seismic belts; causes, intensity and magnitude of earthquakes, seismic zoning in India, earthquake waves and their character, particle motion and behavior in various geological formations; seismography, accelerograms and their interpretation, prediction and prevention; earthquake resistant structures.

Selection of Site and Foundations General considerations, sources of preliminary geological data particularly related to Indian stratigraphic sequences and the types of foundations; nature and preparation of foundations for roads and bridges, buildings and other geo-technical structures; geophysical explorations.

Ground Water: Concept and role in town planning of different types of terrain, hydrologic cycle, vertical distribution of groundwater, interstices; Groundwater bearing properties of different lithological formations, porosity, permeability, specific yield, specific retention, transmissivity and storage coefficient; ground water in igneous, sedimentary and metamorphic rocks; aquifers; types and classification (geological), aquiclude, aquitard; aquifuge, water table and piezometric surface; surface water reservoirs and springs; artificial recharge and ground water mound hydrological features in relation of seepage, fluctuation of water table and hydrographs, geological structure and underground passages for water supply, Definition of Hydrology, classification, hydrological cycle, urban water cycle; Types precipitation, measurement of precipitation, intensity-duration-frequency relationships, rainfall formula, rainfall maps, significance of interpretation and presentation of rain fall data; Surface water run off, hydrograph, measurement of discharge for small and big rivers, rational method for estimating run off, unit hydrograph and its application, definition of watershed; Flood frequencies, flood protection measures in urban areas. Estimating storm run-off, run-off co-efficient, rainfall intensity, time of concentration; Gravity flow, hydraulic gradient line, Manning's formula and nomographs, full flow and partial flow; layout and design of storm water system; General considerations, inlets, self-cleansing velocity, non-scouring velocity, physical layout-design principles, data requirement; hydraulic design of storm water system and computation procedure.

References

1.Hydrology

Subramaniam&ByRaghunath

2.Engineering geology

Ckesavilu,

3.Applied geology

Parbin Singh

PLA125 DEMOGRAPHY AND URBANISATION

Demographic variables-fertility, mortality, migration; evolution of population study, contribution of Malthus; mortality-trends, mortality in developed and developing countries; biological and social factors and mortality- gender, race, social structure, life style, social status, occupation etc; measures of mortality-crude and age-specific death rates; infant mortality, reproductive ages, advance ages; adjusted or standardized death rates; neonatal mortality rate; fertility-fertility trends, fertility and social and biological behavior; differential fertility, ethnic group, socio-economical group mobility, location etc.;

measures of fertility, crude birth rate. Age-specific fertility rate; total fertility rate, net reproduction rate; migration-causes and consequences of population movement; reasons and types of migration trends; theories of migration and population movement; methods of measuring volumes of migration; direct and indirect measures; effects of migration on composition of population.

Source of demographic data; population structure and composition - age sex composition, sex ratio, dependency ratio, child-woman ratio; measures of age - sex structure, age-sex pyramid, population composition; marital status, cast region, literacy level, etc; life table techniques; techniques in preparing life table, abridged life table; population estimation, projection and population forecasting; basic cohorts survival model, inter regional cohorts survival model.

Urban revolution; its preconditions; brief history of urbanization in the world leading upto the industrial cities, related problems, concepts of urbanism and urbanisation; brief history of urbanisation in India; Mughal and British influences of Indian cities; post- independence urbanization; urbanisation process as influenced by socio-cultural, political, economic and administrative factors; definition of urban centers, concepts of rural urban continuum and dichotomy; census definition of urban places town, cities, town groups, urban agglomerations, standard urban area metropolis, megalopolis etc. functional classification of urban places.

Settlement system, primate city, rank-size rule, central place concept, concepts of complementary area, central goods and services, range, threshold etc; city-region relationships; structure of city regions, area of influence, dominance; rural-urban fringes; its structure, stages of growth, its role in urban growth; urbanisation, industrialisation and urban development; push and pull factors; migration trends and impacts on urban and rural development.

Urbanisation policy, basic issues in urbanisation policy; role of national and state level policies; five year plans, latest attempts at urbanisation policy formulation in the country; salient features of the report of the national commission of urbanisation.

References

1. Demographic population studies O H Shrivastava,
2. Urbanization in India C. Yadav (Series)

PLA 126 COMPUTER APPLICATIONS

Need for automated design and drafting; Tools; Elements of spatial data in CAD - Arcs, lines, rectangles, poly-lines, points, circles, donuts, layers, grids, snaps and object snaps, etc.

Move, scale, copy, offset, change, trim, extend, mirror, divide, measure, array, break, hatch, block, zoom, regen, view, pan, fonts, etc.

Paper maps, digital layout maps, on screen digitization; 2D and 3D conversion, perspective view, walk through of layout.

Base map evaluation, scanning the maps, digitization, scale conversion, symbolization, layer control, plotting.

Limitations of Computer Aided Design and Drafting in Planning; Non-linking of spatial and attribute data; Need for GIS packages for handling spatial and attribute data.

Meaning of CAAD and importance in Planning, software used in CAAD, introduction to visualization

Preparation of drawing for visualization, understanding concepts of 3D drawings

Introduction to the modeling techniques using NURBS and surfaces

Rendering, its concepts, material application, setting up lights, background and importing images

Generating photo-realistic images and creation of slide of slide shows

PLA127 PLANNING STUDIO 2

Preparation of Base Maps at the levels of Site, Area, Zone, City, Region, etc; Preparation of Key Maps; Composition of Drawings, Proportions of Lettering and Line thickness, Standard symbols, Linestyles,

Colour-coding; Legend, Drawing Formats; Appreciation of Thematic Maps of various levels of Planning; Introduction to Photography, Basic Principles, Composition for Architectural Building

Photographs and Planning / Site Photographs;

Third Semester

PLA 211 SETTLEMENTS SOCIOLOGY

Sociology as a science; Sociological imagination and rethinking; Applied sociology

Functionalist perspective, Conflict perspective, Internationalist perspective; Culture of space and cultural ecology; Social structure and social control; Stratification and social inequality; Social mobility and Social defiance

Family, kinship pattern and authority; Religion as social work and significance in planning; Voluntary associations (identifying NGOs and involving them as partners of development, operational issues); Groups (primary, secondary and reference groups)

Development induced displacement (anthrop-social considerations); Resettlement and rehabilitation; Neighbourhood pattern and development strategy; Rural and urban issues; Community based and workshop based methods; Qualitative data Analysis; Report writing

Gender and sex; Gender sensitive; Gender and development planning; Gender and implications for spatial planning

References

- | | |
|----------------------------|---------------------|
| 1. A brief introduction | Richard T Schaefer, |
| 2. Sociological principles | CN ShankerRao |

PLA 212 PLANNING THEORY 2

Scientific Rationalism and Planning: Defining instrumental rationality; Systems view of planning with a focus on contributions of J.B. McLoughlin and others; Chief characteristics of Comprehensive Rational Planning Model and implications for planning practice; Systemic change

Advocacy Planning, Pluralism and Equity Planning, Meaning, historical background and purposes of Advocacy Planning Model; Main features of Advocacy Planning Model; Relevance for planning practice; Equity and its various definitions; Major components of the Equity Planning Model; Implications on the role of planners in planning practice

Political Economy Theories and the City, Defining the term political economy; Role of the state in planning; Contributions of David Harvey, Manuel Castells and others; Richard Foglesong and the property contradiction

Collaborative and Communicative Planning Various components of Collaborative Planning Model; Contributions of Patsy Healey and Judith Innes and others; Deliberative policy analysis; Role of trust in planning; Planning as persuasive storytelling

Capabilities, Race, Gender, Religion and Caste Defining functioning and capabilities; Exploring relevance of Sen and Nussbaum's capabilities to planning; Role of planning and planners in enhancing capabilities of the poor; Capabilities perspective on slums and squatters; Feminist planning theory; Planning, caste and religion; Planning rights and responsibilities

References

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|----------------------------|---------------------|
| 1. Urban Planning theory b | Nigel Taylor, |
| 2. Planning futures | Philip Allmendinger |

PLA 213 TRAFFIC AND TRANSPORTATION PLANNING 1

Traffic characteristics and problems at national, regional and urban level; different modes of transport; slow and fast and their characteristics; vehicle types, capacity, overloading factor; vehicle characteristics and road characteristics.

Road hierarchies, classification, capacity and level of service; space standards for road design, land acquisition, components; objectives and functions; intersection types; uncontrolled, controlled; space sharing and time sharing junctions; merits and demerits, design considerations; design in built up areas, cycling and pedestrian systems, design considerations and guidelines; road and road transport infrastructure; terminals, depots, bus bays, stops, fuel stations etc.

Demand and supply surveys and studies: traffic assessment; traffic volume, traffic density, traffic flow and speed; parking supply and demand survey; control, provision and layout of on street and off street parking, traffic regulatory measures for parking, pedestrian facilities; pedestrian volume studies, origin-destination studies, controlled crossings.

Components of geometric design in new development and built-up areas; horizontal and vertical alignment, network alignment planning, sight distance, cross-section, alignment check, lateral and vertical clearance, control of axis; design guidelines for transport infrastructure.

Objectives, principles and approaches for traffic management; traffic signs and signals; types of traffic signs, sign standards, location and maintenance; traffic signals; types, advantages and disadvantages; traffic safety, environmental area concept and application.

References

- | | |
|---|------------------|
| 1. Introduction to transport planning | Michael J Bruton |
| 2. Principal of Urban transport system planning | Hutchinson |

PLA 214 ELEMENTS OF ECONOMICS

Central problems of economics; micro and macroeconomic decisions, use of economics in planning, Law of demand and supply, elasticity's of demand and supply, its use in planning

Perfect and imperfect market types, market demand and supply, pricing under different market conditions; theory of production; factors of production, costs, scale of production, and economies of scale, Classical and modern approaches, growth and development indicators; measures of national income, defining development and under development.

Use of economic concepts in urban planning, housing, transport, taxes, land use, location, etc.; use of economic concepts in regional planning; location, disparities in development, input - output techniques, sectoral development etc.

References

- | | |
|---------------------------|-----------------|
| 1. Modern Economic theory | HL Ahuja |
| 2. Economics | Paul Sauruelson |

PLA215 PLANNING PRACTICE 1

Framing Planning Policies, Role of Town and country planning organization at central level and town and country planning

department at state level. Actors framing public planning policies; Influences of various stakeholders on policy formulation; Implementation of public policies, Development Authorities

Types, functions and spatial jurisdictions of development authorities; Reasons for the establishment of development authorities; Place of development authorities in local government, Development and Development Regulations

Working of building bye-laws in planning practice; Requirements for grant of building permissions; Streamlining the development control regulations; Making development control regulations work for the poor; UDPFI Guidelines; National Building Code and its implementation

Coordination in Planning Practice, Meaning and types of co-ordination; Mechanisms of coordination; Case examples of coordination from planning practice, Privatization of Planning Practice

History of privatization of planning; Special Economic Zones; Retail sector developments;

Infrastructure development by the private sector such as Metro, etc.

PLA216 TECHNIQUES OF PLANNING 1

Choice of appropriate scale for region and settlement level plans; town development plans, zonal development plans, layout plans; graphical, linear and areal scales; contents of base maps at various scales, notations - basic disciplines of maps; Measurement of Areas.

Data requirements for urban and regional planning; sources of primary and secondary data; questionnaire design, measurement scale and their application, sampling techniques, types of socio-economic surveys; self surveys, interviews, mailed questionnaires and observer participation.

Techniques of conducting surveys for land use, building use, density, structural condition of buildings, heights of building, land utilization and physical features of land; Data requirement for various types of regional plans; Techniques for conducting regional surveys .

