WELCOME
TO
MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY
BHOPAL

PROSPECTUS
POSTGRADUATION PROGRAMMES
(M.Tech, MCA, MBA & M.Plan)
AND
RESEARCH
(Ph.D)
(2012-2013)

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MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY,
BHOPAL, (M.P.) - 462 007.

GENERAL

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 Intstute 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^{o}c to 45^{0} 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.

1.2 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 Devlopment. 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.	7	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, Jabalput
9)	One Professor Professor of the institute by Rotation	9.	Dr.Ganga Agnihotri Professor Department of Electrical Engineering MANIT, Bhopal
10)	One Assistant Professor Professor of the institute by Rotation	10.	Prof..Rajat Soni Assistant Professor Department of Architecture MANIT, Bhopal
11)	Secretary	11	Registrar M.A.N.I.T., BHOPAL-462007

1.3 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.Ganga Agnihotri Professor Department of Electrical Engineering MANIT, Bhopal
7)	Secretary	7 Registrar M.A.N.I.T., BHOPAL-462007

2.0 DEPARTMENT OF TEACHING AND RESEARCH

There are four divisions and thirteen departments under the divisions of instruction and research in the institute as mentioned below:

Machine Technology Division

1. Applied Mechanics
2. Civil Engineering
3. Electrical Engineering
4. Mechanical Engineering
5. Material Science and Metallurgy

Soft Technology Division

1. Computer-Science and Information Technology
2. Electronics Engineering
3. Energy Centre
4. Chemical Engineering

Architecture and Planning Division

1. Architecture
2. planning

Science Division

1. Chemistry
2. Physics
3. Mathematics and Computer Application

Humanities and management Division

1. Humanities
2. Management studies

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.

3.0 INSTITUTE LIBRARY

The institute library has a collection of more than 103764 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 7 science streams.

3.1 INDEST consortuom

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

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	Internet 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.

4.0 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.

5.0 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 REC's/NITs

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.

REGULATIONS, COURSE STRUCTURE AND COURSE CONTENT

These Rules/Regulations may be called "MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY (BHOPAL) REGULATIONS for postgraduate and research 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,**
- **"GATE " means, Graduate Aptitude Test.**
- **'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.**
- **" DPRC" means, the departmental PG and research programme committee**
- **"RDC" means, Research Degree committee to doctoral programme of the Institute**
- **"Regulations" means, the set of academic Regulations of the progrmme.**

POSTGRAGUATE PROGRAMMES
REGULATIONS

1. INTRODUCTION

The goals of the postgraduate programmes at the Maulana Azad National Institute of Technology (MANIT) Bhopal are the development of technological and engineering manpower of the highest quality, to meet to the needs of educational institutions, R & D organizations and industries, , a deep understanding of the area of specialization, an innovative ability to solve new technological problems, and a capacity to learn continually and interact with multidisciplinary groups. With these goals, the postgraduate programmes are designed to include courses of study, seminars and project/thesis through which a student may develop his/her concepts and intellectual skills.

The procedures and requirements stated in this ordinance include the philosophy of the postgraduate education and ensure a high standard of performance at the Institute.

1.1 Postgraduate Programmes

(i) The Institute offers programmes leading to the Master of Technology (M.Tech.) degree under Machine Technology Division gives in Engineering materials, Stress and vibration, Structure engineering, environment engineering, Geotechnical engineering, Hydro power Engineering, Transportation Engineering, water resource, geo-informatics, Thermal engineering, Industrial design, Maintenance Engineering and Management, Power Systems, Electrical drives and material science and technology, Soft Technology division gives Digital Communication, VLSI and Embedded System, Information security, advanced computing, Computer Net working, Renewable energy, Green technology, Bio technology and Chemical process design, under Science Division gives Master computer applications, Bio-informatics, Nano Technology, Computation and bioinformatics

(ii) The Institute also offers the Programme leading to the Master of Business Administration (MBA) degree and the programme leading to the Master of Computer Applications (MCA).

(iii) Uunder architecture and planning division gives M.Plan (Urban Development) and M.Plan (Housing);

The Senate Sub-Committee (SC), established according to the bylaws of the Senate, operates through the Departmental Postgraduate Research Committees (DPRCs) to administer all aspects of the above programmes.

2. ADMISSION

2.1. Academic Session

The academic session of the Institute is divided into two regular semesters. The first semester will normally commence in July of every year and the second semester in January of every year.

2.2 Eligibility for admission

(i). The eligibility conditions given below are the absolute minimum. Departments may prescribe any requirements over and above these, subject to the approval of the Chairman Senate.
(ii). For admission in M.Tech/MUDP, a candidate belonging to General Category and Other Backward Class (OBC) must processes a minimum of 60 percent marks /equivalent CGPA 6.0 and above on a 10 point scale in the final year of the qualifying examination in appropriate branch of engineering.
(iii). For the above a candidate belonging to Scheduled caste/Scheduled Tribes Category (SC/ST) must processes a minimum of 55 percent marks /equivalent CGPA 5.5 and above on a 10 point scale in the final year of the qualifying examination in appropriate branch of engineering.

(iv) The M.Tech/M.Plan admission will be based on all India entrance examination "GATE" and all the qualified candidates are eligible for scholarship.

(v). The eligibility criterion for MBA program is a graduate in any discipline with minimum 60% marks/ equivalent CGPA 6.0 on a 10 point scale. The same will be up to 55% marks/ equivalent CGPA 5.5 on a 10 point scale in case of SC/ST candidates. Preference is given for the CAT Qualified candidates.

(v) Reservations of seats for OBC/SC/ST/PH will be as per MHRD/GOI norms/rules.

(vi) The admission in MCA will be based on an all India entrance examination conducted by any one of the NITs every year. The admission criterion for MCA will be same as decided by NIMCET committee.

Eligibility criteria for M.Tech admission is given in the table below:

	Department of applied mechanics	
	Course	Edibility criteria
1.	M.Tech in Engineering Materials	BE/B.Tech in civil/Mechanical/aeronautical/ Material science and metallurgy
2.	M.Tech in Stress and Vibration Analysis	BE/B.Tech in civil/Mechanical/aeronautical/

	Department of Civil Engineering	
	Course	Edibility criteria
3	M.Tech in Structural Engineering	BE/B.Tech in civil/Construction Technology and management /Structures
4	M.Tech in Environment Engineering	BE/B.Tech in civil/Chemical Engineering /Environment
5	M.Tech in Geotechnical Engineering	BE/B.Tech in civil Engineering
6	M.Tech in Hydro power engineering	BE/B.Tech in civil/Mechanical Engineering
7	M.Tech in Transportation Engineering	BE/B.Tech in civil/Transportation/Architecture
8	M.Tech in Water resource	BE/B.Tech in civil/ Engineering /Agriculture
9	M.Tech in Geoinformatics	BE/B.Tech in any discipline

	Department of Mechanical Engineering	
	Course	Edibility criteria
10	M.Tech in Thermal Engineerin	BE/B.Tech in mechanical/ Automobile
11	M.Tech in Industrial design	BE/B.Tech in mechanical/Industrial production
12	M.Tech in Maintenance Engineering	BE/B.Tech in mechanical/Industrial production

	Department of Electrical Engineering	
	Course	Edibility criteria
13	M.Tech in Electrical drives	BE/B.Tech in Electrical/Electrical & electronics/ Electronic instrumentation/Instrumentation and control
14	M.Tech in Power system	BE/B.Tech in Electrical/Electrical & electronics

	Department of Material science and Metallurgy	
	Course	Edibility criteria
15	M.Tech in Material science and technology	BE/B.Tech in mechanical/ Material science and metallurgy

	Department of Electronics and communication	
	Course	Edibility criteria
16	M.Tech in Digital communication	BE/B.Tech in Electronics /Electronics and communication/telecommunication
17	M.Tech in VLSI and embedded systems	BE/B.Tech in Electronics /Electronics and communication/telecommunication

	Department of Computer science and Engineering	
	Course	Edibility criteria
18	M.Tech in Information security	BE/B.Tech in Computer science and Engineering/ Information technology
19	M.Tech in Advanced computing	BE/B.Tech in Computer science and Engineering/ Information technology
20	M.Tech in Computer net working	BE/B.Tech in Computer science and Engineering/ Information technology

	Department of energy	
	Course	Edibility criteria
21	M.Tech in Renewable energy	BE/B.Tech in Electrical/mechanical/Civil/ Chemical Engineering, Energy
22	M.Tech in Green technology	BE/B.Tech in any discipline

	Department of Chemical engineering	
	Course	Edibility criteria
23	M.Tech in Bio technology	BE/B.Tech in Chemical Engineering/Bio

		technology
24	M.Tech in Chemical process design	BE/B.Tech in Chemical Engineering

	Department of Physics	
	Course	Edibility criteria
25	M.Tech in Nano technology	BE/B.Tech in mechanical/ Material science and metallurgy/Electronics and communication/Electrical and B.Sc (Physics)

	Department of Mathematics	
	Course	Edibility criteria
26	M.Tech in Computation and system Bio informatics	BE/B.Tech in Computer science and Engineering/ BIO-technology/ Information technology/ Bio informatics and B.Sc in Maths/Biology/Agriculture
27	M.Tech in Bioinformatics	BE/B.Tech in Computer science and Engineering/ BIO-technology/ Information technology/ Bio informatics and B.Sc in Maths/Biology/Agriculture

	Department of Archetecture and planning	
	Course	Edibility criteria
28	M.Plan in Urban development	BE/B.Tech in Civil/B. Arctecture /B. Planning
29	M.Plan in Housing	BE/B.Tech in Civil/B. Arctecture /B. Planning

2.3 Admission Procedure

The applicants must apply for admission on prescribed forms, which must be sent directly to the AR(Admission) before the last date specified in the advertisement for PG admission every year. All admissions will be made on approval by the Chairman Senate, on the recommendations of the duly constituted admission committees.

(i) Admission to the M.Tech./M.Plan programme will be made on the basis of GATE scores of the candidates through central counseling jointly conducted by all National Institutes of Technology (NITs).

(ii) The total number of seats and admission of OBC/SC/ST/PH candidates will be decided as per the MHRD/GOI rules.

(iii) The selected candidates who have completed all the examinations including project/thesis examination and the viva voce before the date of registration but are unable to produce the certificate in proof of having passed and secured the minimum specified qualifying marks, may be considered for provisional admission. However, if admitted provisionally, they will be required to produce the evidence of their having passed the qualifying degree examination with minimum specified marks by the last date for document submission as specified in the academic

calendar (usually about 8 weeks from the date of registration), failing which the admission is liable to be cancelled.

(iv) On approval by the Chairman, Senate, the admission section will issue the admission letters to the candidates who will be required to accept the offer of admission by depositing the prescribed fee before the specified date.

(v) In case a candidate does not accept the offer by paying the prescribed fee by the specified date, the offer of admission may stand withdrawn, and the admission will be offered to the candidates in the waiting list, if any, in order of merit.

(vi) The offer of admission may also stand withdrawn if the candidate who has accepted the offer fails to register by the date for late registration.

2.4 Admission for Foreign Students

(i) A foreign student (NRI and Foreign Nationals) seeking admission in any PG program of MANIT should have a qualifying degree from any institute/university recognized by the Association of Indian Universities or abroad.

(ii) The application of such students shall be routed through MHRD/Agencies authorized by MHRD to the institute before the last date of the submission of applications as prescribed by the institute.

(iii) The number of seats for such candidates and the required fee shall be fixed by the institute in consultation with MHRD/ Government of India.

These students shall not be eligible for GATE scholarships.

2.5 Admission for Sponsored Students

(i) Any student seeking admission under this category shall be working on a regular post in any Government/semi government/public sector units/industries/ academic institutes/research organizations/Architectural firm for a minimum of two years at the time of admission. Admission of such candidates will be based on the institute test/interview and the required working experience.

(ii) The application form of such candidates should be duly forwarded by the parent organizations and should record that the candidate will be allowed to attend the classes in day time and will be allowed to stay in the campus/Bhopal during his/her PG program.

(iii) There will be NO concessions on fee to be deposited in MANIT however the candidates employed in MANIT Bhopal may be given fee concession subject to approval of Chairman Senate.

(iv) No financial liability will be on the part of the MANIT.

2.7 Admission Fee

The students admitted will have to pay the full fee for one semester/one year as applicable to the particular category of the candidate as per the institute norms. The institute reserves every right to modify the admission fee from time to time based on the approval of competent authority. Any student will be admitted only when he/she has deposited the full fee for one semester/one year as applicable to him.