Tabulation of data, graphical presentation of data; pie diagrams, histograms, bar charts, normal, semi-log and double log graphs and their uses; colour, black and white presentation techniques; basis disciplines of illustration and tables. Unit 5: Techniques of Graphic Presentation of Spatial Data Land use classification, coding and analysis; residential and non-residential density patterns and analysis; colour, black and white presentation techniques; basis disciplines of illustration; Presentation of spatial data, analysis and proposals

References

1. Urban & regional Planning

Peter Geoffrey Hall

PLA 217 PLANNING STUDIO 3 (NEIGHBOURHOOD AND SITE PLANNING)

Design and preparation of plan, sections and elevation of low rise and high rise apartments taking into account the building byelaws and zoning regulations; Preparation of presentation drawings;

Introduction to the working drawings; Preparation of plans, sections, elevations and important details of an apartment unit

Site analysis, development standards and preparation of the design brief; various considerations for site layout, conceptual approach to site planning;

Preparation of preliminary layout and area analysis; Final layout showing the circulation and basic infrastructure;

Rough costing of the scheme, preparation of the model to an appropriate scale

Fourth Semester

PLA 221 TRAFFIC AND TRANSPORTATION PLANNING 2

Transport systems, infrastructure and management, transport systems and their types, design and operating characteristics, urban road hierarchy, planning engineering and management criteria for road and junction improvements, arterial improvement techniques.

Study area definitions, surveys and their types, sampling of travel methods, survey techniques; programming and scheduling, processing of travel data, analysis and interpretation of traffic studies; introduction to transport planning process; trip generation, trip distribution, trip assignment, modal split, land use transportation models; existing organisational and legal framework, traffic and environmental management techniques; review of the existing traffic management schemes in case cities.

Importance of accessibility in regional transport planning, role of road, rail, air and water transport systems; regional transport systems planning; road network planning for micro regions.

Traffic noise, factors affecting noise, noise abatement measures, standards; air pollution standards; traffic safety; accident reporting and recording systems; factors affecting road safety; transport planning for target groups children adults, handicapped and women; norms and guidelines for highway landscape; street lighting types, standards and design considerations.

Pricing and funding of transport service and systems; economic appraisal of highway and transport projects; techniques for estimating direct and indirect road user costs benefits, value of time; review of national, state and local level transport policies and their relevance in spatial and economic planning, pricing and funding of transport systems; energy and environmental implications in transport; transport policy planning; transport planning in developing countries.

References

1. Transport modeling
2. Traffic and Transportation planning & engineering

Ortuzer&Williamson

Kadiyali

PLA222 LANDSCAPE PLANNING

Landscape as an outcome of natural processes; principles and techniques of design with landform, water and vegetation; the role of surface materials, outdoor fittings and structures; man-made landscapes in

history; a comparative study of the major traditions of landscape design in the east and the west in relation to concepts of space and variations in the use of landscape elements.

Characteristics and components of open space patterns in towns and cities (traditional and contemporary) basic types: streets, squares, plazas, gardens, ghats and maidan, public parks at district, local and neighbourhood levels; park systems; landscape design related to land- use, circulation networks and activity; streetfurniture as a component of urban landscape.

Principles of understanding and evaluating and existing landscape; development as a response to constraints and opportunities offered by the site; the landscape concept and open space structure as a basic component of the site plan.

The role of vegetation: environmental benefits, functional requirements, aesthetic considerations; typical situations and criteria for design with plants and selection of species; grading; in relation to existing contours, plinth levels, road alignment and storm water drainage-, principles of cut and fill.

The rural landscape; characteristics, components and change related to agriculture, forestry and development; western experience of landscape planning; landscape assessment techniques; the concept of landscape quality; landscape planning as a component of regional development proposals for industrial location (manufacturing and extractive); environmental conservation, tourism, etc.; landscape planning in the context of urban extensions and new towns.

References

Site planning by Kevin Lynch, Landscape planning by Simond

PLA223 ENVIRONMENTAL SCIENCE (CLIMATOLOGY)

Basics of Ecology and Environment: Study of various natural resources like forest, Water bodies, atmosphere, etc.

Global environmental issues such as global warming, ozone depletion, greenhouse effect,

Elements and types of climate, including the practical measurements of climatic parameters, Built environment, conditions, impact and issues of climate balance in traditional and contemporary built environment.

Human comfort (body & thermal), thermal comfort factors and indices and visual comfort,

Principles of thermal design, structural and ventilation controls and their application in building.

Illumination and day lighting, Use of shading angles for lighting and radiation techniques and their application in buildings

References

1. Tropical design of buildings Koinberger
2. Environment science Fuller moore

PLA224 GEO-INFORMATICS FOR PLANNING

Limitations of Traditional Surveys for Planning; Remote Sensing - Definition, Aerial and Satellite Remote Sensing, Aerial Remote Sensing

Aerial Photo-Interpretation, Qualitative and Quantitative Elements of Photo Interpretation; Satellite Remote sensing, Geo-Stationary and Sun-Synchronous Satellites, Principles of Electro-Magnetic Radiations, Resolutions; Introduction to Digital Image Processing; Salient Features of Popular Remote Sensing Satellites; Applications in Planning; Laboratory Exercises

Systems Approach to Planning as basis for Planning Information Systems; Systems, Hierarchy, Types; Data and Information, Value of Information, Information Flows, Loops; Information Security and Sharing; Information Systems, Types, limitations;

Human Settlements' Information Needs, Scales and Levels, Pre-Conditions for Using Planning Information Systems; Introduction to various Planning Information Systems

Planning Information Systems -NNRMS, NUIS, National Urban Observatory, Municipal Information Systems, Land Information Systems, Cadastre Systems; Applications and Limitations; Tools for Spatial Data Handling, Introduction to GIS.

References

1. Applied geology Parbinsingh&CKesavilu

PLA225 ECOLOGY AND RESOURCE MANAGEMENT

Meaning and scope of ecology; evolution of ecology; man, environment and ecosystem; components of nature and basic concepts and processes of ecology; flow of material, water energy, invasion, succession, predation, regulatory forces, adaptation, trophic levels, food chain, food web, ecological pyramids. Resources and human settlements, impact of advanced agricultural methods, urbanisation and industrialisation. on nature; urban ecosystem approach, evolution and significance; soil, water, land, vegetation and energy resources; resource development and management.

Introduction to quantitative ecology, identification of ecological parameters for planning at different levels; site planning, settlement planning and regional planning; data needs and format for data collection; types of analyses required to evolve ecological parameters.

Environment impact studies of development projects.

References

Ecology & Resource Management by Kenneth E. F. Watt

PLA 226 TECHNIQUES OF PLANNING 2

Methods of analysis of Socio-Economic and Physical data; Use of techniques of Location Quotient, Coefficient of Localization; Locational attributes of activity and population; Techniques for understanding structure of urban areas, land values and density patterns;

Formulation of spatial standards for residential, industrial, commercial and recreational areas, space standards for facility areas, utilities and networks; Population, Distance criteria; Performance standards; Case studies.

Concept and need for Regional Planning, Region, Fact or Fallacy; Formal, Functional, Planning Regions; Regional delineation techniques, Factor analysis, Cluster analysis; Row analysis; Case studies in regional delineation.

Setting of Goals and Objectives; Methodologies for preparation of urban regional development plans, master plans, structure plan and strategy plan techniques; plan implementation techniques; public participation and plan implementation; techniques of urban renewal and central area re-development; Contents of a Master Plan, Regional Plan, etc.

Thresholds analysis, retail location and industrial location analysis; intervening opportunity models; Linear programming; Simulation, Gravity Models; Applications in planning.

References

Urban & regional Planning by Peter Geoffrey Hall & Urban & Regional planning by Hemchandra

PLA227 PLANNING STUDIO 4 (TRANSPORTATION ASPECTS)

Understanding of functional and geometric classifications of urban and rural roads and their cross-sectional elements

Methods, surveys, analysis, presentation of data and also to prepare reports relating to different types of transport surveys

Road geometries and road components, traffic volume, origin destination, spot speed, speed and delay, parking and pedestrian;

Design and preparation of layout for road intersections, rotaries and signalized intersections

Preparation of an area circulation plan by studying the existing land use, existing circulation pattern, geometric design, level of services for a small area through networks improvement and low cost traffic management measures

Fifth Semester

PLA 311 URBAN FINANCE

Nature and composition of income and expenditure, limitations and need for revenue enhancements; Expenditure control methods and mechanisms; Budgetary allocation from Central and State Governments for urban development; Assistance from foreign donors and Multi National agencies; Non-traditional

sources of funding; Market access; Pool finance and prerequisite conditions for accessing non-traditional funds.

Types of partnership approaches; Privatization of civic services; public private partnership mechanisms; Types of contracts and ownerships; Emerging cost effective technology interventions; User charged projects; Pricing of services.

Role of state government and urban local bodies; City's challenge fund; Urban reforms; Implications on resources, incentive fund and state level pooled finance development fund.

Better finance management, management process; Accounting and budgeting, asset management, receivables management, cost centre approach; Computerization as tool for resource enhancement; Role of Management Information Systems.

Financial operating plan, city corporate plan; Development of urban indicators; Infrastructure pricing and financing - financing mechanisms in addition to tax and grants; private public partnerships like BOT, BOOT, BOLT etc.; Impact fee, subsidies.

PLA312 PLANNING PRACTICE 2 & TRAINING

Role of Town and country planning organization at central level and town and country planning department at state level. Actors framing public planning policies;

Influences of various stakeholders on policy formulation; Implementation of public policies

Types, functions and spatial jurisdictions of development authorities; Reasons for the establishment of development authorities; Place of development authorities in local government

Working of building bye-laws in planning practice; Requirements for grant of building permissions; Streamlining the development control regulations; Making development control regulations work for the poor. UDPFI Guidelines; National Building Code and its implementation

Meaning and types of coordination; Mechanisms of coordination; Case examples of coordination from planning practice

History of privatization of planning; Special Economic Zones; Retail sector developments; Infrastructure development by the private sector.

The assessment of the training done during vacation will be examined.

PLA313 RURAL PLANNING

Village as an organic entity; physical, social, and economic structure of village; village problems related to cultivated land, cultivable land, waste land, flooding and water logging, utilities and services, poverty and distress; rural urban relationship-, complementarities, continuation and dichotomy; problems related to rural-urban migration.

Transhumance, accessibility of villages, inter-village communication, delivery of social services, rural reconstruction and related programmes, improvement of rural sanitation, hygiene and drainage; Panchayat raj institutions; district block and village administration.

Norms, principles and strategies for rural development; afforestation, soil conservation and wild life preservation; planning for sustainable agriculture; rural development programmes.

Endowments; types of resources, exhaustive and replenishable resources development; utilization and conservation of national, technological and human resources; resource management, recycling of resources and resource equilibrium; water resource management, waste land management; rural industrialisation and use of non- conventional energy in rural development; major resource development programmes in India; case studies of resource development projects in agriculture, forestry, minerals, water, manpower, etc.

Community development, community development and rural planning; basic principles of self-help techniques and role of voluntary organisations in community development; appropriate technologies, innovation and entrepreneurship

PLA314 SETTLEMENT GEOGRAPHY

Nature and scope of settlement geography, origin, setting evolution and structure of human settlements; man, environment and society; social economic and political consequences of geographical conditions; physical features and its effect on urban and rural communities.

Census classification, urban, rural census size classes: theories of settlement systems, primate city settlement system. rank size rule relationship; central place settlement systems, fundamental concepts, concepts of hierarchy, concept of complimentary area. range of goods; (dynamics of central places. settlement systems in at developing economy.

Types, patterns, morphology, house types, comparative study of origin and growth of settlements in ancient and modern times rural housing problems and policies.

City structure, new towns and cities, environmental impact of planned and unplanned growth, rural - urban fringe.

Rural and urban continuum, settlements as a hierarchy; areas of influences, areas of dominance, distance decay effect.

References

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|-----------------------|------------------------|
| 1. Urban Geography | Pacione M |
| 2. Economic geography | Truman Hartshorn |
| 3. Made simple series | klowness and J. Waring |

Department Elective

PLA 315 UTILITIES AND SERVICES NETWORK PLANNING

Familiarizing to CPHEEO manual and guidance Surface and ground water sources, quality and quantity, location of sources and water intakes, area requirements of the components of water intakes; Water requirement for different land uses, factors affecting water demand, per capita requirement and its relationship with population sizes, variation of water consumption; seasonal & hourly, peak factor; demand of water for fire fighting; Water treatment system, location and space requirements; Components of water distribution systems, water storage location, capacity, fire fighting components, fire hydrants location, spacing, pressure requirement in pipe; Pumps types, efficiency, head loss, pump selection criteria, site selection and space requirements for pump house; Planning of water supply system, organizations and their jurisdictions, basic design guide line and layout of water supply distribution system; Financing water supply system, public and private partnership of providing water; Legal aspects and government policy for urban and rural water supply, Design of Water harvesting systems; Government initiatives for water harvesting system and case study discussion

Methods of sanitations, advantages and limitations; On-site detention, design procedure for on-site detention, Off-site and on-site technology up gradation; Low cost appropriate technologies for sanitation; Quantity of sewage, standards for Indian cities; Sanitary sewer system network and layout, data needs and procedure of planning; Sewer appurtenances; sewer lift station, sewer pumping and forced main manholes; Sewage disposal methods and their advantages and disadvantages, location criteria and capacity; Case study of innovative approaches of sewage disposal in urban area; Approaches for financing and cost recovery for sewer system.

Solid waste management for Indian cities, issues and database, quantity of solid waste and its character; Methods of solid waste managements, collection and transportation, disposal of solid waste; Land filling and composting, pre and post treatment; Indore and Bangalore methods, incineration, pyrolysis and recycling park; Area requirements, location and cost aspects of different methods of solid waste disposal systems; Community participation and involvement of Non Governmental Organizations or NGOs in efficient solid waste management.

References

Building construction and services by Sushilkumar&

PLA 317 URBAN INFRASTRUCTURE PLANNING

Water, Concept of basic needs; formulation of objectives, norms and standards; Planning for water supply;Source of supply, source analysis, quality and quantity; Issues related to transmission of water,, treatment methods, sequence, benefits; Distribution systems suitable in large city, small town;basic requirements, design guidelines; Technological options for water supply; Aspects of water, distribution in

far flung areas; Standards and locations for pumping stations; Water supply projects, financing and management; Legal rights, water pricing, water pollution.

Sewage and Sanitation, Biological/ Environmental/ Cultural concepts in environmental sanitation; Low cost sanitation, options: biogas, *SulabhSauchalaya*, etc.; Basic information, alternative disposal systems and, conditions of use; Principles of sewage system layout; Collection, transportation and treatment of sewage; Principles of water bound disposal system, storm water drainage systems; Different methods of sewage treatments; Issues related to development parameters. Solid waste: basic principles, generation, characteristics, collection, collection, disposal, management of city waste; Environmental issues of garbage disposal; Alternative technological innovations, conversion of garbage into usable forms. Fire Protection and Electricity Planning for fire protection services and space standards; Locational criteria, implications on land use and density. Planning for electrification, general scenario, services and space standards of transformers; Locational criteria, load forecasting. Institutional arrangements for municipal services, sector issues and assessments, financing systems, administrative set-up, people's participation Regional Infrastructure Planning Regional poverty and basic needs; Basic needs approach to the provision of infrastructure and networks; Regional infrastructure and network systems: Physical (roads, irrigation system, water supply, sanitation, drainage, watershed management, fire services, telecommunication, energy, electricity, solid waste disposal, etc.); Social (health and education) and economics (banking, marketing and public distribution systems); Diagnosis of issues, methodology, role of regional planner.

Issues in Regional Infrastructure Planning Planning and programming approaches for regional infrastructure and network systems; Environmental, social and economic impacts of infrastructure and network systems; Integrated planning organization and management of regional infrastructure and network systems; Economic costing of regional networks and services; Pricing and cost recovery for district networks and services.

PLA 318 PLANNING STUDIO 5 (AREA PLANNING/ZONAL PLANNING)

The different approaches to plan making; the concepts of master plan, comprehensive development plan - the structure plan, the sector plan, the area / zonal plan, and other types of plan making processes

Relationship of higher order plans with lower order plans

The approach to developing the area / zonal plan in the framework of a given master plan

The study and development of the relevant planning standards for different land uses

Detailing of specific sites in the proposed area / zonal plans, covering different land uses .

Sixth semester

PLA 321 URBAN DESIGN

Urban design as interface between architecture and planning; city as a three dimensional entity; Study of volumes and open spaces at all spatial levels; A brief historic review of the development of the urban design discipline and principles

Elements of Urban Design: Urban form as determined by inter – play of masses, voids, building typology; scale, harmony, symmetry, color, texture, light and shade; dominance, height, urban signage and graphics; organization of spaces and their articulation in the form of squares, streets, vistas and focal points; image of the city and its components such as edges, paths, landmarks, street features, sky – line, etc.; urban transportation.

Physical and Non – Physical Determinants of Urban Forms Activity and the morphology of places; form, size and structure of cities and the related geometry co – related with their determinants; case studies of urban design characteristics of cities in India and abroad; related issues for public intervention.

Control of Urban Design Urban design and its control; Control of visual pollution; Agencies responsible for ensuring better urban design, their roles, powers and limitations.

Contemporary Practices Townscape policies, building byelaws and regulations for existing and emerging areas of development; Special rules for heritage and hill areas

References

1. Urban Pattern Gallion
2. The city Losangels& urban theory Allenj scot,
3. City shaped “urban pattern meaning through history’ Spirokostof

PLA 322 REGIONAL PLANNING

Concept of regional planning: nature, objectives, levels and aims; Concept of a region, types, and regionalization.

Regional interaction: Rank Size Rule, Settlement patterns, Central place theory; Loschian theory; Regional networks.

Regional development; Balanced and unbalanced development; Under-development; Regional multiplier, input-output model; Linear programming applications; Cumulative causation theory; Core-periphery model; Growth poles and centres

Regional planning processes: Identification of plan objectives; collection, classification and analysis of data; Norms and standards for regional planning; Formulation of alternative plan proposals with respect to population distribution, location of new regional economic activities, infrastructure, plan implementation, etc.

Selected case studies in regional development: Rajasthan Canal Area, South-East Resource Region, Western Ghats Region, etc.; District Planning; Metropolitan regions: National Capital Region, Mumbai Nmetropolitan Region, etc.

References

1. Regional planning for urban spaces AD Walk, Urban
2. Regional planning reader Birch E, Glasson

PLA323 HOUSING

Significance of housing in National Development Goals; Equity and efficiency parameters of housing; Current issues in housing

Existing Housing Statistics; definitions; urban and rural housing statistics; Introduction to concepts of Housing Shortage, Housing Need, quantitative and qualitative aspects of housing; Housing Demand - Understanding current methods of demand assessment; Knowledge of data sources and their use and interpretation; census, NSSO and other data; Limitations of existing methods of assessments.

Understanding of factors affecting residential location, theoretical knowledge of ecological, neo-classical, institutional approach to housing; Housing subsystems and their characteristics: formal and non-formal housing; Process of Public and private sector housing development process; policy context, actors and their interrelationships; Inner city housing, Slums, Squatter housing, Unauthorized Housing; Role of different institutions in housing; International agencies, NGOs, State, Financing Organizations, Private developers, cooperatives.

Factors determining residential densities; Densities, costs and development control regulations; Housing designs parameters and their relationship to costs; Housing design and climate; Housing for disaster prone areas. Communities; its characteristics and housing; socio-economic implication of slums, clearance/ improvement of slum; sites and services schemes, squatter upgrading, incremental approach

Understanding and evaluation of Housing Policy and programmes in India; five year plans, Central government policy; Policy framework for urban and rural housing; Comparative policy analysis; Housing for the low income groups; Cooperative housing, objectives and principles; management and financing of housing projects; investment in housing in public and private sectors.

References

The architectural of affordable housing by Sam Davis Urban housing form by JingminJhou

PLA324 DISASTER PLANNING AND MANAGEMENT

Basic Concepts of Disaster Management, Disaster – definitions, concept and perceptions; different types of disasters; recent initiatives at

national and state level; Kyoto Framework of disaster mitigation and management; Disaster management policy – national and states; Disaster Management Act – national and states, Disaster Management Mechanisms, Disaster management mechanisms – national, state and district levels; select global practices; disaster and development; physical planning and disaster management plans; various role players in disaster management – NGOs / CBOs and Armed Forces; Community Based Disaster Preparedness (CBDP), Disaster Risk Mitigation Natural Disasters – physical phenomenon, causes and consequences mitigation and management practices – cyclones, floods, earthquakes, landslides etc.; causes and risk mitigation strategies at the Master Plan for industrial, chemical and biological disasters; land use planning, building bye laws and disaster safe construction practices for different types of disasters, Disaster Preparedness Forecasting and early warning systems for various types of disasters; communication and information technology in disaster management; disaster education and awareness; documentation and case studies on natural disasters. Urbanization, land requirements, social and affordability issues of land use, Climate change and its implications in disaster mitigation

Post Disaster Management and Cross Cutting Issues, Post disaster management; rehabilitation and reconstruction of disaster affected areas; urban, disaster mitigation; natural resource management for disaster safe habitation; relationship between, disaster and environment; safe hill area development guidelines and coastal zone regulations for safe habitation; human settlement planning for consequence mitigation of global warming and climate change.

PLA325 URBAN CONSERVATION

Overview and introduction of the basic concepts of conservation; values, attitudes and principles for judging the conservation importance of sites, areas and related typology; scope and basic technique of urban conservation; Urban renewal as apart of metropolitan plan; identification of urban renewal areas; conservation, rehabilitation and redevelopment urban renewal policies and strategies

Economic, Financial and Management Aspects

Economic and spatial implications of urban renewal programs, mobilization of resources; incentive zoning - management of urban renewal areas

Conservation and Development Economic and social aspects of conservation, traffic and management issues; Conservation policies - case studies

Slums Clearance and improvement schemes, planning aspects, land management, social economic issues, public participation, government schemes and their critical evaluation

Legal and Administrative Aspects

National and international experience in implementing urban renewal programs; Legal and administrative aspects, archaeological acts/ charters pertaining to conservation, development and conservation; Case studies of proposals for urban conservation of sites/ areas in India and abroad

References

1. Urban conservation Nahoumcuhen

Department Elective

PLA 326 PLANNING FOR INFORMAL SECTOR

Dimensions of urban poverty, magnitude of problem, urban poverty alleviation programmes; impact of macro-economic structural adjustment policies on poor urban households.

Development of the concept of basic needs; identification of basic needs and their provision for various target groups and informal sectors; standards for basic needs, NGO's and voluntary organisations associated with provision of basic needs.

Community planning approach, low cost alternatives and institutional reforms approach.

Characteristics of migrants and their association with growth of informal sector; socio-economic deprivation and informal sector; development of informal sector concept

Study of major aspects; spontaneous living and working, their characteristics and functions in urban context, actions for improvement; appraisal of the role of government, private and voluntary organisations; existing management; their organisational set-up and limitations; planning and

development of urban settlements in respect of the spontaneous growth; case studies from India and other developing countries.