2.8 Financial Assistant

(i) The Institute may provide to postgraduate students, financial assistance in the form of teaching or research assistantships. Assistantships are awarded on a semester to semester basis for a period of up to four semesters for M.Tech. students. The stipend for the assistantship is paid as per the rates by approved MHRD.

(ii) A student is expected to devote up to eight hours per week towards job(s) assigned to him/her by the concerned departments. The renewal of assistantship is contingent on the student's satisfactory performance in the academic programme and in the discharge of assistantship duties.

(iv) A student on teaching/research assistantship is also reimbursed annually for some contingency expenses as per the approved terms and procedures to be notified by the MHRD/GOI from time to time.

3. REGISTRATION

A student is required to register in the beginning of each semester for the courses that he/she intends to pursue in that semester. The registration process involves:

(i) The payment of fees for that semester and clearance of any outstanding dues. Without clearance of the dues a student can not be allowed to register in the next semester.

(ii) A new entrant to any PG program, who is awaiting the results of the qualifying examination, will be allowed to register "provisionally" on submission of a certificate from his/her institution certifying that he/she has appeared in the final qualifying examination (including all papers in theory, practical, project, oral, etc.). The candidate will submit attested copies of the certificates of having passed the qualifying examination by the last date for document submission as specified in the academic calendar (usually about 8 weeks from the date of registration), failing which the admission may be cancelled.

3.1 Late Registration

(i) If for any compelling reason like illness, a student is unable to register on the day of registration, he/she will be allowed to register till the day of late registration specified in the academic calendar. Any student registering late will be required to pay the specified late registration fee. No late registration is permitted after this due date.

(ii) In exceptional cases, the chairman senate, on the recommendation of the HOD through Dean (Academic Affairs) may consider registration beyond the date of late registration. In such a case, the student will be allowed to register for thesis units only if he/she has completed all the course credit requirements.

4. STUDENT'S LEAVE RULES

Students may be granted leave under sections 4.1 and 4.2 on application to the Head of the Department concerned through the DPRC. Leave under sections 4.3 and 4.4 will be sanctioned by Dean (academic affairs) on the recommendation of HOD. Applications must be submitted well in advance of the date of commencement of the leave requested. Leave for a period longer than that specified in sections 4.1, 4.2 and 4.3 may be sanctioned by Chairman Senate on the recommendation of HOD through Dean (Academic Affairs) and it will entail loss of financial assistantship for the extended period.

4.1. Vacation and Casual Leave

(i) A postgraduate student may be allowed vacation leave during any period of the Institute's vacation or during the mid-semester break up to a maximum of 15 days per semester, subject to a maximum of 8 days at a time. Leave not availed in one semester may be carried over to the next semester up to a maximum of 15 days.

(ii) In addition, a student may be allowed casual leave for up to 5 days per semester to the condition that such leave will not be allowed for longer than 3 days at a time. The casual leave cannot be combined with any other kind of leave, and will not be carried over.

(iv) There will be no loss of financial assistantship for students going on vacation or casual leave.

4.2. Medical Leave

Leave on medical ground, duly supported by a medical certificate, may be granted to a student up to 8 days per semester. Unavailed leave may be carried over to the next semester up to a maximum of 8 days. However, at a stretch, the medical leave shall not exceed 15 days. Such leave shall not entail any loss of financial assistantship.

4.3. Maternity Leave

A female student may be granted maternity leave for a maximum of 3 months. Leave up to 6 weeks can also be granted for miscarriage including medical termination of pregnancy, if supported by a proper medical certificate. Such leave can be combined with any other leave due and will not entail any loss of financial assistantship.

4.4. Semester Leave

If a student falls ill while on the MANIT campus, the medical certificate must be obtained from the Institute's medical officer. If he/she falls ill outside the campus while on sanctioned leave, the medical certificate must be obtained from a registered medical practitioner.

4.5 Absence without Sanctioned Leave

Absence without sanctioned leave will entail loss of financial assistantship for the period of absence, and may result in the termination of the student's programme on the recommendation of the DPRC and approval of Chairman Senate.

5. PERMISSION TO PROCEED FOR ACADEMIC ACTIVITIES

The PG students can be permitted to proceed for academic activities outside MANIT to carry out field work, library work, computational work, experimental work, and Lab works, and also to attend conference, courses and to undertake other research work etc. as recommended by the department. Permission for a duration up to 16 days be sanctioned by the Dean (Academic) through the concerned head of the department/center with an intimation to chairman Senate and more than 16 days by the Chairman-Senate on the recommendation of the Departmental head through Dean (academic). Such leave will be beyond all leave in section 4.

6. ACADEMIC REQUIREMENTS

6.1 Number of Semester, Maximum Duration and Academic Requirements

The following table lists the maximum duration allowed in the programme, and credits requirements for post-graduation in the various programmes. A student must complete the entire academic requirements prescribed by the institute/department/center before proeeding for the thesis/project work.

Name of Programme	**Number of Semester Required**	**Maximum Duration Allowed to complete the program**
M.Tech.	4 Semester	3 Years
MBA	4 Semester	2 Years
MCA	6 Semester	3 Years

No student who has completed the prescribed maximum duration in the programme shall be allowed to register in the subsequent semester unless he/she has been granted extension of the programme by the Chairman Senate on the recommendations of the HOD and Dean (Academic Affairs).

6.2 Requirement of Attendance

(i) Students are expected to attend all the classes. Institute expect 100 % attendance in the class is desirable for a student to be eligible to appear for the end semester examination in every course in each semester. However students may be given a concession of 25 % on account of sickness or any other genuine reason. A student shall be eligible to appear in the examination in any course if and only if he/she has attended more than 75 % of the total number of classes scheduled in the course in that semester before each examination.

(ii) Attendance for the above purposes shall be compiled and reported by each subject teacher to the concerned HOD before the start of the examination.

(iii) The decision on the prevention shall be made by a committee duly constituted by the concerned HOD for the same.

6.3 Evaluation process for M.Tech./MCA/MBA

Theory paper

End term Examination (Duration 180 minutes) Maximum mark	Mid term Continuous Evaluation			Total Marks (Theory)
	Distribution		Total	
60	Minor I Innovative work/ assignment	20 20	40	100

Practical

End Term Examination (Duration 180 minutes) Maximum mark	Continuous Evaluation (Practical)			Total Marks (Practical)
	Distribution		Total	
60	Laboratory/ workshop work Mid term Submission & viva	20 20	40	100

Evaluation process for M.Plan

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

6.4 Credits, Grades, Semester and Cumulative Grade Performance Average

(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.

(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.

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**

(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 student are allowed to continue in the programme.

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

6.5 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 awarded to a student are G_1, $G_2 \ldots G_n$ etc in courses with corresponding credits C_1, $C_2 \ldots C_n$ etc, the SGPA is given by-

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

Similarly, the CGPA indicates the cumulative academic performance in all the courses/subjects taken during the entire stay in the institute. 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.

6.6 Academic Performance Requirement

(i) The minimum SGPA requirement for continuing in the programme or for post graduation is 6.5 for M.Tech./M.Plan/MBA and 6.0 for MCA.

(ii) If a M.Tech./M.Plan/MBA student secures a CGPA between 6.0 and 6.5 or a MCA student secures a CGPA between 5.5 and 6.0, he/she may be allowed to continue in the following semester on the recommendation of the DPRC and with the approval of the Chairman senate.

(iii) A student will not be allowed to continue in the M.Tech./M.Plan/MBA/MCA. programme if:

(a)his/her CGPA is below 6.0 in two consecutive semester.
(b) He/she obtains more than two F in the same or different courses.
(c) He/she accumulates three or more N grades before the start of the final semester/thesis.
However, those who have completed course work and CGPA is less than 5.5 or discontinued from the course, diploma in the course can be awarded by the recommendation of the chairman, senate.

(iv) The DPRC will keep a watch on the progress of every student and whenever a student fails to meet the requirements will intimate the Dean (academic) who can start the termination procedure. If a student's program is terminated, the Head of the Department will issue the letter of termination with consultation of Dean (academic) through COE.

Maximum credit point average, CGPA required for M.Tech/M.Plan degree is 90 credits, for MCA it is 150 credits and for MBA it is 100 credits.
The provisions of conducting the Revaluation of answer books and supplementary examinations are completely abolished.

7. DISCIPLINARY/GRIEVANCE COMMITTEE

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

Dean (Academic)	**Convener**
Dean (Student Affairs)	**Member**
Concern HOD	**Member**
Controller of Examination	**Member**
Associate Dean (PG and research)	**Member**

The above committee will be dealing with all the PG student's academic matters/grievances related to attendance, academics etc. problems in the PG 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 PG 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 PG students in the MANIT campus. This committee consists of the following members.

Dean (Student Affairs)	**Convener**
Dean (AcademicAffairs)	**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 PG 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.

8. M.Tech/M.Plan/MBA/MS Thesis/Project

8.1 Supervisor(s) Selection

Any PG student who has completed all the academic requirements as prescribed by the institute can proceed to select a thesis/project supervisor(s) from the research area in which he/she is interested to work in his parent department. A student can also choose the thesis supervisor from other departments of the institute if the chosen supervisor has the same working area in which the student is interested. For this due permission should be taken from the Dean (Academic Affairs) through head of the parent department of the student. The same procedure should be adopted if a student is choosing the supervisor from any other academic institute (NOT below the level of NITs)/industries/research organizations. In case a thesis supervisor leaves the

institute permanently/ for more than three months before the completion the thesis, a student can choose other supervisor with consultation of the DPRC and HOD with the intimation to Dean Academic.

8.2 Thesis/Project Writing and Submission

A PG student who has completed all the necessary work of the thesis/project to the satisfaction of the concerned supervisor(s) may write his/her thesis/project report in the prescribed format of the PG thesis and must submit the same in the academic section, with the clearance of all dues, before the last date specified by the institute failing which he/she will have to pay the late fee as indicated in section 3. The thesis must be soft bounded with ***blue color cover page*** and must be certified by the concerned supervisor(s) that the required work was done under his/her/their supervision and there is no duplication of the work. The thesis/ project report should be arranged in following manner and should strictly be followed.

(i) Cover page with blue color hard paper followed by white paper having the cover page items.
(ii) Certificate by supervisor(s) in the format specified by the institute
(iii) Acknowledgement by candidate.
(iv) Preface/Abstract
(v) Table of Contents followed by Chapters of the thesis
(vi) Appendices if any
(vii) List of Publications, if any.
(viii) References.

The details about the PG thesis format will be available on institute website.

8. 3 Thesis/Project Oral Examination Board

(i) The thesis/project will be examined by an oral examination board formed by the thesis supervisor(s) in consultation with the Head of the Department. It must be recommended by the DPRC and approved by the Chairman senate.

(ii) The committee shall consist of the thesis supervisor(s) and at least one member from outside the department and a member from the concern department. The head of the department or person deputed by the head of the department will act as the Convener of the Committee.

(iii) In addition to these board members any thesis/project oral examination/ defense must be open to those all who are interested to be the part of the same. A notice regarding thesis defense should be placed on notice boards before one week of its schedule clearly indicating the date, time and venue. Except in some exceptional cases normally the theses defense will not be on any holiday including Saturday and Sunday.

8.4 Use of Unfair means/Copying of Thesis

(i) Use of unfair means in any examination of the institute is strictly prohibited and is considered as a serious offense. If any such matter is reported by an invigilator, the

grievance committee given in Para 7 will recommend any one of the following punishment based on the written report of the invigilator, relevant papers etc. The disciplinary committee will use its own discretion for all the points of category/punishment not covered in the following table.

Category	UFM Type	Punishment
A	During the course of any examination if any book or written paper related to the examination is found with the candidate.	Examination of that theory paper of the candidate will be cancelled.
B	If a candidate leaves the examination hall finally without handing over the answer book to the invigilator or smuggles in an answer book or replaces the continuation sheet during or after the examination.	His/her full semester examination will be cancelled.
C	Getting impersonated by any other person or refuses to hand over the materials used for copying or destroyed the proofs or refuses to sign on UFM Performa all such candidates will be put under this category.	Present examination will be cancelled in full and the student will be debarred from appearing in the next examination and there fore the candidate can not be admitted in next coming semester exams.
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	Present examination will be cancelled in full and the candidate will be debarred for next two examinations.
E	A candidate misbehaves or uses abusive languages or beats or fights or threatens to harm or tries to bribe or actually bribes an invigilator or a person appointment for examination work at the center or carries any weapon in examination center or takes any dog or any other animal or birds in the exam hall will be grouped under this category	Cancellation of present full examination and debarred from appearing next four examination and FIR will be sent to police for criminal proceeding of the candidate.

(ii) Copying of the thesis from any source at any stage is strictly prohibited and is treated as a criminal offense. If any candidate is found guilty in this offense at any stage of the program, his/her thesis liable to be cancelled after a due departmental enquiry set up by the Chairman Senate for the same. The Chairman senate is empowered to take any decision on such matters including the termination of the program of candidate.

9. 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.***

10 COURSE STRUCTURE (M.Tech)

The M.Tech courses were originally designed keeping in view the industries around the Bhopal and National level requirements. The courses are modified /updated keeping latest advancement in the subjects and new PG courses are introduced. The collaboration with industries is considered as an important ingredient and courses content and structure are modified in view of i) strengthening industry-institute interaction ii) imparting industry oriented education and training iii) enhance collaborated research.

The M.Tech courses are in 24 months duration comprising of 4 semesters about 6 months each, with particular emphasis on project/dissertation in 3rd and 4th semesters. First and second semester only have the theory and practical/seminar classes. In the second year student are required to perform preliminary investigation, literature review on a selected topic of project and research work which is to be presented as thesis report. Since the second year students only have to do the project work, all the departments has to follow the rule for the evaluation as below.

Third Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	23*
As applied by the department	Project Phase - I	-	-	23	

*****Out of 23 credits, 05 credits will be assigned to mid- term project-seminar. Remaining 18 credits will be assigned to end term seminar.

Fourth Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	23*
As applied by the department	Project Phase – II/ Dissertation	-	-	23	

*****Out of 23 credits, 5 credits will be assigned to mid- term project-seminar. Remaining 18 credits will be assigned to end term seminar.

For the first and second semester course structure are given below in department wise. For a particular course students have to take some core subjects, department electives and open electives. Any student from the Department registered for particular programme can take department electives. Open electives can be registered from any department depend upon the opinion of staff advisor or area related to his interest.

MACHINE TECHNOLOGY DIVISION

10.1 DEPARTMENT OF APPLIED MECHANICS

i) M.Tech. in Engineering Materials

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EM511	Advanced Engineering Mathematics & Optimization Techniques	3	-	-	3
EM512	Material Science	3	-	-	3
EM513	Behavior of Materials	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
EM514	Behavior of Materials Laboratory	-	-	2	2
EM515	Seminar - I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
EM521	Material Processing	3	-	-	3
EM522	Materials Management	3	-	-	3
EM523	Tribology & Wear Analysis	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
EM524	Advanced Materials Laboratory	-	-	2	2
EM525	Seminar - II	-	2	-	2
				Total credit	22

List of Electives

EM531 Bio-Materials
EM532 Nuclear Materials
EM533 Aerospace Materials
EM534 Polymer Engineering
EM535 Corrosion Engineering
EM536 Metal Forming
EM537 Theory of Plasticity
EM538 Advanced Materials
EM539 Product Design & Development
EM-541 Intellectual Property Right
EM 542 Fracture & Failure of Materials
EM543 Composite Materials

List of open electives

EM 551 Advanced Mechanics of Materials
EM552 Finite Element Method

ii) M.Tech. in Stress and Vibration Analysis

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
SV511	Advanced Engineering Mathematics & Optimization Techniques	3	-	-	3
SV512	Theory of Elasticity	3	-	-	3
SV513	Theory of Vibrations - I	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
SV514	Vibration Analysis Laboratory	-	-	2	2
SV515	Seminar – I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
SV521	Experimental Stress Analysis	3	-	-	3
SV522	Theory of Plates	3	-	-	3
SV523	Theory of Vibrations - II	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
SV524	Experimental Stress Analysis Laboratory	-	-	2	2
SV525	Seminar - II	-	2	-	2
				Total credit	22

List of Electives

SV531 Advanced Machine Design SV-532 Theory of Elastic Stability
SV533 Theory of Plasticity SV-534 Product Design & Development
SV535 Earthquake Engineering SV-536 Non-linear & Random Vibrations
SV537 Stress & Vibration Analysis in Turbo-machinery
SV538 Rotor Dynamics & Balancing SV-539 Analysis & Design of Shells
SV541 Analysis of Composite Structures SV542 Computer Aided Design
SV543 Mechanics of Composite Materials

List of open electives

SV551Finite Element Method SV552 Condition Monitoring

10.2 DEPARTMENT OF CIVIL ENGINEERING

iii) M. Tech. in Structural Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
STR511	Theory of Elasticity	3	-	-	3
STR512	Advanced Structural Analysis	3	-	-	3
STR513	Design of R.C.C. Structures & Steel Structures	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
STR514	Structure Lab – II	-	-	2	2
STR515	Seminar 1	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
STR521	Prestressed Concrete	3	-	-	3
STR522	Structural Dynamics	3	-	-	3
STR523	Theory of Plates & Shells	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
STR524	Structure Lab – II	-	-	2	2
STR525	Seminar-2	-	2	-	2
				Total credit	22

List of electives

STR 531 Soil Structure Interaction
STR 532 Design of Steel Concrete Composite Structures

STR 533. Maintenance and Rehabilitation of Structures
STR 534 Tall Structures STR 535 Bridge Design
STR 536 Safety in Construction STR 537 Advanced Steel Structures
STR 538 Earthquake Analysis and Design of structures
STR 539 Design of foundation systems STR 541 Advance RCC Structures

List of open electives

STR 551 Advanced Mathematics STR 552 Advanced Soft Computing Techniques
STR 553 Probability and statistical methods
STR 554 Finite Element Methods in Structural Engineering

iv) M. Tech. in Environment Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MT511	Treatment plant design	3	-	-	3
ENV512	Environment microbiology and energy	3	-	-	3
ENV513	Environment chemistry	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
ENV514	Environment Laboratory -1	-	-	2	2
ENV515	Seminar-1	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
ENV521	Biological treatment process	3	-	-	3
ENV522	Industrial waste treatment	3	-	-	3
ENV523	Air pollution control	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
ENV524	Environment Laboratory -2	-	-	2	2
ENV525	Seminar 2	-	2	-	2
				Total credit	22

List of electives

ENV531 Quantitive techniques and project management
ENV532 Building environment ENV533 Environment quality monitoring

ENV534 Environment economic and management
ENV535 Noise pollution and control ENV536 Environment modeling
ENV537 Risk assessment ENV538 Environment hydraulics
ENV539 Resource recovery and utilization

List of open electives

ENV 551 Statistical techniques and computer applications in environment Engineering
ENV552 Advanced Mathematics ENV553 Advanced Soft Computing Techniques
STR 5554 Finite Element Methods in Structural Engineering

v) M. Tech. in Geotechnical Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GEO511	Advanced Geotech Engg.	3	-	-	3
GEO512	Foundation Engg. - I (Shallow Foundation)	3	-	-	3
GEO513	Machine Foundation Vibration	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
GEO514	Lab. Practice - I Soil Mech.	-	-	2	2
GEO515	Seminar-I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
GEO521	Soil Dynamics	3	-	-	3
GEO522	Design and Construction of Machine Foundation	3	-	-	3
GEO523	Foundation Engg. - II (Deep Foundation)	3	-	-	3

	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
GEO524	Lab. Practice - II Soil Dynamics	-	-	2	2
GEO525	Seminar-II	-	2	-	2
				Total credit 22	

List of electives

GEO531 Advance structure analysis GEO 532 Structural dynamics
GEO533 Reinforced soil structure GEO534 Rock machines and engineering geology
GEO 535 Environmental geotechque GEO 536 Theory of elasticity and plasticity
GEO537 Geotechnical Investigations and Field Testing of Soils
GEO538 Critical State Soil Mechanics GEO541 Earthquake Engineering
GEO539 Strength and Deformation Behaviour of Soils
GEO541 Modern Geotechnical Processes

List of open electives

GEO 551 Advanced Mathematics GEO552 Advanced Soft Computing Techniques
GEO553 Probability and statistical methods GEO554Finite Element Methods

vi) M.Tech in Hydro Power Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH511	Advanced Mathematics	3	-	-	3
HYD512	Advanced Fluid Mechanics	3	-	-	3
HYD513	Hydrology and Hydro Power Plants	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
HYD514	Hydraulic Lab Practice-I	-	-	2	2
HYD515	Seminar	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
HYD521	Fundamentals of Hydraulic Machines	3	-	-	3

HYD522	Design of Hydraulic Machines- Turbines	3	-	-	3
HYD523	Design of Hydraulic Machines- Pumps	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
HYD524	Hydraulics Lab Practice-II	-	-	2	2
HYD525	Computational Lab Practice	-	2	-	2
				Total credit 22	

List of electives

HYD531 Theory of Cascades HYD 532 Water Resources Systems
HYD533 Manufacturing Processes HYD534 Hydro Power Structures
HYD535 Hydraulic Transients HYD536 Design of Power House
HYD537 Industrial Hydraulics HYD 538 Governing systems

List of open electives

HYD551 Computer Applications to Hydraulic Systems
HYD552 Instrumentation and Measurement HYD553 Computational Fluid Dynamics
HYD554 Project Planning and Management

vii) M.Tech. in Transportation Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
TRE511	Analysis and Design of Pavement Structures	3	-	-	3
TRE512	Traffic Engineering and Management	3	-	-	3
TRE513	Transport Planning	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
TRE514	Lab practice –I	-	-	2	2
TRE515	Seminar 1	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
TRE521	Highway Construction and Maintenance	3	-	-	3
TRE522	Public Transport System	3	-	-	3
TRE523	Highway Geometrical Design	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
TRE524	Lab practice II	-	-	2	2
TRE525	Seminar II	-	2	-	2
Total credit 22					

List of electives

TRE 531 Geotechnical Investigations and Field Testing of Soil
TRE 532 Analysis and Design of Highway Intersections
TRE 533 Concrete Technology TRE 534 Bridge and Tunnel Engineering
TRE 535 Fundamentals of Remote Sensing, GIS and GPS
TRE 536 Highway Maintenance Management System
TRE537 Environmental Impact Assessment TRE538 Planning and Design of Airports

List of open electives

TRE551 Probability and Statistics TRE552 Optimization Techniques
TRE 553 Operation Research
TRE554 Engineering Economics and Project Management

viii) M.Tech. in Water Resources Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MTH 511	Advanced Mathmatics	3	-	-	3
WRE512	Advanced Fluid Mechanics	3	-	-	3
WRE513	Applied Hydrology	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
WRE514	Lab Practice- I	-	-	2	2
WRE515	Seminar-I	-	2	-	2
Total credit 22					

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
WRE521	Advanced Hydraulic Structures	3	-	-	3
WRE522	Water Resources Systems	3	-	-	3
WRE523	Open Channel Hydraulics	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
WRE524	Lab Practice- II	-	-	2	2
WRE525	Seminar-II	-	2	-	2
Total credit 22					

List of electives

WRE531 Irrigation & Drainage Engineering WRE532 Water Supply Distribution System
WRE533 Geo Technical Investigations in Water Resources Projects
WRE534 Integrated Watershed Management WRE535Hydraulic Measurement Systems
WRE 536 Flood Control & River Training Works WRE 537 Ground Water Engineering
WRE538. Hydraulic Energy Dissipaters
WRE539 Water Resources Project Planning, Economics & Management
WRE541 Sediment Transportation Engineering WRE 542 Stochastic Hydrology
WRE543 Eco-hydrology

List of open electives

WRE551 Geospatial Techniques in Water Resources Engineering
WRE552 FEM in Water Resources Engineering WRE553 Transients in Pipe flow

ix) M.Tech. in Geoinformatics and its Applications

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GI511	Basics of mapping and cartography	3	-	-	3
GI512	Basic concepts of photogrammetry	3	-	-	3
GI513	Principles of remote sensing technology	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
GI14	Remote sensing & cartography lab	-	-	2	2
GI541	Seminar	-	2	-	2
Total credit 22					

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
GI521	Space geodesy and GNSS based mapping	3	-	-	3
GI522	Basic concepts of GIS	3	-	-	3
GI523	Digital processing of remotely sensed data	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
GI524	DPS and GIS lab	-	-	2	2
GI525	Seminar	-	2	-	2
				Total credit 22	