References

1. Urban Informal sector in Asia ILO publications

PLA327 ENVIRONMENTAL IMPACT ASSESSMENT

Role of Environmental Impact Assessment in the planning and decision making process; Definition and need, evolution and objectives, tasks and scope. Methods of Environmental Impact Assessment; Advantages and limitations; Case studies from India and abroad on projects of various types covering different levels of planning. Assessment of impacts on land use, Urban and regional; Assessment of impacts on resources (including air, water, flora and fauna); Case studies from India and abroad on projects of various types covering different levels of planning. Assessment of social and health impacts; Case studies from India and abroad on projects of various types covering different levels of planning. Public - private - people's participation in Environmental Impact Assessments: definition and concepts, objectives, techniques, advantages and limitation; PRA techniques; Case studies from India and abroad on projects of various types covering different levels of planning; Practical exercises on Environmental Impact Assessments

References

1. Introduction to EIA John Glassoy

PLA328 ENERGY EFFICIENT PLANNING

This is advance course in area of energy conscious Architecture. Building design in response to various climates and its impact upon requirements of energy in building. Assessment of energy in buildings using computer software. Low energy strategies and guidelines. Non- conventional energy sources and system integrated building design. Building energy management system and energy audit of buildings using computer software

References

1. Energy Efficient planning Efraimgil
2. Energy Planning & Urban form Susan E. Owens

PLA329 PLANNING AND DESIGN STUDIO 6 (DEVELOPMENT PLAN PREPARATION)

The study shall involve understanding of contents of various types of development plans and explore their foci. Identification and preparation of secondary source information of the towns or cities selected for the study.

Visit to the case study area, collection of primary and secondary data and information on various aspects such as demography, social, economic, housing, transportation, etc.; conduct of primary and secondary surveys

Analysis and synthesis of data and information collected on various aspects; projections of population and workforce; trends and issues identification

Preparation of policies and proposals with different scenarios and identification of priorities and action areas; phasing and monitoring; governance structures for implementation; land use plan and the plan document. Note: Each student will be required to undertake training and planning (or related) during summer vacation. The exact period and place of training will be decided in consultation with the coordinator in charge of training

Seventh Semester

PLA 411 PLANNING LEGISLATION AND PROFESSIONAL PRACTICE

Sources of law (custom, legislation and precedent); meaning of the term of law, legislation, ordinance, bill, act, regulations and bye-laws; significance of law and its relationship to planning; benefits of statutory backing for planning schemes; eminent domain and police powers.

Concepts and contents of Indian Constitution; provisions regarding property rights; evolution of planning legislation and overview of legal tools connected with urban planning and development; model town planning laws

Introduction, scope and relevance of various laws and acts relevant to planning; Model Town and Country Planning Acts, Development Authorities Act, 73rd and 74th Constitution (Amendment) Acts; Municipal Acts, Environmental and Pollution Control Acts, etc.; Case studies.

Introduction to Land Acquisition Act, 1984, Historical background, need, advantages, Limitations; Relevance in today's context; Case studies highlighting nature of contention, parties in dispute and the decisions in specific planning dispute.

Special purpose bodies for plan implementation such urban metropolitan development authorities, improvement trusts, water and sewerage boards, housing boards, slum improvement, clearance boards, transport undertakings; regional development boards.

References

1. Legislation and Planning practice Namavati

PLA 412 URBAN MANAGEMENT

Urban development as a decision making process and corporate activity; Application of management techniques in urban planning and development

Urban development bodies; urban development authorities: background, functions, powers, organization structure and resources, Case studies; Role of NGOs and private organizations in urban development, relationships with local and state governments.

Financing urban development projects; Sources of funding: cost recovery, cost subsidization, medium and long term financing; Private investments in urban development projects: prospects and limitations; Municipal financing: sources of revenue and items of expenditure; Financial resource mobilization for urban development particularly for municipal/ local bodies.

Decision-making; definition, features, factors, essentials and hindrances in sound decision-making; structure of decisions and types of decisions; theories of decision- making: rational theory, incremental theory, systems theory, game theory, conflict theory, Herbert Simon's contribution in decision making; decision makers and decision making bodies related to urban and regional planning at national, state and local level.

Planner's functions as a leader, urban development manager, public bureaucrat, policy analyst and social reformer; approaches to study leadership; trait-approach, behavioural approach and situational approach; role of the planner in the decision- making process; generalists vs. specialist competitions and copyrights. Fundamentals of valuation, ownership of land, compound interest theory, calculating of present value, concepts of economic rents and social rents, property taxes, sinking fund, annuity, depreciation, valuation tables; Legislative framework-rent control, land acquisition, easements and their effects on properties.

Income capitalization methods, land and building method and other methods of valuation; Purpose of valuation; Valuation for wealth tax, income tax, capital gains tax, property tax, gift tax, etc.

Tenders, contracts, arbitration, schedule of rates for construction; Materials, labour and equipment for land development, unit and mode of measurements, rate analysis; Formulations of project proposals and outline; Preparation of and response to Notice Inviting Tenders, Expression of Interest, Terms of Reference, Penalty clauses, etc.

PLA413 REMOTE SENSING AND GIS

Basic remote sensing, platform, sensors, and introduction to sensors, basic principal & methods of photo interpretation and techniques of data collection through satellite data. Classification techniques using satellite data

Digital image processing, enhancement techniques in urban information extraction

Aerial photography as a tool for collection of data and preparation of maps, its application in planning and preparation for a project, orientation concept and methodology transformation and adjustment techniques. Experiments in lab, Instruction for making overlays Computation of photo scale Orientation of a stereo pair under a mirror stereoscope Recognition on aerial photograph of objects indicated on ground photographs Detection of defined objects, Description and identification of objects. Use of auxiliary

features for object identification Systematic scanning of a photograph, and object identification. Identification of land use with a given classification Monitoring urban changes, Mosaic preparation Base map preparation & elementary data analysis using satellite data Experiments in lab, Instruction for making overlays Classification preparation Interpretation & delineation of various land use on satellite data products

GIS techniques and their application in planning field NOTE: Sessional work shall consist of term paper, small project formulation using satellite data and analytical report preparation through GIS, seminars

References

1. Concepts and techniques of GIS CP.LO

Department Elective

PLA 414METROPOLITAN PLANNING AND DEVELOPMENT

Introduction to metropolis and related concepts, growth and scale; Complexities: social, economic, physical and administrative; Metropolitanisation in India: general trends and distribution; Issues and problems in metropolitan planning and development

Area of influence, service area of a metropolis; Metropolis as a primate city; Concept of degree of primacy; Metropolitan region and delineation techniques; Metropolitan regional structures: characteristics, components and spatial patterns

Metropolitan centralization and decentralization processes; Concepts of ring and satellite towns, counter-magnets; Forms and concepts for metropolitan planning and development: Sheet, Galaxy, Core, Star, Ring and Multi-nucleated; Merits and demerits; Efficient functioning of metropolis

Metropolitan planning: spatial planning studies and surveys; Concepts and techniques of preparation of metropolitan city plans; Metropolitan planning and development strategies at regional and settlement levels; Tools and constraints in the implementation of metropolitan development plan in terms of administration, legal and financial aspects; Role and function of public participation.

Metropolitan planning and development in India; Appraisal of planning and development efforts in case of some of the metropolises, viz. Kolkata, Mumbai, Delhi and Chennai, etc

References

1. Cities urbanization and urban system K Siddharth& S Mukherjee

PLA 415PLANNING FOR SPECIAL AREAS

Location of Special areas, special areas in different countries. Typology of formal and functional special areas, (Coastal areas, Hill areas, Export Processing Zone , Special Economic Zones Free Trade Zones (FTZ), Export Processing Zones (EPZ), Free Zones (FZ), Industrial Estates (IE), Free Ports, Urban Enterprise Zones etc.)

Process of formation of Special areas/ zones.characteristics of special areas, role of special zones in economy,

Organisation of Special areas Institutional structure of special areas -government, and Private.Quasi-government agencies Laws and acts rules and regulations for special Areas.Land acquisition for special areas.

Basic services and transport.Medical and education facilities. Systems for Performance monitoring of Special areas

Capital investments, foreign investments, Public, Private Partnership in special areas and zones.

PLA 416 SUSTAINABLE URBAN DEVELOPMENT

Changing perspectives in man-environment relationship with focus on issues of population, urbanization, resource depletion and pollution; limits to growth vis-a-vis sustainable economy; growth and environmental imperatives of developing vs. developed countries; definitions, concepts and parameters in sustainable development with particular reference to Brundtland Commission, Agenda 21, Eco-City approach, etc.

Application of ecological principles in sustainability: energy and resource cycles, food webs, ecological pyramids and evolution and succession of natural ecosystems; Carrying Capacity based planning:

concept, parameters and indicator measures, models and case studies in urban and regional development; Environmental Impact and Strategic Environmental. Assessment for urban areas; Ecological Footprint Analysis of cities; Sustainable Lifestyle Assessment and behavioral modifications at household levels.

Land capability and suitability analysis in location and planning of urban land uses; implications of urban form, density, land use pattern and transportation system in land and energy conservation

Urban interference in hydrological cycle, with particular reference to water pollution, water resources, drainage and natural ecosystems; urban water treatment, recycling and harvesting; use of non-conventional energy sources in urban development.

Sources, types and effects of air pollution and solid waste disposal in cities, urban industrial processes and land use and transportation implications in air and solid waste pollution; norms, standards, laws, organizations and policies in urban air quality control and solid waste management; examples of best practices.

References

1. Sustainability & cities Peter Newman & Jeffrey R. Cohen
2. Sustainable urban development Cooper I

PLA417 PROJECT FORMULATION

The concept of projects, Importance of project formulation, appraisal and management; reasons for shortfall in its performance; scientific management, life cycle of project; detailed project report, and feasibility studies; techniques of financial appraisal, payback period, IRR, DCF, NPV, CBR.

Project formulation: definition, objectives; Stages of project formulation and their significance; Methodology for project identification and formulation; Feasibility studies, input analysis, financial cost-benefit analysis, social-cost benefit analysis; Project appraisal and report.

Project formulation: definition, objectives; Need for project appraisal; Project formulation: definition, objectives; Stages of project form Network analysis; CPM, PERT, resource levelling and allocation, time-cost trade off aspects; Bar charts, Milestones, Standard oriented cost control techniques; Techno-economic analysis of projects.

Project implementation, stages of implementation, Teamwork, actors in project implementation; Project monitoring: meaning objectives and significance; Monitoring techniques: integrated reporting, Milestones, time and cost overrun and under runs, unit index techniques.

Project evaluation: meaning, objectives, scope, stages, approach and steps, Life of a project; Techniques of project evaluation: input analysis, financial cost-benefit analysis, social-cost benefit analysis; case studies in urban and regional development projects.

References

1. Project formulation Prasanna Chandra

PLA418 DISSERTATION

Objective of subject Dissertation is to enlighten students on the fundamentals of Research methods before attempting final year Project Thesis.

Basics of research

Basic research principles and research methods, Report writing skills

Dissertation

First phase of dissertation allows students to identify the broad area / field of Planning of their interest in which they may intend to do the research. This is to be done by studying and reproducing the brief of technical papers in the form of report review.

Second phase allows the students to do the study of sample example of research already done by choosing the specific aspect / area relevant to broader field they have selected in first phase. This exercise involves the writing of report / review of book / journal dedicated to that specific aspect or area. This review writing is aimed to understand the method of collecting data (survey methods), analysis of data (statistics and mathematical formulas), drawing inferences and conclusion as attempted by the author of the book / report writer

Third phase is the writing of detailed dissertation report. Students are expected to choose their own topic of research by referring the area / field already identified in other two phases.

PLA419 TRAINING

The training done during semester break will be assessed

PLA420 PLANNING AND DESIGN STUDIO 7 (BLOCK/SUB-REGIONAL PLAN)

Understanding the role and relevance of regional planning; state of art, role of planning at district and sub district level, critical appraisal of district/ sub district plans. Formulation of goals, objectives, methodology, identification of data sources, analysis of data available, survey and preparation of schedules. Field work: visit to the field study area; conducting surveys, collection of data from secondary sources, sectorally and block wise. Detailed data analysis, identification of potential thrust areas and development issues, both sectorally and block wise. Appropriate alternate strategy planning, settlement development strategy and programmes. Formulation of sectoral prioritisation and financial allocation (block wise); final recommendations for a district/sub district development plan.