List of electives

GI531 Remote sensing and GIS for environmental engineering
GI532 Microwave remote sensing GI533air borne laser terrain mapping
GI534 Hyperspectral remote sensing
GI535Remote sensing and GIS for hydrology and water resources
GI536 Change detection using remote sensing
GI537 Remote sensing and GIS for earth sciences GI538 Digital photogrammetry
GI539 Remote sensing and GIS for agriculture & forestry

List of open electives

GI551 Probability and statistical methods GI552 Advanced soft computing techniques
GI553 Geoinformatics in urban mapping and management
GI554 concepts of database systems
GI555 Geoinformatics applications in engineering projects and utility management
GI556 Remote sensing and GIS for disaster management

10.3 DEPARTMENT OF MECHANICAL ENGINEERING

x) M.Tech. in Thermal Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
TH 511	Advanced Mathematics	3	-	-	3
TH 512	Advanced Thermodynamics	3	-	-	3
TH 513	Advanced Heat & Mass Transfer	3	-	-	3
	Elective - 1	3	-	-	3

	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
TH 514	Thermal Engg Lab - I	-	-	2	2
TH 515	Seminar - I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
TH 521	Instrumentation & Control	3	-	-	3
TH 522	Thermal Environmental Engg	3	-	-	3
TH 523	Theory and Design of Heat Exchangers.	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
TH 524	Thermal Engg Lab - II	-	-	2	2
TH 525	Seminar - II	-	2	-	2
				Total credit 22	

List of electives

TH561 Numerical Heat Transfer TH532 Experimental Stress Analysis
TH533 Maintenance of Thermal Power Plant Equipment
TH534 Refrigeration System and Component Design TH535Theory and Design of Gas Turbines
TH536Combustion
TH537 Vibrations and Its App for Design of Turbomachinery
TH538 Theory & Des. of Blowers & Compressors & Ind. Steam Turbines
TH539 Gas Dynamics and Flow Through Turbomachines

List of open electives

TH551 Non-Conventional Thermal Energy System TH552 Thermal Power Plant Engineering
TH553 Power Generation Systems

xi) M.Tech. in Industrial Design

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ID 511	Computational Methods	3	-	-	3
ID 512	Mechanism & Synthesis	3	-	-	3
ID 513	Reliability Engineering	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
ID 514	Dynamics of Machines Lab.	-	-	2	2

ID 515	SEMINAR-I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
ID 521	Advanced Computer Aided Graphics	3	-	-	3
ID 522	Stress & Vibration Analysis	3	-	-	3
ID 523	Advanced Product Design	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
ID 524	CAD Lab.	-	-	2	2
ID 525	SEMINAR-II	-	2	-	2
				Total credit 22	

List of electives

ID531 Bearing Design & Selection ID532 Design and Development of Prototype Product.
ID533 Computer Aided Facility & Process Planning ID 554 Product Design for Market
ID 535 Acclerated Product Design & Development ID536 Electronics Packaging Design
ID537 Complex Mechanism & Graph Theory ID538 Nature of Materials and Processes
ID539 Detailed Design of Rotating Machines ID541 Advanced Machine Dynamics

List of open electives

ID 551 Applied Ergonomics. ID 552 Concurrent Engineering
ID553 Design of Computer Aided Engineering System ID554General Computer Aided Design

xii) M.Tech. in Maintenance Engineering

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MT511	Statistics and Probability	3	-	-	3
MT512	Maintenance Management – Policies, Strategies & Options	3	-	-	3
MT513	Lubrication Management & Practice	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
MT514	Maintenance Engg Lab-I and Tribology Lab	-	-	2	2
MT515	Seminar I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
MT521	Reliability, Availability & Maintainability Engineering	3	-	-	3
MT522	Failure Analysis & Prevention	3	-	-	3
MT523	TPM, CBM and RCM	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
MT524	Maintenance Engg Lab-II and Diagostics Lab.	-	-	2	2
MT525	Seminar II	-	2	-	2
				Total credit 22	

List of electives

MT531 Maintenance Audit MT532 Risk Analysis and Safety
MT533 Concurrent Engineering MT535 Maintenance Awareness
MT534 Maintenance of Agriculture and Earth Moving Machinery
MT536 Bulk Solids and Handling MT537 Maintenance of Electrical Machines
MT538 Maintenance of Power Plant Machinery MT539 Maintenance of Transport Machinery
MT541 Mechatronics and NDT in Maintenance Engineering
MT542 Maintenance of CNC Machines MT543 Restoration, Repairs and Retrofitting
MT544 Machinery Vibration Monitoring Analysis
MT545 Maintenance of Chemical Plant Machinery

List of open electives

MT551 Theory of Tribology Elements
MT552 Maintenance Economics and Turn Around Management
MT553 Maintenance Economics and Turn Around Management

10.4 DEPARTMENT OF ELECTRICAL ENGINEERING

xiii) M.Tech. in Electrical Drives

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
ED511	Power Controller	3	-	-	3
ED512	Electrical Drives	3	-	-	3
ED513	Modeling & Analysis of Electrical Machines	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
ED514	IMachines & Drives	-	-	2	2

	Laboratory				
ED515	Seminar I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
ED521	Advanced Power Electronics	3	-	-	3
ED522	Advanced Control System	3	-	-	3
ED523	DSP & Its Applications	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
ED524	PLC & Micro controller Laboratory	-	-	2	2
ED525	Seminar II	-	2	-	2
				Total credit 22	

List of electives

ED531 Power Quality ED532 Traction Drives
ED533 Advanced Electrical Drives ED534 Microcomputer & its Application
ED535 Reactive Power Control and Facts ED536 Evolutionary Techniques
ED537 Microcomputer Controlled Drives ED538 Instrumentation in Electrical Drives
ED539 Special Machines ED541 AC & DC Transmission

List of open electives

ED551 Finite element method ED552 Maintenance Economics
ED553 Turn Around Management

xiv) M.Tech. in Power systems

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
PS511	Power System Analysis	3	-	-	3
PS 512	Advanced Power System Protection	3	-	-	3
PS513	Evolutionary Techniques	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
PS514	Power System Laboratory	-	-	2	2
PS515	Seminar I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
PS521	Modern Trends in Power System Operation	3	-	-	3
PS522	Advanced Control System	3	-	-	3
PS523	Power System Stability and Control	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
PS524	Computer Applications in Power System Lab	-	-	2	2
PS525	Seminar II	-	2	-	2
Total credit 22					

List of electives

PS531 EHV AC and DC Transmission PS532 Power Controller
PS533 Economics of Regulation and Restructuring of Energy Industries
PS534 Computer Aided Power System Analysis
PS535 Microcomputer & its Applications PS535 Power Quality
PS536 Instrumentation PS537 Advanced Power Electronics
PS538 Modelling and Analysis of Electrical Machines
PS539 Power System Planning & Management PS539 Power System Transients

PS539 DSP & its Applications PS541Advanced Electrical Drives

PS542 Reactive Power Control and Facts PS543 Power System Economics

List of open electives

ED551 Finite element method ED552 Maintenance Economics
ED553 Turn Around Management

10.5 DEPARTMENT OF MATRIAL SCIENCE AND METULLURGY

xv) M.Tech. in Material science and technology

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
MSME 511	Concepts in Materials Science	3	-	-	3
MSME 512	Thermodynamics and Kinetics in Materials	3	-	-	3
MSME 513	Mechanical Behavior of Materials	3	-	-	3

	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
MSME 515	Materials Characterization Lab	-	-	2	2
MSME 51`6	Seminar I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
MSME 521	Nano Materials	3	-	-	3
MSME 522	Advance Materials Processing	3	-	-	3
MSME 523	Research Techniques in Material Science	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
MSME 524	Materials Processing Lab	-	-	2	2
MSME 525	Seminar II	-	2	-	2
					Total credit 22

List of electives

MSME531 Maintenance Audit MSME532 Risk Analysis and Safety
MSME533Concurrent Engineering MSME534 Maintenance Awareness
MSME535 Maintenance of Power Plant Machinery

List of open electives

MSME551 Finite element method MSME552 Maintenance Economics
MSME553 Turn Around Management

SOFT TECHNOLOGY DIVISION

10.6 DEPARTMENT OF CHEMICAL ENGINEERING

xvi) M.Tech. in Design of processing Plants

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CH511	Optimization Technique in Chemical Engineering	3	-	-	3

CH512	Advanced Transport Phenomena	3	-	-	3
CH513	Heterogeneous Catalysis and Reactor Design	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
CH514	Advanced Chemical Engineering Lab	-	-	2	2
CH515	Seminar-I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
CH521	Advanced Process Dynamics & Control	3	-	-	3
CH522	Advance Heat & Mass transfer	3	-	-	3
CH523	Advanced Thermodynamics in Chemical Engg.	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
CH524	Software Lab	-	-	2	2
CH525	Seminar-II	-	2	-	2
				Total credit	22

List of electives

CH531 Polymer Science & Technology CH532 Nano Technology
CH533 Bioprocess Technology CH534 Pinch Technology
CH535 Advanced Fluid Dynamics CH536 Bio-energy Engineering
CH537 Food Processing & Technology CH538 Advanced Separation Technology
CH539 Textile Technology CH541 Petroleum Engineering & Technology
CH542 Multiphase flow/CFD of Multiphase reactor

List of open electives

CH551 Pollution control & Engineering and Safety
CH552 Modeling & simulation of Chemical Engineering. Systems
CH553 Industrial Catalysis CH554 Pharmaceutical Technology

xvii) M.Tech. in Biotechnology

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
BIO511	Instrumentation in	3	-	-	3

	Biotechnology				
BIO512	Genetic Engineering and Population genetics	3	-	-	3
BIO513	Cell and tissue culture engineering	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
BIO514	Biotechnology laboratory 1	-	-	2	2
BIO515	Seminar-I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
BIO521	Chemoinformatics and drug designing	3	-	-	3
BIO522	Molecular Biotyping	3	-	-	3
BIO523	Bionanotechnology	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
BIO524	Biotechnology laboratory 2	-	-	2	2
BIO525	Seminar 2	-	2	-	2
				Total credit	22

List of electives

BIO531 Bioehics, biosafety regulations and IPR BIO532 Computational Biology
BIO533 Microbiology and immunology BIO534 Computational Phylogetics
BIO535 Protein Engineering and Enzyme Technology
BIO536 Bioenergy engineering BIO 537 Genomics and trascriptomics

List of open electives

BIO551 System Biology BIO 552 Molecular and cellular diagnosis
BIO553 Computational Advancement in Biotechnology
BIO554 Quality management and Process design marketing

10.7 DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

xviii) M.Tech. in Information Security

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
IS511	Computer and net work security	3	-	-	3
IS512	Cryptography	3	-	-	3

IS 513	Cyber crime and information warfare	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
IS514	Computer Laboratory 1	-	-	2	2
IS515	Seminar 2	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
IS521	Database security and access control	3	-	-	3
IS522	Security assessment and risk management	3	-	-	3
IS523	Biometrics	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
IS524	Computer Laboratory 2	-	-	2	2
IS525	Seminar 2	-	2	-	2
				Total credit	22

List of electives

IS531 Advanced Software Engineering IS532 Distributed Computing
IS533 CAD of Digital Systems IS534 Digital Image Processing
IS535 Data Mining and Warehousing IS 536 Advanced data structure
IS 537 Advanced computer networks IS538 Graph Theory and Network Algorithms
IS539 Information theory and coding IS541 Simulation and modeling
IS542 Operation system design IS543 Architecture of large systems
IS544 Wireless communication and mobile computing
IS545 Cloud security IS 546 Intrusion detection systems

List of open electives

IS551 Technical Foundation for E-commerce IS552 Optimization Techniques
IS553 Digital forensics IS554 Cluster and grid computing
IS555 Object-oriented Design and Modeling

xix) M.Tech. in Advanced computing

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CNE511	Computational Methods for Comm.	3	-	-	3
CNE512	Satellite Communication	3	-	-	3
CNE513	Advanced Digital Comm.	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
CNE514	Modeling and Simulation Lab	-	-	2	2
CNE515	Seminar I	-	2	-	2
Total credit 22					

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
CNE521	Wireless networking	3	-	-	3
CNE522	TCP/IP networking	3	-	-	3
CNE523	Network security	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
CNE524	Modeliing and simulation laboratory.	-	-	2	2
CNE525	Seminar II	-	2	-	2
Total credit 22					

List of electives

CNE531 Mobile communication
CNE532 Microwave Communication
CNE533 VLSI Design
CNE534 Statistical Signal Analysis
CNE535 Queuing Theory
CNE536 Detection & Estimation Theory
CNE537 Modern Telecom Switching Systems
CNE 538 Data Compression and Cryptography
CNE539 Optical Network
CNE541 Active RF Devices and Circuits

List of open electives

CNE 551 Neural Networks
CNE552 Fuzzy Logic

xix) M.Tech. in computer networking

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CNC511	Advanced computer networking	3	-	-	3
CNC512	Graph theory and network algorithms	3	-	-	3
CNC513	Net working algorithms.	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
CNC514	Computer Simulation Lab	-	-	2	2
CNC515	Seminar I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
CNC521	D.S. P. & its Applications	3	-	-	3
CNC522	Information Theory & Coding	3	-	-	3
CNC523	Digital Image Processing	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
CNC524	Communication Engg. Lab.	-	-	2	2
CNC525	Seminar II	-	2	-	2
				Total credit	22

List of electives

CNC531 Advanced software engineering
CNC532 CAD of digital systems
CNC533 Distributed systems
CNC534 data communication
CNC535 Advanced data structures
CNC536 Architecture of large systems
CNC537 Modern Telecom Switching Systems
CNC 538 Data Compression and Cryptography
CNC539 Optical Network
CNC541 Active RF Devices and Circuits
CNC542 Information theory and coding
CNC543 Simulation and modeling
CNC544 Network design and analysis
CNC 546 Web search and information retrieval
CNC 547 Ad hoc and sensor net working
CNC548 Optical networks
CNC 549 Advanced operating system
CNC 550 Queuing theory and stochastic processes

List of open electives

CNC 551 Optimization technique
CNC552 Object oriented design and modeling
CNC 553 Cloud computing
CNC 554 Cluster and grid computing

10.8 DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS

xxi) M.Tech. in Digital communication

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
DC511	Satellite Communication	3	-	-	3
DC512	Advanced Digital Comm.	3	-	-	3
DC513	Optical Comm.	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
DC514	Modeling and Simulation Labortary	-	-	2	2
DC515	Seminar I	-	2	-	2
				Total credit 22	

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
DC521	D.S. P. & its Applications	3	-	-	3
DC522	Information Theory and Coding	3	-	-	3
DC523	Digital Image Processing	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
DC524	Communication Engg. Lab.	-	-	2	2
DC525	Seminar II	-	2	-	2
				Total credit 22	

List of electives

DC-531 Mobile communication
DC-532 Microwave Communication
DC-533 VLSI Design
DC-534 Statistical Signal Analysis
DC-535 Queuing Theory
DC-536 Detection & Estimation Theory
DC-537 Modern Telecom Switching Systems
DC-538 Data Compression & Cryptography
DC-539 Optical Network
DC-540 Neural Networks
DC-541 Fuzzy Logic
DC-542 Active RF Devices and Circuits

List of open electives

DC-521 Computational Methods for Comm.
DC-522 Optimization Technique
DC-523 Numerical Analysis
DC-524 Data communication Network
DC-525Internet Technology
DC-526 B ISDN and ATM

xxii) M.Tech. in VLSI and embedded systems

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
VED511	Computational Techniques in digital system design	3	-	-	3
VED512	VLSI Technology	3	-	-	3
VED513	VLSI Design	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
	VLSI Lab	-	-	2	2
DC514	Seminar I	-	2	-	2
					Total credit 22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
VED521	Low power VLSI Design	3	-	-	3
VED522	CAD of Digital System	3	-	-	3
VED523	VLSI Signal Processing	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
DC524	CAD Laboratory	-	-	2	2
DC525	Seminar II	-	2	-	2
					Total credit 22

List of electives

VED-531 Digital System Design
VED-532 Mixed signal design
VED-533 MEMS
VED-534 Design of Semiconductor Memories
VED-535 Active filter design
VED-536 Physical Design Automation
VED-537 ASIC Design
VED-538 Co-design of large systems
VED-539 Design of analog IC
VED-540 Design for Testability
VED-541 Advanced Signal &Image Processing
V ED-536 Device Modelling and simulation

List of open electives

VED-521 Computational Techniques in digital system design
VED-522 Optimization Technique
VED-523 Numerical Analysis
VED-524 CAD of Digital System
VED-525 Microprocessor and Micro-controller
VED-526 Advance Computer Architecture

10.9 DEPARTMENT OF ENERGY

xxiii) M.Tech. in Renewable Energy

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EN511	Renewable Energy sources	3	-	-	3
EN512	Energy Conservation and Management	3	-	-	3
EN513	Ecology & Environment	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
EN514	Energy Laboratory –I	-	-	2	2
EN515	Seminar –I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
EN521	Wind Energy & Utilizations	3	-	-	3
EN522	Solar Energy and its Utilizations	3	-	-	3
EN523	Energy Economics, Policy & Planning	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
EN524	Energy laboratory-II	-	-	2	2
EN525	Seminar –II	-	2	-	2
				Total credit	22

List of electives

EN531 Instrumentation and Control
EN532 Energy Storage Technology
EN533Intellectual Property Rights
EN 534 Power Plant Engineering
EN535 Solar Passive Architecture
EN536 Energy Efficient Electric Drives

List of open electives

EN 551 Green Building
EN552 Power Conversion Techniques
EN553 Integrated Energy Systems
EN554 Energy from Waste

xxiv) M.Tech. in Green Technology

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
GT511	Renewable Energy sources	3	-	-	3
GT512	Energy audit and Management	3	-	-	3
GT513	Energy Modeling & Simulation	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
GT514	Sustainable Energy Laboratory-I	-	-	2	2
GT515	Seminar-I	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
GT521	Solar Thermal & PV System	3	-	-	3
GT522	Wind Energy & Small Hydro Power	3	-	-	3
GT523	Carbon Sequestration & Emission Trading	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
GT524	Sustainable Energy Laboratory-II	-	-	2	2
GT525	Seminar-II	-	2	-	2
				Total credit	22

List of electives

GT531 Instrumentation & Control
GT532 Energy Storage Technology
GT533 Intellectual Property Rights
GT534 Hydrogen and Fuel Cell
GT535 Power Plant Engineering
GT536 Geothermal, Tidal and Ocean energy
GT537 Energy efficiency in Electrical Utilities
GT538 Environmental Impact assessment

List of open electives

GT551 Green Buildings
GT552 Energy, Environment Policy & Planning
GT552 Bio-energy Conversion systems
GT553 Environmental Pollution Control Technologies

SCINECE DIVISION

10.10 DEPARTMENT OF PHYSICS

xxv) M.Tech. in Nanotechnology

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
NT511	Solid State Physics	3	-	-	3
NT512	Physics of Nano Materials	3	-	-	3
NT513	Atom and Photon Physics	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
NT514	LAB-Practice-I	-	-	2	2
NT515	Seminar	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
NT521	Nanostructure Characterization Techniques	3	-	-	3
NT522	Properties of Low-dimensional System	3	-	-	3
NT523	Molecular Physics	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
NT524	LAB-Practice-II	-	-	2	2
NT525	Seminar	-	2	-	2
				Total credit	22

List of electives

NT531 Physics of nano fluids and surfaces NT532 Physics of amorphous materials
NT 533 Laser technology NT534 Semiconductor devices
NT535 Opto electronics NT536 Computational physics
NT537 Advanced topic in physics NT538 processing and fabrication of nanostructure

List of open electives

NT551 Instrumentation NT552 Advanced low temperature physics
NT553 Molecular electronics & bio molecules

10.11 DEPARTMENT OF MATHEMATICS

xxvi) M.Tech. in Bioinformatics

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
NT511	Solid State Physics	3	-	-	3
NT512	Physics of Nano Materials	3	-	-	3
NT513	Atom and Photon Physics	3	-	-	3
	Elective - 1	3	-	-	3
	Elective - 2	3	-	-	3
	Open elective-1	3	-	-	3
NT514	LAB-Practice-I	-	-	2	2
NT515	Seminar	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
NT521	Nanostructure Characterization Techniques	3	-	-	3
NT522	Properties of Low-dimensional System	3	-	-	3
NT523	Molecular Physics	3	-	-	3
	Elective - 3	3	-	-	3
	Elective - 4	3	-	-	3
	Open elective-2	3	-	-	3
NT524	LAB-Practice-II	-	-	2	2
NT525	Seminar	-	2	-	2
				Total credit	22

List of electives

NT531 Physics of nano fluids and surfaces NT532 Physics of amorphous materials
NT 533 Laser technology NT534 Semiconductor devices
NT535 Opto electronics NT536 Computational physics
NT537 Advanced topic in physics NT538 processing and fabrication of nanostructure

List of open electives

NT551 Instrumentation NT552 Advanced low temperature physics
NT553 Molecular electronics & bio molecules

xxvii) M.Tech. in computational and bio systems

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CSB511	Foundations of computational and system biology	3	-	-	3
CSB512	Applied bioinformatics	3	-	-	3
CSB513	Mathematical and Computational Biology	3	-	-	3
	Elective – 1	3	-	-	3
	Elective – 2	3	-	-	3
	Open elective-1	3	-	-	3
CSB514	Computational; laboratory 1	-	-	2	2
CSB515	Seminar	-	2	-	2
Total credit 22					

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
CSB521	Mathematical modeling and simulation of biological systems	3	-	-	3
CSB522	Applied bioinformatics	3	-	-	3
CSB523	Mathematical and computational biology	3	-	-	3
	Elective – 3	3	-	-	3
	Elective – 4	3	-	-	3
	Open elective-2	3	-	-	3
CSB524	Computational; laboratory 2	-	-	2	2
NT525	Seminar	-	2	-	2
Total credit 22					

List of electives

CSB531 Biophysics of molecules and molecular mechanics

CSB532 Data ware housing and data mining

List of open electives

CSB 551 Stochastic and statistical methods in system biology

ARCHITECTURE AND PLANNING DIVISION

10.12 DEPARTMENT OF ARCHITECTURE AND PLANNING

xxviii) M.PLAN. in Urban Development

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CM 511	Evolution and theory of planning	3	-	-	3
CM 512	Urban sociology	3	-	-	3
CM 513	Urban economics	3	-	-	3
CM 514	Remote sensing and GIS	3	-	-	3
CM 515	Quantitative research methods	3	-	-	3
CM 516	Introduction to housing	3	-	-	3
CM 517	Seminar -1	-	-	2	2
CM 518	Studio -1	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
UD 521	City and Regional Planning	3	-	-	3
UD 522	Statistics and Demography	3	-	-	3
UD 523	Traffic and Transportation Planning	3	-	-	3
UD 524	Elective- 1	3	-	-	3
UD525	Elective 2	3	-	-	3
UD526	Planning legislation and professional practice	3	-	-	3
UD 527	Planning Studio-II	-	-	2	2
UD 528	Planning Studio Seminar- II	-	2	-	2
				Total	22

List of electives

UD 531 Ecology & Resource Development Ancient Indian Planning
UD532 Environmental Planning UD533 Energy Efficient Environment Services
UD 534Planning of Disaster prone areas UD535 Urban Energy Systems
UD536 Rural planning & development UD537 Urban Conservation

UD538 Planning & Development of Informal sector
UD539 Landscape planning

xxix) M.PLAN. in Housing

First Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
CM 511	Evolution and theory of planning	3	-	-	3
CM 512	Urban sociology	3	-	-	3
CM 513	Urban economics	3	-	-	3
CM 514	Remote sensing and GIS	3	-	-	3
CM 515	Quantitative research methods	3	-	-	3
CM 516	Introduction to housing	3	-	-	3
CM 517	Seminar -1	-	-	2	2
CM 518	Studio -1	-	2	-	2
				Total credit	22

Second Semester

Course Number	Subject	Scheme of Studies Periods per week			Total Credits
		L	T	P	
HU 521	Urban infrastructure planning	3	-	-	3
HU 522	Elective 1	3	-	-	3
HU 523	Housing project formulation and development	3	-	-	3
HU 524	Housing finance	3	-	-	3
HU 525	Land and housing economics	3	-	-	3
HU526	Planning and development of informal sector	3	-	-	3
HU 526	Seminar -2	-	-	2	2
HU 528	Studio -2	-	2	-	2
				Total	22

List of electives

HU531 Land-use and transportation planning
HU532 Rural development & rural housing
HU533 Housing design and technology