Eighth Semester

PLA 421 URBAN GOVERNANCE

Meaning of governance and government; Scope of governance, evolution of concept of governance; Theories of local government; History of urban local bodies in India, Evolution of modern urban local governments during British rule; Decentralization of local government; Recommendations of various committees; Politics and progress of decentralization.

Government, governing and governance; Determinants and indicators of good governance; Citizens charter and other instruments; Decision making processes; Need for openness and transparency; People's participation, collaborative management; Local governance.

Evolution of development and management systems; Scope of development management at the National, state and local levels; Hierarchy of urban settlements institutions and organizations; Stakeholders, their perceptions and role in urban management

Processes of urbanization, developmental conflicts, resource constraints, systems deficiencies; Urban poverty and exclusion from development process; Sustainable development; Impact of globalization and economic reforms; Social diversities; Defects in planning approaches, multiplicity of organizations and authorities.

74th Constitutional amendments - XII schedule, decentralization of powers and functions; Local and participatory planning, bottom up, decentralized and integrated planning processes; Planning, governance and spatial strategy; Best practices of planning and quality of governance.

References

1. Urban Governance

Gordan McLeod

PLA 422 REAL ESTATE PLANNING AND MANAGEMENT

Economic concepts of land, objectives and scope of land economics; relevance for spatial planning; economic principles of land uses; economic rent, land use and land values, market mechanism and land use pattern.

Process, cost of development, source of finance, and financial calculation for real estate development. Valuation of land and property- Discounted Cash Flow Method, Development Method etc. Valuation, value and purpose of valuation; Definition and importance of valuation land and buildings; Factors affecting property and land value at a city and clarity level .

Heterogeneity and imperfections, valuation of real property - principles and practices; private ownership and social control of land; disposal of land; land development charges and betterment levy; land use restrictions, compensation and requisition taxation of capital gain on land versus public ownerships, economic aspects of land policies at various levels of decision making. Legal, fiscal and administrative measures of land value; Betterment; Scrap value, salvage value, outgoings; Capitalized value of buildings; appreciation, methods of calculating depreciation

Analysis of location of specific uses like residential, industrial, commercial and institutional in the light of location theories in intra-regional and inter-regional context; Techniques of cost benefit analysis of urban development programme.

Case studies of real estate development in public, private, partnership sectors; Real estate as facilitator of development; Development of real estate as a tool for controlling land and property prices; Transaction and renting of real estate, Lease deeds/ sale deeds, sale documents, registration; Mortgage and pledging.

References

1. Land development Linda

Department Elective

PLA 423 PUBLIC PRIVATE PARTNERSHIP

The urban environment; existing attributes and changing scenario; Problems associated with urban environmental services.

Public-Private Partnerships in delivery of urban environmental services; Recent trends of increasing private participation; Possible partners and their possible roles. Possible forms of partnerships such as contracting out, BOT, joint venture, concessions and community led informal partnership approaches; Strengths and weaknesses of PPPs and their funding structures

Preconditions for partnerships; Advantages of collaborating; Making groups and partnerships effective; Methods of promoting participation; Using partnerships for improving urban environmental services in small and medium size cities; Meeting the needs of the urban poor through public-private partnerships.

Processes, procedures and mechanisms in partnerships: regulations and administrative procedures, competitive bidding, due diligence technique, regulatory authority. Transaction cost; Use of municipal bonds for raising public investment; Capacity building of municipalities for undertaking partnership efforts.

PLA 424 INTERNATIONAL FINANCE

Global Financial Environment, Globalization and its impact. WTO and its impact.

Understanding Exchange Rates, Foreign Exchange Market, Introduction to Currency Futures and Options. Nature, scope and significance of international finance, Working of multinationals

International Project Appraisal, Role of financing agencies such as World Bank, IMF, SDR. Understanding Financial Risk. Introduction to risk mitigation.

PLA 425 PLANNING AND HUMAN VALUES

Nature of Values: The value-crisis in the contemporary Indian Society; The nature of values: the value spectrum for a good life; The Indian system of values. Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education

Types of Values, Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment;

Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom.

Ethics, Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education.

Values and Managements, Management by values — professional excellence; inter-personal relationships at work place; leadership and team building; conflict resolution and stress management, management of power

PLA 426 THESIS

The thesis project shall include an individual's work on Planning topic selected by the students and approved by the department. work programme and thesis manual shall be supplied by the department. Each student is required to prepare terminal project on a subject concerning urban, rural or regional

development as approved by the Department. The terminal project will provide an opportunity to the student to synthesize the knowledge and skills acquired through the learning of various theories and practices during the course.

PLA 427 GENERAL PROFICIENCY

General Proficiency is meant for developing co-curricular activities in individual student. By this they are encouraged to participate in ASP / NASP activities, NSS, NCC, Debates, Dramas, Paper presentations, Sports and Games etc. at Dept./College/ University level.

Note: Study tour during winter semester break will be conducted for 6th semester students to a city for urban design, renewable and conservation study.

36 BACHELOR IN ARCHITECTURE (B.Arch.)

First semester

AR111 ARCHITECTURE DESIGN 1

Parameters of design: Anthropometrics, human activity and the use of spaces Interrelationship of architectural space to form, structure, materials and to nature as a contextual setting. Problems related to the understanding of the elements of architectural design, concepts of space and form and their perception. Study of a given space through elementary measured drawings, sketching and Photography. Synthesis of observations in design of a basic shelter, an architectural form with a specific function. Design exercise may include spaces like Exhibition stall, drinking water fountain, information kiosk, etc. Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR112 BUILDING MATERIAL& CONSTRUCTION-I

Introduction to building components and materials Study of properties of constituents, components, manufacturing process, quality tests of bricks and stones. Study of properties of constituents, components, manufacturing process, quality test of cement, lime, sand, aggregate, concrete and mortar

Superstructure: Masonry: Bricks: type of bonds, ends and junctions, attached and detached piers, jointing and pointing Stones: types of walling and joints, facing of bricks over stonework, lintels , coping

Spanning component: Arches: types of arches in bricks and stone, centering of arches Plinth and foundation: Timbering of trenches Brick foundations for walls and piers Stone foundations for walls and pier Plinth filling D.P.C. Details for entrances showing steps and ramps.

Note: Sessionals will be in the form of reports, drawings and models. There shall be regular visits to construction sites.

AR113 STRUCTURES 1

Concurrent and non-concurrent coplanar forces, moment, conditions of equilibrium. Statically determinant plane frames, determination of forces in members of pin jointed frames by analytical and graphical methods, wind forces on frames. Stress, strain, Hooke's law, lateral strain, Poisson's ratio, young's modulus, modulus of rigidity, bulk modulus and their relationships. Shear force and bending moment diagrams for strained beams subjected to concentrated and distributed loadings Centroid and moment of inertia of plain areas, parallel axis theorem, moment of inertia, principal axis Bending stresses and deflection in simply supported beams and cantilever beams. Combined bending and direct strain, eccentric loading, stability of retaining walls and dams, fixed and continuous beams, theorem of three moment.

Different types of welded joints, eccentric loading on welded joints, efficiency of joints, eccentric loading on riveted joints. Introduction to various structural forms, viz vaults, domes, shells, folded plates with an understanding through force diagrams. Advantages of folded plate roof, domes, shells etc.

Note: The sessionals shall be in form of reports, drawings and models of structures with the strut membrane.

AR114 ARCHITECTURAL DRAWING 1

Introduction to drafting procedures, graphic codes, symbols and architectural lettering. Construction of architectural scales and their application to real objects and drawings. (Plain scale, diagonal scale, isometric scale) Construction of basic and complex geometrical shapes. Orthographic projections of simple regular two dimensional shapes. Orthographic projection of simple, complex solids and hollow objects and sections Study of interpenetration of solids and development of surfaces.

Isometric, axonometric and oblique projections.

Note: This subject is intended to develop the skill of conceiving and communicating the ideas through the graphic ideas. Emphasis is given more on instrumental drawings.

The sessional shall be in the form of drawings and sketches.

AR115 HISTORY OF ARCHITECTURE 1

Art & culture of pre historic man, Harappan civilization, Egypt, Mesopotamia, Greece, Roman and pre Columbian American cultures. Art & culture of Ancient India (Vedic, Buddhist, Jain and Hindu). Art and Architecture of Rajput and Mughals, spread of Indian culture sub continent either China, Japan, Indonesia, Korea etc. Impact of Christianity on Europe- (Byzantine, Gothic etc.), development and spread of Islam and its influence on art & culture, renaissance, French and Russian revolution and their influence on art. Folk and tribal art traditions, study of art from Africa, Australia etc. Industrial Revolution and its influence on art and culture, modern art movement in India and West.

Note: Sessionals shall be done in the form of small exercise, written assignments, sketches and visits of the relevant sites.

AR116 ART & GRAPHICS 1 (BASIC DESIGN)

Introduction to Arts, Visual arts, Basic design. Developing Drawing and painting skills: Introduction to freehand sketching. Understanding importance of hand, eye and mind coordination in drawing and sketching. Exercises based on freehand sketching, Indoor and outdoor sketching, live drawing, rapid sketching etc. Drawing and painting geometrical shapes, plants, trees and manmade objects etc. Elements of composition: Point, line, shape, form, texture and colour. Types and effects of lines. Study of elementary two dimensional geometrical shapes.

Colour theory: Introduction to colour theory and various colour schemes. Use of various colouring techniques and medium i.e. pencils, pastels, water colour, crayon, ink etc. Art lettering: introduction to various styles of lettering and incorporating lettering as part of graphic design and composition. Basic Design and Principles of design: Understanding form-space interrelation, negative and positive space, space handling, chaos to order, scale, proportion, proximity, surface tension and juxtaposition. Use of contrast, Rhythm, harmony, balance, symmetry etc. in design and compositions. Small exercises based on application of skills, colour theory, elements and principles of composition and design.

AR117 WORKSHOP

Carpentry- Introduction to the carpentry tools, processes, joints and wood working machines.

Preparation of various carpentry joints, fixing of plywood, blackboards, commercial boards etc. and their application in furniture.

Techniques for preparation of models using different mediums i.e. clay, thermocol, mountboard, paper, acrylic sheet etc with application of different mediums for painting different surfaces and textures.

Modelling- Preparation of models of live materials in full scale and models of 3D objects.

Painting and polishing- Classification of paints, varnishes ingredients of paints, painting methods-brush, spray, hot spray etc.

Use of clay, Plaster of Paris, metal scrap, jute fiber etc. for study of forms.

Second semester

AR121 ARCHITECTURE DESIGN 2

Design of a simple building in the immediate or observable environment. Exercise relating personal experiences to behavioral needs and translating them into architectural program requirements. Systematic introduction to issues related with the design of human habitat, its components and space standards.

The design exercises may include small shelters like residence, cottage, weekend house, etc.

AR122 BUILDING MATERIAL& CONSTRUCTION 2

Study of properties of timber, seasoning, process, quality tests. Study of properties of constituent components, manufacturing process, quality test of ferrous and non-ferrous metals, glass Timber doors and windows: Doors: ledged, braced and battened, panel , glazed, flush doors Windows: Fixed, side and top hung, pivoted, louvered, ventilators and fanlights Metal (pressed steel and z-section) doors and windows: Doors: with and without fanlight Windows: Fixed, side and top hung, pivoted, louvered, ventilators and fanlights Miscellaneous: Jamb casing, skirting, architrave, pelmet, mouldings.

Note: Sessionals will be in the form of reports, drawings and models. There shall be regular visits to construction sites.

AR123 STRUCTURES 2

Introduction to Structures.