11. MCA (MASTER IN COMPUTER APPLICATIONS)

I SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA511	Mathematics-I	3	---	---	3
MCA512	Computer Organization & Architecture	3	---	---	3
MCA513	Data Structure	3	---	4	5
MCA514	Operating System	3	---	---	3
MCA515	Programming through C & C++	3	---	---	3
MCA516	Programming Lab - I	---	---	10	5
	Total	15	---	14	22

II SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA521	Mathematics-II	3	---	---	3
MCA522	Advance Computer Architecture	3	---	---	3
MCA523	Software Engineering	3	---	4	5
MCA524	Principles of Programming Languages	3	---	---	3
MCA525	Theory of Computation	3	---	---	3
MCA526	Programming Lab - II	---	---	10	5
	Total	15	---	14	22

III SEMESTER

Subject Code	***Subjects***	***Periods per Week***			***Total Credits***
		L	T	P	
MCA611	Mathematics-III	3	---	---	3
MCA612	Unix & its Internal	3	---	2	4
MCA613	Windows Programming & Scripting Languages	3	---	---	3
MCA614	Analysis & Design of Algorithm	3	---	---	3
MCA615	Database Management System	3	---	---	3
MCA616	Minor Project - I	---	---	12	6
	Total	15	---	14	22

IV SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA621	Computer Oriented Optimization	3	---	---	3
MCA622	Computer Networks	3	---	2	4
MCA623	Compiler Design	3	---	---	3
MCA624	Distributed Systems	3	---	---	3
MCA625	Web Based Applications Development	3	---	---	3
MCA626	Minor Project - II	---	---	12	6
	Total	15	---	14	22

V SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA711	Computer Graphics	3	---	2	4
MCA712	Intelligent Systems	3	---	---	3
MCA713	Mobile Application Development	3	---	---	3
MCA714	Elective – I	3	---	---	3
MCA715	Elective – II	3	---	---	3
MCA716	Minor Project - III	---	---	12	6
	Total	15	---	14	22

VI SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA721	Final Dissertation (Major Project)	--	---	30	30
MCA722	Seminar/Presentation (Major Project)	---	---	10	10
	Total	---	---	---	40

List of electives

MCA-511 Data Warehousing and Mining
MCA-512 Advanced Software Engineering
MCA-513 Advanced RDBMS
MCA-514 Information Retrieval
MCA-515 Natural Language Processing
MCA-521 Multimedia Computing
MCA-522 Parallel Computing
MCA-523 Cloud Computing
MCA-524 Image Processing

12. MBA(MANAGEMENT BUSINESS ADMINISTRATION)

First Semester

Subject code	Subject	Periods per week			Total Credits
		L	T	P	
MBA511	Principles and practices of management	3	-	-	3
MBA512	Organisational behaviour	3	-	-	3
MBA513	Managerial economics	3	-	-	3
MBA514	Business statistics	3	-	-	3
MBA515	Information technology and applications	3	-	-	3
MBA516	Business and corporate laws	3	-	-	3
MBA517	Financial accounting & analysis	3	-	-	3
MBA518	Business communication	3	-	-	3
					Total credit 24

Second Semester

Subject code	Subject	Periods per week			Total Credits
		L	T	P	
MBA521	Financial management	3	-	-	3
MBA522	Marketing management	3	-	-	3
MBA523	Human resource management	3	-	-	3
MBA524	Cost and management accounting	3	-	-	3
MBA525	Management information system	3	-	-	3
MBA526	Business environment	3	-	-	3
MBA527	Research methodology	3	-	-	3
MBA528	Operational research	3	-	-	3
					Total credit 24

Third Semester

Subject code	Subject	Periods per week			Total Credits
		L	T	P	
MBA611	Strategic management	3	-	-	3
MBA612	Supply chain management	3	-	-	3
	Operations Management	3	-	-	3
	Elective 1	3	-	-	3
	Elective 2	3	-	-	3
	Elective 3	3	-	-	3
MBA613	Seminar	-	2	-	2
MBA614	Summer Training	-	-	2	2
					Total credit 22

Fourth Semester

Subject code	Subject	Periods per week			Total Credits
		L	T	P	
MBA621	International business and trade	3	-	-	3
MBA622	Project management	3	-	-	3
MBA623	Business Ethics and corporate governance	3	-	-	3
	Elective 4	3	-	-	3
	Elective 5	3	-	-	3
	Elective 6	3	-	-	3
MBA624	Seminar	-	2	-	2
MBA625	Project work	-	-	20	10
					Total credit 30

List of electives
Finance
MBA631 Security analysis and portfolio management

MBA632 Corporate tax planning and management

MBA633 Management of financial institution and markets

MBA634 International finance MBA635 Working capital and management

MBA635 Financial audit

Marketing

MBA641 Product and brand management MBA642 Marketing research

MBA643 Sales, distribution and retail management

MBA644 Consumer behaviour and marketing communication

MBA645 Rural marketing and agro business MBA646 Marketing of services

Human Resource

MBA651 Human resource development MBA 652 Industrial relations and labour legislation

MBA653 Compensation and performance management

MBA654 Strategic human resource and planning

MBA655 Organisational development and change management

MBA656 International human resource management

Information Technology

MBA671 Data warehousing and data mining

MBA672 Technology and innovation management MBA673 E business

MBA674 Software product management

MBA675 Enterprise resource planning MBA676 Business and IT strategy

13. REGULATION FOR DOCTORAL PROGRAMME (Ph.D degree)

The doctoral program leading to Ph.D degree is offered in the following departments of the Institute

1. Applied Mechanics
2. Civil Engineering
3. Electrical Engineering
4. Mechanical Engineering
5. Material Science and Metallurgy
6. Computer-Science and Information Technology
7. Electronics Engineering
8. Energy Centre
9. Chemical Engineering
10. Architecture
11. Planning
12. Chemistry
13. Physics
14. Mathematics and Computer Application

15. Humanities
16. Management studies

The provisions contained in the Regulations govern the conditions for imparting courses of instructions, conducting of the examinations and evaluation of students performance leading to Ph.D. Degree. These Regulations are applicable to any new disciplines that are introduced time to time and applicable to the students already registered for the Ph.d degree programme. The Senate should exercise its powers to change/amend/interpret/implement decisions and actions concerned with academic matters. The Board Governors of the Institute may, on the recommendation of the Senate, change any or all parts of these Regulations at any time.

11.1Admission

There shall be provision for two categories of registration to the candidates willing to register for Ph.D. degree.

i. Full- Time : Students who are willing to pursue Research studies on full time basis with scholarship or scholarships awarded by QIP/CSIR/AICTE/UGC or other equivalent organizations

ii. Part Time : Any employee working on regular position in any academic/research/public sector organization duly recognized by MHRD/AICTE/UGC/Central government/State Government/ or other reputed organizations approved by Institute..

Eligibility for Admission

The eligibility for admission to Ph.D. in Engineering Faculty, Architecture and planning faculty, Science Faculty, and interdisciplinary areas is:

A candidate shall possess master's Degree in relevant area of Research and should have passed with minimum of 55% marks / (CGPA 5.5) or equivalent. The candidate with B.E./ B.Tech./ B.Arch./B.Plan qualification may be admitted directly to Ph.D programme subjected to following conditions:

i. CGPA More then 7.5 or 75 % marks in UG Exam
ii. Extra course work to be completed during Ph.D programme

MCA/Science/Humanities department may consider PG degree in relevant discipline approved by MHRD/AICTE/UGC. For Ph.D in a management studies, the candidate must have MBA degree or two years PGDM from Intuitions recognized by MHRD/AICTE/UGC. The minimum requirement for all interdisciplinary departments/ centers shall be as decided by senate time to

time. Candidate must have the final result of the qualifying examination and NOC in original from employer 9i applicable) at the time of interview.

11.1 Course structure

The complete Research Programme will be of minimum 3 years duration for all full-time candidates and 4 years duration for all part-time candidates. The maximum period allowed to complete the course is 5 years (for both full time & part-time), which may be extended to 7 years subject to approval of Senate. A relaxation of 1 year in minimum duration may be given to teacher candidates subject to the approval of SENATE.

Every stream of specialization in the Programme will have a curriculum and syllabi for the courses approved by the Institute. The curriculum should be so drawn up that the minimum number of credits for successful completion of the course work including seminar in any stream. In addition the guide can provide a self study courses to the candidate as self study courses. However, proper examination and evaluation has to be done by the course instructor. Candidates also can give open seminar of the topic relevant to his research works and evaluation committee cosists of Head of the department, Guides and an professor from department and another expert professor in the filed of research from other department.

The medium of instruction for examination, seminar and reports will be in English.

Course credit requirements

The distribution of credits for the programme shall be as follows

Semester I/II	Credits		
	MCA/ M.Sc/ .MBA	M.Phill/M.Tech./ M.Arch/ M.Plan	B.E./B.Tech./ B.Arch.
Minimum credit for the Course work	18 (6 courses)	12 (4 courses)	24 (8 courses)
2 Seminars	4	4	4
Total Credits	22	16	28

One of the courses may be on Analytical techniques/Design tools.

The minimum CGPA to clear the course work will be 7.5 The grading pattern for individual subject will be same as for M.Tech./M.Plan./MBA

Failure in Courses

If any student fail in course work, may be allowed only once to re-appear in the exam after due permission from Dean (AA) & Chairman senate.

Failure in Seminar

If a student does not submit the Seminar report and / or present the Seminar on the scheduled date, he will be awarded F grade unless extension of date is granted by chairman senate.

11.2 Research supervisor

In each Department, applicants will be given the details of various research topics proposed by various faculty members for Ph.D. programmes at the time of selection so that they will have an opportunity to discuss those topics with the respective faculty members and thereafter, indicate their choice in order of preference.

All selected candidates shall be assigned to Research Supervisor(s) at the time of selection by selection committee. The following guide line should be followed in selection of present supervisors.

a) Each external candidate shall have maximum one Supervisor from sponsoring organization where he is employed and one or two supervisor(s) at the institute.
b) The research programme and the title of the research topic of a selected candidate shall be finalized by his Supervisor(s) after mutual discussion and approved by RDC. Change of Supervisor(s) under exceptional circumstances shall be permitted on recommendation of the RDC after obtaining the consent of (i) the candidate (ii) the present Supervisor(s) and (iii) the proposed Supervisor(s).
c) If the Research programme and / or area of the work require modification due to this change, the there is a change in the Research

programme and/ or title of the work, the registration date shall be revised, if found necessary.

i) In the event research Supervisor leave the Institute on lien / sabbatical leave etc. justified under institute regulations and if he / she is the main guide he / she continues to be the main guide and has to opt a co-guide. If period of leave increases more then three years the co guide becomes the main guide.

ii) If the guide is registered in one discipline he / she may act as guide for another discipline also. No other guide from the same discipline may required where the candidate is registered

At any given time the The Maximum number of candidate of Ph.D. under a supervisor as guide or co guide in the institute or outside is FIVE In this regard an undertaking is to be furnished by the guide at the time of RDC. Further the chairman senate is empowered to allot more than five t candidates to a supervisor depending upon his / her merit.

11.4 ELIGIBILITY FOR RESEARCH SUPERVISOR

A permanent faculty of MANIT, Bhopal having at least 3 years of teaching experience and possessing Ph.D. shall be recognized as a Research Supervisor. External Guide from other NITs, IITs and National level Research laboratories/Institutions may be associated as Co- guide only with due approval of the Director (Chairman Senate). The RDC shall scrutinize the Bio-data of supervisor(s) and on its recommendation, the Dean (AA) shall issue a recognition letter to all such supervisor(s).

In case of more than one supervisor(s) involved in guiding a student, then the recognition of the Co-Supervisor by the Institute shall be necessary and RDC shall adopt the same procedure adopted for recognition of Institute Supervisors.

However, in all cases for Ph.D. registration, one of the supervisor(s) shall be compulsory from the Institute.

11.4 Procedure for admission

Application forms for Ph.D. will be available in Admission Section. Admission will normally be done once in each semester through advertisement/ notification. The merit will be prepared by chairman DPRC based on test/ interview/ presentation / evaluation.

11.5 Procedure for registration

If the candidate is found eligible to be registered in Ph. D., he/she should complete the course work in maximum of two semesters (i.e. in one years). After the completion of course work comprehensive viva/ Doctral research programme committee (DRPC) should be organized

In first year itself the first preliminary meeting should be called by the concern HOD's to finalize the topic of the candidate. There after DRPC meeting to be conducted to asses the progress of the work of the candidate. At the third year, Research degree committee (RDC) is formed with expert from outside to review the work and recommend for the synopsis submission.

11.6 Place of work, progress and duration

Place of Research work will be MANIT, Bhopal. However on the recommendations of the supervisor (s) and DRPC, the institute may allow the Research work for the Ph.D degree to be partially or fully carried out at another organization duly approved for this purpose by the institute for part-time Ph.D students.

The external organization where a candidate wishes to carry out the Research work partially or fully shall have to be recognized by the institute before such work is undertaken, which will depend on the facilities available for proposed research work in that institute.

Change of status form part-time to full time or vice-versa will be subject to the approval of the senate. An external organization may be granted recognition by the DRPC as an approved place of work after inspection by a committee constituted by the chairman of Senate.

i. A particular candidate shall normally give the recognition only for the purpose of individual research project.
ii. The details of research facilities available give the organization shall be furnished by the candidate along with the application for admission to Ph.D Programme.
iii. The DRPC shall examine the details given and may decide either to ask for further information, if necessary, or even collect first hand information. Only when the DRPC is fully convinced about the adequacy of the research facilities, the institute shall be permitted to be used by the candidate at a fee prescribed by the institute.
iv. The RDC shall give the final approval after the due consideration of the recommendations of the DRPC.

All candidates shall, after registration, submit through their supervisor(s), progress report of their work to the concerned DPRC twice a year in July/ January depending upon the date of their admission.

In addition, all external candidates must give at least one Seminar per year at the institute until they submit the synopsis. At the end of three years from the date of their admission, the DPRC shall appoint a committee to review the candidate's progress in Course/ Seminar/ Approved Research programmed and shall forward the report to Dean (AA). The continuation of registration of all candidates is subject to satisfactory progress made by them. In the case of institute scholarship holders, the continuance of scholarship beyond 3 years and up to a

maximum of 6 months will also be considered, subject to satisfactory progress made by them which will be assessed by the panel appointed by Dean (AA).

(a) Every external candidate shall carry out a part study of his Research work residing at the institute for period, which shall be in no case less than one semester, including course work.

(b) Candidate sponsored by local organizations may, on the basis of an application, recommended by DRPC, be exempted form stay on the institute campus while fulfilling the requirements under (a) above. However, the work under this rule shall be carried out during normal working hours of the institute/ evening P.G. program.

(c) The organization has to certify that the candidate has been fully relieved of his normal duties/ granted leave during the period of the residential requirement.

(d) External candidates will be provided with hostel accommodation only during the semester(s) in which the residential requirement is fulfilled, subject to availability.

Every external candidate shall put-up at least 60 days of research duration with his guide at MANIT, Bhopal For all categories of candidates, the period of validity of their Ph.D. registration is 7 years. The candidate may submit their thesis before the end of this period. Any candidate who concurrently registers for any postgraduate degree at another organization shall be automatically de-registered at the institute.

Research Scholars/ staff who has submitted the synopsis of thesis may be permitted by DRPC on recommendation of the DRPC to leave the institute and submit from outside within a period of six months provided they fulfill the provision of all other rules. In case a candidate does not submit his thesis within six month from the date of submission of synopsis, his registration will be deemed to be cancelled.

11.7 THESIS EVALUATION

Prior to the submission of the synopsis of the thesis, a comprehensive internal assessment of the Research work should be made by panel appointed by Dean (AA) in consultation with a supervisor(s). The thesis may only be submitted if candidate publishes two reviewed papers in the journal of Internal repute.

(a) A panel consisting of two faculty members from the institute conversant with the field of Research work and supervisor(s) shall asses the work through a pre synopsis

seminar. The candidate can submit the synopsis only when the panel is satisfied about the quality of the work for submission as a Ph.D. Thesis.

(b) Details of the pre-synopsis seminar shall adequately notified so as enable the interested staff members an students to attend the same.

(c) The Convener of the DRPC shall forward the panels report to the Dean(AA)

The candidate shall submit the synopsis of his work at least one month before submitting the thesis. The synopsis written in the approved format, shall be submitted to DRPC for consideration. After approval by the DRPC ten copies of the synopsis will be submitted to the Dean (AA) with the following certificates:

(i) Certificate from the Convener DRPC that the prescribed course credits and related comprehensive viva are completed.

(ii) Certificate from the Convener DRPC that the prescribed seminar has been completed satisfactory.

(iii) Certificate from the Research Supervisor stating:

(a) That there is a prima facie case for consideration of the thesis,

(b) That the thesis does not contain any work which has been previously submitted for the award or any degree, and

(c) The extent of collaboration, if any

(iv) Certificate from the Accounts section that there are no dues up to the date of submission of the synopsis.

The thesis shall be written in the approved format.

(a) The candidate shall submit four copies of the thesis to the Dean (AA) within the prescribed time limits, namely, not earlier than one month and later than six months from the submission of the synopsis.

(b) Along with the thesis, the candidate shall submit the requisite forms containing the authorization from the Research Supervisor(s) for submission of the thesis and a certificate from accounts section that there are no dues against the candidate.

Two external referees are chose by Senate Chairman from the set of panel of experts from IIT/NIT/IISc/ equivalent institute in India and a set of panel experts from abroad as recommendation by the DRPC and duly approved by the Dean (AA). In the set of panels at least

five experts in the field of research is to be recommended. The referees will evaluate the thesis on the following basis:

i. A critical survey and evaluation of the quality quantity of the work as embodied in the thesis.

ii. Question, if any, to be asked or points to be clarified at the viva-voce examination,

iii. A definite recommendation as to whether the thesis is acceptable for the award of the degree of Doctor of Philosophy.

If referee in his report in not in a position to make a definite recommendation for the award of the degree, he should be requested to assist the Senate in deciding whether the candidate be required to make:

i. Substantial revisions involving rewriting of one or more chapters without, however, doing any further Research work.

ii. Completely rewrite the thesis if the thesis, though not acceptable in the present forms, reveals sufficient quality and quantity of work to warrant the candidate being given an opportunity for further Research work and/ or reinterpretation of results.

The copies of the referees' reports when received shall be confidentially made available to the Research Supervisor(s). the Research Supervisor(s) shall send comments on these reports for consideration by the DRPC.

(a) On the basis of the referees' reports and the Supervisor' comments thereon, the SPRC shall, recommend to the Senate Chairman whether the thesis be accepted for the viva-voca examination or be rejected or be referred again to a new referee.

(b) A thesis may be considered acceptable for holding the viva-voce examination if both the referees give positive recommendations, if one of them accepts and the other rejects the thesis, as it is, shall be referred to a third referee chosen from the panel of examiners by the Senate Chairman.

(c) Wherever a thesis is referred to a third referee the comments of the Research Supervisor point by point for the queries by the first two referees should also be reported to the senate.

(d) The senate shall, however, be the final authority in deciding whether the thesis be accepted for the award of the degree.

If the referees recommend acceptance of the thesis subject to minor modifications only, the thesis can be resubmitted only once after incorporating the modification, within a period of six months, the same referee(s) shall examine the thesis so resubmitted.

(a) A thesis rejected by two referees may be re-submitted after revision, not earlier then one year and not later than two years from the date of such intimation to the candidate by the Dean (AA). The thesis so resubmitted may be examined by the same referees or by new referees.

(b) Rejection of the thesis so resubmitted will disqualify the candidate from further consideration for the award of the Ph.D degree, in the topic of research chosen by him.

A candidate, whose thesis has been accepted for the award of Ph.D degree shall be required to defend his work at an open viva-voce examination conducted by a Board of Examiners at the institutes. The Board of Examiners shall be appointed by the Senate Chairman and shall consist of:

i. A professor of the institute, outside the department as chairman,

ii. The Research Supervisor(s);

iii. A faculty members of the institute conversant with the subject to act as an internal examiner; and

iv. One of the referees, failing which an examiner from approved panel.

The Board of Examiners shall submit its report in the prescribed format to the Senate within 3 days after completion of viva-voce examination.

After satisfactory completion of the viva-voce examination, the degree may be conferred upon the candidate after approval by the senate. If a thesis has been accepted but the candidate fails at the viva-voce examination, he may be permitted by the Senate Chairman to re-appear for viva-voce examination once again at a later date. The Recommendation of the board of examiners conducting the viva-voce examination shall be considered in taking a decision in this respect.

11.7 Constitution of DRPC for each candidate

1	Chairman	HOD of concern department
3	Member (Optional)	One member from Industry / Research organization if he / she posses doctoral degree
4	Members	Two representatives from other department possessing

		doctoral degree
5	Convener*	supervisor

The penal above , is got forwarded through Dean (AA) for due approval of chairman senate

11.8 Constitution of RDC for each cnadidate

1	Chairman	HOD of concern department
2	Member	One expert from IIT / NIT / IISc
3	Member (Optional)	One member from Industry / Research organization if he / she posses doctoral degree
4	Members	Two representatives from other department possessing doctoral degree
5	Convener*	supervisor
The penal above , is got forwarded through Dean (AA) for due approval of chairman senate		

* Necessary arrangements for issuing notices for RDC meeting / seminars and honorarium to external examiner are proposed to be made by convener.

Functions:

1. Evaluation of proposed research work and to approve the topic of the proposed research work along with its synopsis.
2. Evaluation of Supervisors bio-data and recognize them as approved supervisors in the respective discipline.
3. To approve the external research centers for carrying out research work in a given discipline.
4. Any other advice/ recommendations desired by Dean (AA) time to time.

COURSE CONTENTS

12 DEPARTMENT OF APPLIED MECHANICS

i) ENGINEERING MATERIALS (M.TECH)

EM5 11 ADVANCED ENGINEERING MATHEMATICS & OPTIMIZATION 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 and partial differential equations.

Introduction to optimization by linear programming, solution by graphical and simplex method, concept of degeneracy and duality, artificial variable techniques-Big-method, transportation and assignment problem.

References

1. Numerical Methods for Engineers — Stevan C. Chapra and Raymond P Canale.
2. Numerical Methods for Engineers — Iyengar and M.K.Jain.
3. Operation Research — S.D.Sharma.
4. Numerical Optimization Techniques with Applications — Suresh Chandra.

EM512: MATERIAL SCIENCE

Crystal structure and characterization of materials, Bragg's law, X ray diffraction.

Crystal imperfections, frank reed source of dislocation, elastic & plastic modes of deformation, slip & twinning, strain hardening, seasons cracking, Bauschinger's effect, yield point phenomenon, cold/hot working, recovery, recrystallisation, and grain growth, strengthening of metals.

Electrical properties of materials, resistivity, conductivity, semiconductors: intrinsic/extrinsic semiconductors, insulating materials, dielectric materials, piezoelectricity.

Magnetic properties of materials, classification of magnetic materials, description of magnetic material, effect of temperature, heat treatment and grain direction on magnetic properties of materials, effect of impurities and alloying elements, Losses.

Diffusion in solids, fick's law, factors affecting diffusion.

References

1. Material Science and Engg. — V. Raghvan
2. Material Science — G.K.Narula
3. Physical Metallurgy Principles — Robert E. Reed Hill
4. Engineering Material — R.K.Rajput

EM513: BEHAVIOUR OF MATERIALS

Mechanical behaviour of materials under Tension and Compression, Nominal/True stress-strain properties in elastic and plastic range and their application in design, maximum instability load.

Mechanical behaviour of materials under Shear, torque-twist diagram, static shear properties using solid circular and thin-walled circular torsion specimen. Static stress-strain properties in bending, load-deflection diagram. Utilization of shear/bending properties in design.

Static stress-strain properties for combined stresses, theories of yield strength, stiffness, resilience, ultimate strength, fracture strength, ductility and toughness. Comparison of results.

Griffith criterion, LEFM, fracture toughness, crack opening displacement, J integral, Mechanical behaviour of materials under Fatigue, fatigue strength, factors affecting fatigue strength, influence of superimposed static stresses, stress concentration, notch sensitivity.

Mechanical behaviour of materials under Creep, Creep testing, creep parameters. Impact toughness, Notch bar impact test, Material Damping and its determination.

References:

1. Behaviour of Material — Joseph Marin
2. Mech. Behaviour of Materials — Norman E. Dowling
3. Mech. Behaviour of Materials — K.K.Chawla
4. Mech. Behaviour of Material — Thomas H Courtney

EM 514 BEHAVIOR OF MATERIALS LABORATORY

Experiments on mechanical, thermal and electrical properties of materials, Studies of crystal structures, Corrosion.