Understanding of design of timber with various components, their functions and inter relationships through force diagram Types of beams, columns and foundations in timber, including joints and connections. Types of roof trusses in timber with joints and connections Floors, staircases and balconies in timber, their joints and connections. Design in timber: design of simple trusses, beams and columns in timber Understanding of design in steel with various components, their functions and inter relationships

Note: The sessionals shall be in form of reports, drawings and models of structures

AR124 ARCHITECTURAL DRAWING 2

Architectural presentation techniques, isometric and oblique three dimensional views, Conical projections, perspectives, one point and two point. Sciography Introduction of basic principles of sciography and it's application to the field of Architecture. Sciography of two dimensional objects in plan and elevation. Sciography of three dimensional objects in plan and elevation and views. (isometric, Axonometric and Perspective) Sciography of simple building elements.

Perspective:Introduction to basic terms, principles, types and techniques of perspective drawing: realistic expression of ideas.Two point perspective of simple objects. (Drafted and free hand). Presentation of interior and exterior views in one point perspective. (Drafted and free hand).

Note: The sessionals will be in the form of Drawings and sketches.

AR125 HISTORY OF ARCHITECTURE 2

Early Indian Architecture upto 3rd century A.D. Study of Harappan architecture and Planning. Buddhist Architecture in India. Vastu Purush Mandala and other canons of Hindu Architecture 3rd to 11th century Architecture.A D.: Gupta, Dravidian and Rajput Architecture. 11th to 17th century A.D. : Early Indo-

Islamic and Mughal Architecture. Medieval Hindu and Jain Architecture, Rajput palaces. 18th century A.D. and beyond: Post Islamic and Colonial Architecture in India. Oriental and pre Colombian American Architecture. Introduction to Chinese and Japanese Architecture. Mayan and Inca Architecture.

Note: The study shall be through selected samples of buildings under various historic civilizations in chronological order. Sessionals shall be submitted in the form of sketches, notes, audio-visual and reports of visits to historical buildings etc. as per programme scheduled by the department per session.

AR126 ART & GRAPHICS-II

Study of two and three dimensional geometrical forms and objects: Study of structure, form and space relation. Exercises based on two dimensional and three dimensional form as an appropriate base for subsequent architectural designs. Colour in design and architecture: Psychology of colours, warm and cool colours, colour and light, colour symbolism. Application of different mediums and materials using liquid, transparent, reflective, opaque, flexible and hard materials. Appreciation and use of various colours and textures in the design exercises.

Photography: Fundamentals of photography, composition in photography. Elementary exercises based on photography of objects, activities, interior and exterior of buildings. Creative application of skills and theory: Graphic representations of ideas, concepts and design principles in the form of Ideograms, logo and symbols for selected activities, organizations, themes. Special emphasis may be given on three dimensional expressions. Exercises based on Media exploration, art lettering, poster, collage, sculpture, model, mural making and photography.

AR127 COMPUTER APPLICATION

Introduction to computer, Hardware and software components. Computer terminology. Introduction to windows and its applications. Introduction to Microsoft. Office, Word, Excel. Introduction to Internet, using e-mail.

Introduction to basic graphical softwares like Photoshop, Coreldraw, powerpoint, etc.

Third semester

AR211 ARCHITECTURE DESIGN 3

Design of a group of residential and ancillary buildings set in the context studied in the study tour- Introduction to concepts of shared open space, clustering, community, aggregation and economy in the context of space utilization.

Design exercises may have buildings like Housing for elderly, SOS village, transit housing, housing for training institute, or similar projects, based on community living and shared facilities.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR212 BUILDING MATERIAL& CONSTRUCTION 3

Techniques of preserving and finishing of timber Study of materials for roofing (Mangalore tile, slate, corrugated asbestos sheet etc.) Timber floor: single, double and triple Timber roofs: flat, lean-to –type, couple, close couple Timber trussed roof, king post, queen post, built in truss Timber canopies, staircase and balcony Shoring

Note: Sessionals will be in the form of reports, drawings and models. There shall be regular visits to construction sites.

AR213 STRUCTURES 4

Introduction to concepts of R.C.C. structure and structural components like tie, stirrups, beams, arch, vault, dome etc. Type of structures and structural framing, rigid jointed, pin jointed. Moment of resistance

of homogenous beams of rectangular cross section- under / over and balanced sections for various grades of concrete and types of steel , design on doubly reinforced beams and design of cantilevers

Design of shear, development length and anchor length. Design of cantilevered slabs spanning in one direction, cantilever. Columns axially loaded, short and long columns, eccentric loaded. Isolated column footings.

Note: Sessional work should include design and analysis of simple elements as stated above along with the drawings.

AR214 HISTORY OF ARCHITECTURE 3

This course is studied in order to see how builders in the past solved their structural, functional, and aesthetic problems. This survey of history gives the students Architecture chance to study the structural basis of great styles, methods of admitting daylight, decoration. Importance is also attached to the sociological background I.e. political, religious, technical and philosophical ideas which lie behind all buildings.

This will be studied with the help of selected examples of buildings of various historical civilizations in Europe and the west in chronological order. Egyptian, west Asiatic and Greco Roman. Early Christian Architecture: (Architecture) Byzantine (b) Gothic (c) Early medieval Renaissance, Romanesque, Baroque, and Rococo. Modern and contemporary Architecture Comparative study of Indian and world Architecture

Note: Sessional work will be submitted in the form of sketches. Notes, audio visuals and report of site visits to some historical buildings etc. as per programme scheduled by the department per session.

AR215 ENVIRONMENTAL SCIENCE (CLIMATOLOGY)

Basics of Ecology and Environment: Study of various natural resources like forest, Water bodies, atmosphere, etc. Global environmental issues such as global warming, ozone depletion, green house effect, etc. Elements and types of climate, including the practical measurements of climatic parameters. Built environment, conditions, impact and issues of climate balance in traditional and contemporary built environment.

Human comfort (body & thermal), thermal comfort factors and indices and visual comfort. Principles of thermal design, structural and ventilation controls and their application in building. Illumination and day lighting. Use of shading angles for lighting and radiation techniques and their application in buildings.

AR 216 COMPUTER DRAFTING

Introduction to computer aided drafting fundamentals, CAD software and introduction to Auto CAD.

Drafting with AutoCAD, fundamentals and procedures of drafting geometric shapes in two dimensions, including lettering, hatching, dimensioning and filling.

Fundamentals and procedures of editing Architecture drawing i.e. modifying geometry of the objects, changing properties of the objects, changing views and work planes etc.

Fundamentals of drafting and editing complex geometrical shapes (combination of two or more geometrical shapes) in two dimensions.

Fundamentals of drafting and editing of 3D objects (plains and solids).

Note: Sessional work should include assignments incorporating the use of AutoCAD, in form of drawings.

AR217 ARCHITECTURAL GRAPHICS 3

Introduction to various methods of depiction of ideas and concepts in architectural design in different mediums with examples.

Methods of rendering and presentation of various elements, textures, designing formats, selection of lettering styles etc.

Rendering two dimensional building drawing i.e. plans, site plans, elevations etc. with shade and shadows

Techniques of drawing and rendering different types of views, one point, two point, and three point perspectives and interior views for buildings with shade and shadows

Use of photography, model making, etc. for architectural presentation.

Fourth semester

AR221 ARCHITECTURE DESIGN 4

Study of vernacular architecture, the social and physical environment and methods of construction emerging out of the traditional way of life of the people in a given place, this may be a village or part of a small town. Study of practices and design principles of vernacular architecture and its application with contemporary architectural interventions (like steel truss for a large span roof in place of wood). Design of a simple building for public activity, in a non-urban setting, or a situation without urban regulatory controls such as Panchayat bhawan, rural school, primary health center, aanganwadi, extension centres, forest huts, etc.. Introduction to other role players in the architectural process viz..., the client and the user.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR222 BUILDING MATERIAL& CONSTRUCTION 4

Study of properties of R.C.C. and stone.

R.C.C. slab beams, lintels chajjas including cantilevers.

R.C.C. columns, footing, staircase canopies.

Precast components i.e. masonry blocks, hollow blocks, jallis, shelving units, slabs and prestressed units.

Miscellaneous – stone slab flooring, stone balcony, stairs jack arch.

Note: Sessionals will be in the form of reports, drawings and models. There shall be regular visits to construction sites.

AR223 STRUCTURES 4

T and L beams and other sections. Slabs spanning in two directions, flat slab. Staircases of different types. Combined footings.

Introduction of typical structures like – Cofferslabs, Folded plates, Domes, Vaults and shells.

Note: Sessional work shall include designing and analysis of simple elements as stated.

AR 224 THEORY OF DESIGN

Studies of Folk and crafts, indigenous Architectural studies, Influence of tradition, culture and socio-economic developments on art and Architecture. Introduction to enquires initiated by various western and Indian Philosophers. Understanding of determinants of physical form such as concepts of space, structure, organization, symbolism, mass, surface, scale, order, proportion, rhythm, datum, axis, etc. In relation to place time and society with due consideration for perceptual qualities as affected by colours, light conditions, vision angles etc.

Communication and interpretations in Architecture. The eloquence, aphesis and style in Architecture, their judgment and design. Developments in world Architecture, environmental design and technology with reference to trends setting work of Architects, designers, ecologists, engineers etc. Design parameters, principles, processes, methods and programme formulation. Design matrices and system integration. Process of Design synthesis.

Note: The sessionals will be in the form of drawings, technical report writing and presented in the departmental seminars along with the audio visuals which will be based on Building assigned or identified during site visits.

AR225 SURVEYING AND LEVELLING

Aspects of surveying instruments and the study if their use

Scales: Plain scales, Diagonal scales, comparative scale, shrunk scale, vernier scale. Study ,test, degree of accuracy, use and care of survey instruments and accessories

Chain Survey, Compass survey, Plane table method and surveying with theodolite Leveling and contouring

AR226 COMMUNICATION SKILLS

Language and communication: Spoken English and grammar. Technical composition (e.g., reports, papers essays) writing Public Speaking Making sequences and framework for presentation, importance of posture, gesture, pronunciation, tone etc. on Presentation quality

Architectural communications:Presenting simple, complex architectural concepts and proposal with the help of text, drawings, transparencies, slides, video, photographs, models etc. Computer aided presentation: Preparing simple and interactive slide shows and presentations using computer software

Article review, presentations and seminars. Individual and group work on selected theme.

Department electives

AR 231 TRADITIONAL AND CONTEMPORARY INDIAN ARCHITECTURE

This subject intends to develop an understanding in Contemporary Architecture in India. Colonial Architecture in India, emerging trends, works of Le Corbusier and Louis Kahn in India and their influence of Indian architecture. Elements of Vernacular Architecture and related terms. Chronological development of Vernacular architecture in India Contemporary Indian architects: A.P.Kanvinde, Charles Correa, Anant Raje, Raj Rewal and others, their philosophies and examples. Post modern architecture in India, examples.

AR232 AESTHETICS, ART AND APPRECIATION

Introduction of aesthetic relevance to architecture and study of influence of culture and socio economic development of architecture and art through history Study of various mater pieces of art and architecture through buildings, sculpture, paintings, etc. Development in environment design and technology with reference to world architecture through study of building materials Study to evolve the concept and framework for understanding architecture. it should lead to building of vocabulary to discuss ideas in architecture. Discussion on architecture and social function based on philosophy in architecture. Illustrate, through examples, both, traditional and contemporary buildings.

Fifth semester

AR311 ARCHITECTURE DESIGN 5

Study of an urban environment in use: Urban activities, services and construction methods, social utilization, growth and change shall be the focus of the study centered in a medium sized town poised for major changes in the near future.

Design of a multi-functional public building: in the urban setting. Introduction to urban development controls, codes and bye-laws. Exercise in articulation and manipulation of programmed needs criticism and evaluation of alternative concepts, decision making process. Use of computers as an aid to Design. The design exercises may include buildings like Collectorate office, Degree College, navodaya vidyalaya, corporation office, shopping complex, dharamshala, inn, motels, budget hotels, etc.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR312 BUILDING MATERIAL& CONSTRUCTION 5

Building materials: Study of aluminum, steel plastic, etc. Study of Aluminum sections: Doors, windows, grills etc, i.e. Aluminum Door cum Partition. Aluminum self closing Door. Aluminum casement window. Aluminum sliding window. Aluminum swing Door.

Timber: Timber Sliding Door. Timber Sliding Folding Door. Timber Revolving Door.

Form work – steel and timber

Trusses: north light, monitor, tubular, built in trusses, patent glazing etc.

Note: Sessionals will be in the form of reports, drawings and scaled models. There shall be regular visits to construction sites.

AR313 STRUCTURES-V

Limit state analysis design of RCC beams, slabs and columns.

Design of water tanks, circular tanks with flexible and rigid bases, rectangular and square tanks resting on ground.

Analysis of continuous beams and rigid jointed plans frames by moment distribution.

Approximate analysis pre-stressed concrete.

Design projects in timber with stress on joint designing for door and window frames and trusses.

Note: Sessional work shall include designing and analysis of simple elements as stated above with drawings.

AR314 SPECIFICATIONS AND ESTIMATION

Objective of this subject is to understand the specifications and financial aspect of the building projects. This subject will give them an understanding and insight the role of material, construction and cost together for budgeting the projects and cost management. Introduction to Specification, its importance, its types; for material, for items of works, the brief and the detailed specification Brief and detailed specification of all items of works for any type of medium sized buildings referring to State PWD, Central PWD and Indian Standards

Introduction to Estimation, its importance in budgeting of building projects, Types of estimate, Detailed study of Phase I estimate, Introduction to cost management, advantages of cost management, system approach to cost management

Introduction to quantity surveying, data required for quantity surveying, standard mode of measurement, various methods of taking out detailed quantities, abstract of quantities, bills of quantities, study of man power involved in building works, Analysis of material in composite items, Rate analysis, Measurement of works for interim and final payments

Detailed project tender document of any building consisting brief and detailed specification, summary of the expenditure, abstract sheet and quantities from excavation to water proofing to terrace also including material and man power analysis

Minor assignment can be small building examples or components of buildings for specification, quantity and abstracting of the cost. Major assignment will be preparation of medium sized building tender document consisting brief and detailed specification of major items, summary of expenditure, bills of quantities, quantities of all items from excavation to terrace water proof, material and man power analysis.

AR315 ACOUSTICS

Introduction to acoustics and general principles of sound, its origin, propagation and sensation.

Behavior of sound with respect to various surfaces and in an enclosed space. Sound absorbing materials, single and in combination for various frequencies of sound. (Panel and porous materials and cavity resonators)

Reverberation time and sound levels and their calculations. Constructional and planning measures for good acoustical design. Acoustical defects and remedies. Sound application systems. Case studies for the above aspects. Structure borne and air borne noise, their effects and control.

Note: Sessionals shall be based on practical, case studies and design proposals.

AR316 WATER SUPPLY & SANITATION

Water Supply: Sources of water, treatment for domestic use, study of quality of potable water Standards in water supply. Water Supply, fittings, types of water supply pipes and joints. Water Supply distribution networks at municipal and colony level. Water Supply, storage and plumbing for residences (including multistoried buildings)

Sanitation: Basic principles of sanitation; Modern plumbing systems- Urban, semi-urban, rural (CBRI, Sulabh techniques etc.) Standards in Sanitation Sanitary fixtures and fittings (including traps etc.), Placement and functions. Types of sanitary pipes, joints and laying.

Internal and external drainage: Stage of disposal of domestic effluent from fixtures to sewer- line, types of sanitary systems for a single residence, multistoried buildings and cluster houses. Ducts for sanitary purpose. Inspection chambers, septic tank, soak pits, etc. Rain water disposal

Municipal level sanitation: Disposal of city effluent: Public sewer lines, manholes etc. Treatment of city effluent and recycling of wastewater. Study of refuse chutes in multi-storied buildings. Collection of refuse and recycling of city solid waste

Note: For standards IS codes, NBC, BIS special publications etc. are to be referred. Sessionals should also include detailed sanitation, water supply and rain water disposal proposals

AR317 TOUR AND BUILDING APPRAISAL

An educational tour to the places of architectural interest / building appraisal shall be organized as per the programme approved by the department. The documentation shall be done in the form of photographs / slides and sketches presented in form of a seminar and written report immediately after the tour / building appraisal.

Sixth semester

AR321 ARCHITECTURE DESIGN 6

Design of closed environments, with emphasis on the articulation of interior spaces detailing and finishing materials, textures. Colour and light, acoustics and air-conditioning, Exterior spaces formed by buildings, Elevations, Fenestration and build form as a moderator of urban space, site planning and landscaping. The design exercise may include buildings like Museum, art center, single screen theatres, hospitals, convention centre, auditorium, club, etc.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR 322 WORKING DRAWING

Introduction to need and relevance of Working Drawing set and municipal drawings and their comparison to presentation drawing. Preparation of corporation drawing: Check list as a guide for information in a municipal drawing. Introduction to various components and their precise function in a set of working

drawing. Preparation of check list as guide for list of working drawing. Method of representing various contents and specific information in working drawing. Preparation of details for various building units. Time problem for specified building units (manually or on computer).

Note: Sessional shall be presented in form of full set of presentation, municipal and working drawings

AR323 STRUCTURES 6

I.S. Structural section, study of steel tables, steel joints and connections. Tension members: single and built up sections, beams and built up, plate girders. Compression members: Single and built up sections. Design of column bases (slab base and gusseted base) and grillage foundation. Design of roof trusses includes design using tubular sections.

AR324 ENERGY EFFICIENT DESIGN

This course is intended to understand the implication of energy in building design: Types of energy, energy sources, energy requirements in buildings. Building design in response to various climates and its impact upon requirements of energy in building. Study of basic principles, techniques and tools. Methods of energy conservation through passive cooling, heating and ventilation systems. Study of works of various Architects in this area through history. Implication of above in design of energy conscious buildings. Introduction to ECBC, GRIHA, LEEDS, etc., simulation techniques and their applications.

Note: Sessionals shall be done in the form of technical reports and drawing forms.

AR225 ELECTRICAL SERVICES

This course is intended to integrate the knowledge of electrical services in buildings and broadly comprises of: Introduction to electrical energy, basic definitions and related theorems to understand distribution of electrical energy Assessment of electricity requirements in buildings, study of fittings and accessories used in electrical system Systematic diagrams for electricity distribution, different types of wiring, various circuit diagrams for bedroom lighting, staircase lighting etc. Internal and external illumination- definitions, direct, indirect and semi-direct lighting, types of luminaries, reflectors, application of lighting study for street lighting, factory lighting, domestic and commercial buildings Study of electrical services for special buildings like exhibitions, cinemas, stadium etc.

Note: Sessionals shall be done in the form of reports and project drawings.

AR326 MECHANICAL SERVICES

This course is intended to integrate the knowledge of mechanical services in buildings. Introduction of mechanical services, it's internal and external components, their functions and principles of air-conditioning. Air- conditioning methods , equipments and ducting: their space requirements and placements. L.P.G / Bio-gas installations, their location and layouts in residential and non- residential buildings. Vertical transportation ; lifts, moving walkways and escalators, their layouts. Fire escape staircases and fire fighting equipments/ alarms- their spatial requirements and locations.

Note: Sessional shall be done in the form of reports and project drawings.

AR 327 BUILDING BYE LAWS AND CODE OF PRACTICES

Introduction to Policies, Act, Regulations and Building Byelaws, their need and relevance, Detailed study of Town planning Act since pre independence period, details of agencies for making Town planning Acts and Regulations, Role of Master plan in the development process of cities in context of land and building developments byelaws and rules

Detailed study of National Building Code and Building Byelaws framed by various agencies

Administrative and financial set ups and power of various regulatory agencies involved in making Building laws, method of enforcement, monitoring and relevant civil laws for legal application
Procedural method for use of Acts and byelaws for land development and building design and execution process

Note: Sessional will be submitted in the form of Seminar and term papers. Sessional shall be in the form of case studies and reports.

Seventh semester

AR411 ARCHITECTURE DESIGN 7

Design of high density, large scale housing: Socio-economic determinants, legislative and economic constraints and technological alternatives shall be studied in detail. Exercises in simulation and conceptual modeling shall be conducted. Application of concepts of community participation, phasing, financing and construction planning Computer aided Project documentation including basic working drawings, preliminary estimates, outline specifications and scheduling aimed at comprehensive understanding of the implementation process. The design exercises may include apartment blocks, multi-storey office building, hospitals, hotels, corporate offices, call centres, etc.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR412 ADVANCED BUILDING CONSTRUCTION

Curtain wall- steel, aluminium, Advance foundation types- grillage, pile raft etc. Exterior finishes and treatments Water proofing, sound proofing, fire proofing, thermal insulation etc. Expansion joints

Shop fronts, show windows etc, Advance construction system – waffle slab, reinforced brick construction, glass block construction etc.

Note: sessionals will be in the form of reports, drawings and scaled models. There shall be regular visits to construction sites.

AR413 STRUCTURES 7(Structure Design)

The course intends to develop the understanding of structural design buildings. RCC Buildings, Steel buildings Composite structures.

Note: The course shall include site visits and short seminars and the sessionals shall be in the form of calculations, drawings and models.

AR434 PRINCIPLE OF HUMAN SETTLEMENTS

The course aims at introducing the history of development of settlement planning and also gives emphasis on tracing broad principles of settlement design. Man's role in designing and developing settlements. Various factors influencing development of settlements. Introduction to settlement planning followed during various river valley civilizations. General information of various settlement planning principles and examples from ancient India and study of the principles described in the ancient Indian text. Planning in the pre independent India i.e. contribution of mughal and british . Settlement planning principles developed and contributed by Egyptians, greeks and roman etc. study of city planning during medieval and renaissance period. Study of selected historical examples of villages, towns , forts, palaces gardens, public places etc.

Note: the sessionals will be in the form of report, seminars and presentations.

AR414 TOWN PLANNING

Introduction to Town Planning, need, basic term and definition. Development and impact of Industrial revolution on settlement planning; Philosophies of eminent planners and their work.

Introduction to survey of planning, planning acts and bye laws. New towns and introduction to planning process, zoning and document.

Note: Sessional shall be in form of design of small town planning schemes, site layout in urban areas and villages schemes.

AR415 LANDSCAPE ARCHITECTURE

This course intends to build an understanding of Landscape Architecture to compliment Architectural Design. Introduction of landscape architecture, its scope and role in architecture & planning. The landscape elements, major revolution in landscape architecture, study of works of pioneers of various revolutions. Major garden styles: Hindu, Buddhist, Mughal, Japanese, Italian etc. Their design philosophy, structure components and planting design. Landscape design process. Preparation of technical data sheets, study of plant material and preparation and herbarium. Landforms: modification, alteration accentuation, grading etc.. Study of works of major landscape architects. Design exercise covering all parts of the above.

Note: The sessional shall be in form of reports, drawings, models and examples.

AR415 BUILDING ECONOMICS & SOCIOLOGY

Economics: Broad features of Indian Economy, Economic significance of building, features of development plans, Money and banking functions, factors of production, macro economic theory, demand and supply, Indifference curve analysis, Equilibrium of firm, laws of returns, macroeconomic concepts and system, theory of growth and models.

Land economics: Land as limited resource, demand for land acquisition. Economics of regional Development: Economic development in relation to the regional planning, regional economic theories, problems and prospects of balanced regional development.

Building Economics: Building Efficiency and cost reduction through planning, design of building components, use of new materials and innovative construction techniques etc. rent and other building acts, economics of high rise buildings.

Sociology Introduction- man his social and physical environment, social group and social structure, utility and relation with architecture.. Indian Communities- Rural and Urban communities, their social structures and problems, cultural heritage, rituals and community gatherings, etc. Urbanization- Trends and characteristics, dynamics of urban growth and social change and attitude, value and behavior, review of Planning Commission reports.. Social aspect of physical environment, its limitations and implications on buildings, neighborhood planning, slum improvements and city fabric. Case study, sociological study of communities with their habitat and built environment

Eighth semester

AR421 ARCHITECTURE DESIGN 7

Design of a multi-functional complex of buildings in the metropolitan context. Issues related to the growing problems of urban areas in third world countries and their future development shall be explored. Emphasis on the design with relation to the contextual environment, traffic and planning controls and impact analysis. An understanding of the architectural implications of such developmental scheme should lead to insights in the formulation of political and administrative policies for the development of the physical environment. The design problems may include projects like Re-densification, campus planning, factories, etc.

Study Tour- A study tour should be conducted during the semester as per the requirement of design studio/ exercise.

AR422 MODERN BUILDING SYSTEM

Domes, shells, vaults, arches. Large span roofing for special areas like Gymnasium, airport, stadium, etc. Space frames, Geodesic domes. Tensile structures, pneumatic structures. Modern construction systems and techniques adopted like lift- slab, slip form, etc. Principles applied to the design of high rise buildings form structural system etc. Structural systems adopted for high- rise buildings like rigid frame system, shear wall system, tubular system, etc. Working and consideration for structural for disaster prone areas coastal areas structures, subterranean structures etc. Earth quake resistant structures, seismic performance Criteria and performance of structure

AR423 URBAN DESIGN

Definition of Urban design, scope of urban design under Indian context and its integration with urban planning. Historical development and approach to urban design - spatial organization, classical, functional, ornamental, etc. Urban form, its elements, visual order of form, sequence, scale, and visual space dynamics. The various surveys needed to document visual aspects of environs. Urban structure and design rational inter - relationship between economic activities, public organization, communication systems, urban conservation and land- use structure.

Review and designing of urban renewal and redevelopment projects for old and new towns.

AR424 PROJECT MANAGEMENT

Introduction , need and importance of management. Principles, theories, concepts, approaches, softwares in management, Role of manager.

Project Management Acquiring projects. Scope of work and liasoning, Feasibility studies, project proposal and reports, financial facilities.

Construction Management planning, monitoring and controlling. Planning techniques, Bar chart, CPM, PERT Selecting appropriate specification, manpower, technology, etc.

Financial Management, Value of work and cash flow costing and life cycle costing, Time, Value and money.

Organization and staffing purpose of organizing Human resources management, Motivation and productivity.

Note: This subject is to understand through case- studies of building projects. Sessional should be in the form of reports, charts and jury reviews.

AR425 INTERIOR DESIGN

Theory of interior design.

Visual perception of interior spaces, function, form, scale, proportion, balance, harmony and rhythm. Modern interior materials and their applications. Furniture, color and lighting, object de-art, adaptation of interior design to architectural spaces. Case studies of outstanding interior design examples. Project work.

AR426 RESEARCH PRINCIPLES AND DISSERTATION

Objective of subject Dissertation is to enlighten students on the fundamentals of Research methods before attempting final year Project Thesis.

Basics of research: Basic research principles and research methods. Report writing skills Dissertation

First phase of dissertation allows students to identify the broad area / field of Architecture of their interest in which they may intend to do the research. This is to be done by studying and reproducing the brief of technical papers in the form of report review.

Second phase allows the students to do the study of sample example of research already done by choosing the specific aspect / area relevant to broader field they have selected in first phase. This exercise involves

the writing of report / review of book / journal dedicated to that specific aspect or area. This review writing is aimed to understand the method of collecting data (survey methods), analysis of data (statistics and mathematical formulas), drawing inferences and conclusion as attempted by the author of the book.

Third phase is the writing of detailed dissertation report. Students are expected to choose their own topic of research by referring the area / field already identified in other two phases.

Note: Sessionals will be submitted in the form of review reports and Dissertation report.

Department electives

AR431 CAAD AND VISUALIZATION

This course intends to develop proficiency in CAAD and visualization Meaning of CAAD and importance in Architecture, software used in CAAD, introduction to visualization Preparation of drawing for visualization, understanding concepts of 2D drawings Introduction to the modeling techniques using NURBS and surfaces. Rendering, its concepts, material application, setting up lights, background, importing images Generating photorealistic images and creation of slide of slide shows

AR432 VALUATION AND ARBITRATION

The objective of this subject is to equip the students with sufficient knowledge of valuation and arbitration

Valuation: Importance of valuation for rental, income/wealth tax, selling/ purchasing. Values, sinking fund, capitalized cost year purchase, methods of depreciation and valuation tables Mortgage/ lease, fixation of rent of private/ Govt., residential, commercial buildings etc. Different methods of valuation. Valuation reports, duties and responsibilities as registered government valuer

Arbitration: Role and qualities of an arbitrator. Arbitration act-1940 with amendment till date Arbitration with reference to competitions, valuation, contract, land disputes and legal implications.

AR433 VASTU SHASTRA

This subject is intended to introduce the fundamentals and philosophy of vastu shastra and its application Introduction to vastu shastra and its application. Study of man, functions and structures and their interrelationships. Application of Vastu Shastra in buildings and planning schemes. Assessment of building performance. Interior and exterior design as per Vastu principles

AR434 SITE PLANNING AND LANDSCAPE ARCHITECTURE

This course intends to develop an understanding of Site Planning and landscape architecture to compliment architectural design. Introduction to site planning its scope and role. Environmental/ regional context in site planning and landscape design. Access network parking and service planning. Service layout and trenching. Factors effecting Site Planning and landscape design. Geological setup, Topography/ Slope, Drainage network, Flora and fauna.

Use of land development softwares; Landscape constructions, Pavings, curbs, edgings, drains, trees/plants in paved areas, services , trenches, landscape furniture etc. Ponds, pools, waterways and fountains

Design exercise incorporating all /part of the above

Note: Sessionals shall be in form of reports, drawings, models and examples

AR 435 ARCHITECTURAL JOURNALISM

Journalism in general, Theories of journalism, Techniques and processes, Contemporary Architectural journalism, Digital Journalism, Architecture, Arts and Journalism / Media

AR436 VISUAL COMMUNICATION

Architecture/ Visuals/ Language meaning psychology. Visual theories. Architectural implications of virtual environment. Digital arts and presentations/ Media Elements of Visual design. Discussion and

analysis of various types of communication media including visual identities. Study and application of drawing and other communication skills for architects.

AR437 REMOTE SENSING AND GIS

Basic remote sensing, platform, sensors, and introduction to sensors, basic principal & methods of photo interpretation and techniques of data collection through satellite data. Classification techniques using satellite data. Digital image processing, enhancement techniques in urban information extraction. Aerial photography as a tool for collection of data and preparation of maps, its application in planning and preparation for a project, orientation concept and methodology transformation and adjustment techniques. Experiments in lab, Instruction for making overlays. Computation of photo scale

Orientation of a stereo pair under a mirror stereoscope. Recognition on aerial photograph of objects indicated on ground photographs. Detection of defined objects, Description and identification of objects. Use of auxiliary features for object identification. Systematic scanning of a photograph, and object identification. Identification of land use with a given classification. Monitoring urban changes, Mosaic preparation. Base map preparation & elementary data analysis using satellite data. Experiments in lab, Instruction for making overlays. Classification preparation. Interpretation & delineation of various land use on satellite data products. GIS techniques and their application in planning field

Note: Sessional work shall consist of term paper, small project formulation using satellite data and analytical report preparation through GIS, seminars

Ninth semester

AR511 PROFESSIONAL PRACTICE

Introduction to Architectural profession, Role of professional bodies, The Architect's registration act 1972. The duties, liabilities and relationships of client, contractor and other technicians. The code of professional conduct and conditions of engagement of Architects. Scale of remuneration for Architectural services and mode of payments. Types of tenders and their process. Execution of contract. Problems in operation of contract. Architectural competitions. Introduction to Valuation, arbitration and dilapidations.

Note: Sessional work shall be in the form of Technical reports, notices, certificates, etc.

AR514 THESIS PROJECT

The thesis project shall include an individual's work on Architecture topic selected by the students and approved by the department.

Architecture work program and Architecture thesis manual shall be supplied by the department

Department electives

AR 531 URBAN AND REGIONAL PLANNING

Basic components of urban areas and Regions. Role and working of Urban and Regional planning at different levels like national level, state level, district level etc. Different planning theories and models. Socio-cultural, economic planning, land use planning etc. General principles and working. Planning norms and development norms for urban and Regional approaches / techniques of development for existing areas, renewal schemes and development. Detailed survey and preparation of questionnaire for land use, socio-economic, Transportation planning etc.

AR532 HOUSING

Introduction: Housing as Architecture basic need, housing as an integral part of urban & rural development, housing problem and statistic, etc. Housing design and policies: Qualitative and quantitative

demands of housing, housing estimates, various government policies and programmes, etc Housing surveys and standards: Sources of Data and information, methods and techniques of housing surveys, housing standards, etc. Housing cooperative and financing agencies: Objectives and general principles of cooperatives, self help housing, financing agencies and their functions etc. Housing design: Introduction to methods and approaches to housing design. Study analysis and design of housing schemes. Redevelopment of slums and squatters settlements.

AR533 HOTEL SERVICES

This course intends to develop an understanding of integration of services in the Architectural design of hotels. Hotel types, size, locational criterion, land and building bye-laws, requirements. Site Planning: Traffic and circulation, Parking, Services (Electrical, mechanical, sanitary services, garbage disposal and incinerators etc.) Services planning and details in public/ common spaces/ utilities within the hotel building. Recreation and administration, Restaurants, dining halls, coffee shops and bars, Conference spaces, meeting rooms, auditoriums, Gymnasiums, Health centers, swimming pools, Dance floors, Discotheques, Shopping, emporia, Kitchens and toilets etc. Services planning and detail in the residential spaces and open spaces: Single and double rooms, suites, including toilets facilities, Open spaces, viz. Party Lawns, gardens, Terrace gardens, open air dinning areas, visual landscapes, etc. An exercise in hotel design with an integrated services planning, incorporating all the above.

AR 534 ARCHITECTURAL CONSERVATION

This course intends to develop an understanding in Architectural conservation. Meaning of Architectural Conservation, need and degrees of conservation. History of conservation in India and West , conservation charters, role of archeological survey of India in conservation of India's cultural heritage Listing and documentation, its importance and methods. Urban conservation, methodologies to be adopted for conservation management Case studies in conservation related to Adoptive reuse, Building in context, Preservation, Urban conservation

AR 535 GREEN AND SUSTAINABLE ARCHITECTURE

Introduction to the ideas, issues and concepts of sustainable Architecture, global environment and the built environment, principles of environmentally and ecologically supportive architecture. Study of sustainable architecture, use of energy, materials, health and global environment as related to the construction and operation of buildings. Sustainable and conservation practices – water conservation, sewerage treatment, solid waste treatment, economics and management

Low energy design, hybrid systems, modelling and simulation of energy systems, integration of PV and wind systems in the building, wind solar and other non conventional energy systems, solar thermal applications for heating and cooling, electricity generation in buildings

Case studies on specific contemporary sustainable architecture.

Note : The Sessional will be oriented towards live case studies and modelling

AR 536 DISASTER MANAGEMENT

Types of disaster, meanings and related definitions

Causes and effects of natural hazards

Disaster profile of India

Disaster preparedness and response and rehabilitation

Roles and responsibilities of different agencies

Tenth semester**AR 521 TRAINING**

The students shall have to complete the practical training for a period of one semester (six months) so as to qualify for obtaining the final B. Arch degree. The candidate shall have to submit to the dept. of architecture, the practical training report along with the certificates by the firm/ office / organization to the effect that he / she has completed training satisfactorily for a period of one semester. The student has to appear for the viva examination as per the exam schedule announced by the university.

AR 522 GENERAL PROFECIENCY

General proficiency is meant for developing participation in core/ curricular activities in individual students like sports, NCC, student activities, etc.