Second semester

EM 521: MATERIALS PROCESSING

Solid solutions, phase diagrams, gibb's phase rule, construction of phase diagram, lever rule, phase transformation, nucleation and growth.

Iron-carbon equilibrium diagram, microconstituents, transformations in steel, TTT diagram.

Heat treatment processes, Chemical treatment of steels, Surface hardening, Quenching media and their characteristics. Heat treatment of Aluminium and its and alloys.

Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing, Properties of Powder processed materials, high energy compaction, HIP, Explosive forming. Metal matrix composites, preparation properties and uses. Fiber reinforced resin plastics.

Corrosion, coatings, diffusion in solids.

References:

1. Heat treatment Priciples & Techniques — T.V.Rajan & Sharma
2. Material Science and Engg. — V. Raghvan
3. Physical Metallurgy Principles — Robert E. Reed Hill
4. Engineering Materials Technology — Kilduff & Jacobs

EM522: MATERIALS MANAGEMENT

Importance of material management system-integrated concept. Planning and Organization, store codification, standardization and variety reduction, waste management.

Purchase management-Forecasting of material for Purchase and Sales, source selection, pricing theory, negotiation, purchasing for public agencies, make or buy, budget, vender evaluation rating forward and speculation buying and purchase research, how much to buy, when to buy.

Stores management-sores function, receipts and inspection, storage of material, presentation and warehouse design, issues, stores records and stores accounting, stock taking, overstock surplus and cracks.

Inventory management- introducing inventory, relevant costs, selection controls, replenishment inventory, project inventory. cost reduction, 5-S, JIT.

Computer applications and evaluation- cost reduction through material management, value analysis, computer applications in material management, evaluation of material management and performance and starting of material management organization in large and new undertaking. ABC analysis and classification.

References:

1. Materials Management — P.B. Pandey
2. Materials Management — H.C. Sharma
3. Operation Research — Heera Gupta
4.

EM523: TRIBOLOGY & WEAR ANALYSIS

Introduction: Background, Historical development, striebeck curve, Tribology over view friction wear & lubrication, economic significance, Peter jost committee report, impact of tribology on maintenance, plant life, energy conservation, material conservation, safety & pollution.

Friction & wear: Laws of friction, sliding & rolling friction, dry & lubricated

friction, contribution to force of friction, concept of friction coefficient. Wear, its significance, wear regimes, adhesive, abrasive, corrosive, erosive & fatigue wear, effect of surface film, control of wear.

Lubrication: Lubrication types, Shiebeck curve, boundary, lubrication, surface film formation & failure, elasto hydrodynamic lubrication, hydrodynamic & hydrostatic lubrication. Fluid dynamics in lubrication, Newtonian fluid, compressible &incompressible fluids, theory of hydrodynamic lubrication.

Lubricants: function, types of lubricants, solid, liquid, semi solid & gaseous lubricants, mineral, natural & synthetic lubricants, greases, aditives, special purpose lubricants, lubricant properties, testing of lubricants.

Triboelements: Bearings types, Journal bearing, babbitts, important steps in design, rolling element bearing, selection, comparison of journal & rolling element bearings, Gears, gear lubrication, gear failure, seals, elastomers, synthetic and natural, their behaviour, seal failures.

References:

1. Basic lubrication theory — A. Cemeron
2. Introduction to Tribology of bearings — B.C. Majumdar
3. Maintenance Engineering Handbook — Ed. Lindley R. Higgins
4. Friction & Wear of Materials — Rabinowicz
5. ASM Handbook on friction, wear & lubrication

EM 524ADVANCED MATERIALS LABORATORY

Experiments related to advances materials

EM525 seminar 2

Department Electives

EM531 BIO MATERIALS

Studies of biomaterial interactions with the human body, bio-compatibility, interfacial and interaction problem.

Biomaterials-Biocompatible materials having high degree of wearing resistance such as medical grade 18-8 stainless steel, Teflon, Silastics, Siloconized rubbers, Acrelic cements for dentures and Bine setting cements. Biodegradable materials such as polymers, high concentrated protein compounds with a short life time. Impact failure fields and degradation of implants biosensors, bioreacters. Bioprocess instrumentation and control system.

Biomechanical behaviour under biological and/or medical condition such as fracture toughness, fatigue, plasticity, viscoelasticity, rheology, tribology and wear and behaviour under impact. Mechanics and device for promotion of physical strength.

Biomechanics: Mechanics of forces and movements of joints. Fracture mechanics of the human skeleton with special reference to dynamic impact. Effect of vibration on human skeleton, Mechanical and biological properties of membrane biomaterials, cellular and tissue engineering.

Standardization problems on biomaterials and related products. Assessment of reliability and safety of biomedical materials and man-machine systems. Product liability of biomaterials and related products. Bioengineering and materials technology as applied to decontamination against environmental problems.

References

1. Bioengineering Materials R.S.Sharma
2. Engineering Materials R.L.Timings.

EM532 NUCLEAR MATERIALS

Structure of a power plant, requirements of reactor materials, fuel materials, plutonium uranium and thorium and their alloys and compounds, core materials, beryllium, graphite, control and shielding materials, magnesium and its alloys, aluminum and its alloys, zirconium and its alloys, austenitic stainless steel materials for reactor vessel and other components, pearlitic steels, ferritic, chromium stainless steels, copper alloys, titanium and its alloys, coolants used in reactors, radiation embrittlement , corrosion of reactor materials, mechanical properties of materials.

EM533 AEROSPACE MATERIALS

Carbon- carbon composites, production, properties and applications, inter metallic matrix composites, ablative composite based on polymers, ceramic matrix, metal matrix composites based on aluminum, magnesium, titanium and nickel based composites for engines, super alloys, aluminum alloys, magnesium alloys and titanium alloys, materials for plasma engines, inter-metallic aluminides, ceramics and polymeric materials.

EM 534 POLYMER ENGINEERING

Introduction, Plastic today, Automotive applications of plastic, Environmental considerations, Structure of the molecule, Structure of polymeric solids, elastic properties of rubber.

Viscoelasticity, Nature of viscoelasticity, Theory of linear viscoelasticity, Stiffness, Yield and fracture, yeilding, Crazing, linear elastic fracture mechanics, Brittle fracture of polymers rubber toughening, High strength polymer, Water soluble polymer.

Metal polymer combination, Polymer composites, FRP, mechanics of fibre reinforcement, reinforced rubbers, Forming, flow properties of polymers melts, cooling and solidification, extrusion.

Mechanical, Electrical and Barrier Properties, Conducting polymer, High temperature polymer, Rheological behaviour of polymer.

Design and Analysis, materials selection, designing for manufacture, designing for stiffness, strength, testing of polymers.

References

1. Engineering Polymer R.W. Dyson
2. Principles of Polymer Engg. N.G. McCrum

EM535 CORROSION ENGINEERING

Electrochemical and thermodynamic principles, Nernst equation and electrode potentials of metals, EMF and galvanic series, merits and demerits; origin of Pourbaix diagram and its importance to iron, aluminium and magnesium metals.

Exchange current density, polarization - concentration, activation and resistance, Tafel equation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity.

Atmospheric, pitting, dealloying, stress corrosion cracking, intergranular corrosion, corrosion fatigue, fretting corrosion and high temperature oxidation; causes and remedial measures.

Purpose of testing, laboratory, semi-plant and field tests, susceptibility tests for IGC, stress corrosion cracking and pitting, sequential procedure for laboratory and on-site corrosion investigations, corrosion auditing and corrosion map of India.

Corrosion prevention by design improvements, anodic and cathodic protection, metallic, non-metallic and inorganic coatings, mechanical and chemical methods and various corrosion inhibitors

References

1. An Introduction to Metallic Corrosion and its Prevention Raj Narayan
2. Corrosion Engineering Fontana M. G., Greene N. D.
3. Denny Jones, "Principles and Prevention of Corrosion", Prentice Hall of India, 1996

EM536 METAL FORMING

Classification of metal forming processes, hot, cold and warm working, flow curve for materials, effect of temperature, strain rate and microstructural variables; residual stresses, experimental techniques, yielding theories, processing maps

Classification of forging processes, forging equipment, forging defects, plane strain forging analysis, open die forging and close die forging operations, force calculations

Classification of rolling processes, rolling mills, cold rolling, hot rolling, rolling of bars, billets and shapes, defects in rolled products, gauge control systems, process variables in rolling

Types of extrusion, process variables, extrusion defects, force calculation, wire, rod, and tube drawing, lubrication processes

Shearing, blanking, bending, stretch forming, deep drawing, defects in formed products, explosive forming, electro-hydraulic and magnetic forming processes, formability diagrams

References

1. Mechanical Metallurgy Dieter G. E,
2. Engineering Metallurgy, Volume II, Higgins R.A,
3. Mechanical Working of Metals-Theory and Practice Harris J.N
4. Metal Forming Technology Narayanasamy R,

EM-537 THEORY OF PLASTICITY

Nature of plasticity, Differential equations of equilibrium, 3D stress analysis, infinite deformation, finite deformation,Von Mises, Tresca's and anisotropic yield criteria, halgh-Westerguard stress space representation of yield criteria, experimental verification of yield criteria, subsequent yield surfaces, Elastic and Plastic stress strain relations and stress strain rate equations, Prandtle-Reuaa equations, Generalised plastic stress strain relations, Anisotropy and instability.

Plane plastic flow, Slip-Line field, Application of slip-Line field theory to plain strain metal forming processes, Plain plastic stress and pseudo plane stress analysis and its applications, Extremum principle for rigid perfectly plastic material, surfaces of stress and velocity discontinuity, Upper bound and lower bound theorems and applications.

References

1. The Mathematical Theory of Plasticity R Hill
2. Applied Plasticity Chakrabarty
3. Plasticity theory Jacob Lubliner

EM538 ADVANCED MATERIALS

Nanomaterials: Carbon nanotubes, structure and properties, chemistry of carbon nanotubes, graphite whiskers, cones and polyhedral crystals, nanocrystaline diamond, carbide derived carbon nanotubes in multifunctional polymer nano composites, nanostructred materials for field emission devices, nanotextured carbons for electrochemical energy storage.

Composites: Introduction, reinforcements, matrix materials, processing, interface, micromechanics, monotonic behaviour, cyclic fatigue, creep, wear, applications, shape memory alloys (SMAs), metallic foam, recemat metal foam etc.

Plastics: Introduction to plastics, polymeric materials (molecular viewpoint), microstructures in polymers, mechanical properties (macro view point) chemical and physical properties (macro view point), designing with plastics,, thermoplastic materials (commodity plastics), thermoplastic materials (engineering plastics), thermoset materials, elastomeric (rubber) materials, extrusion, injection moulding, blow moulding, thermoforming, rotational moulding, casting, foaming, compression moulding, transfer moulding, and related processes, radiation, finishing, adhesion and assembly operations and management, Environmental aspects of plastics.

References

1. Materials, their Nature, Properties and Fabrication — Sukh Dev Sehgal, Lindberg R.A.
2. Light alloys: Metallurgy of Light Metals — Polmear I. J.

EM 539 PRODUCT DESIGN AND DEVELOPMENT

Elements of successful product design in their specialist market place. Study of Engineering / Marketing relationship. The buying motivation and perception of industrial buyers. Individual customers, industry and government departments. Presentation of designs to potential customers. Acclerated product development. Variety proliferation. Differential product "fast to market".

Forecasting and market research for a new product. Purchasing and sales procedure. Demand analysis for new product. Intellectual property right. Introduction to IPR laws, nature, types of intellectual property, IPPP as an economic entity. Ddevelopment of IPR copyright, patents, design, trademarks, forms, global IP structure and IPRS in India, Infringement and remedies available, patent search, contractual agreements involving patents. Case studies

EM541 INTELLECTUAL PROPERTY RIGHT

Introduction to IPR, Importance, need of IPR, Intellectual Property protection.Patents and methods of application of patents, Trade secret copyrights, Trademarks. Legal implications, Historical development of International Intellectual Property, Protection of IC layout designs. Intellectual Property Issues in Cyber Space – Domain Names and Related Issues.

Cyber laws: Scope of Cyber Laws – Nature of Cyber Space, Cyber Property, Cyber Personality, Cyber Transactions, Cyber Jurisprudence – Concepts of Historical, Analytical and Ethical , Jurisprudence, Relationship between Meta Society Laws and Cyber Laws, How Cyber Laws need to be developed. Law of Digital Contracts – Digital Contract – Definition; Formation of Digital Contracts, System of Digital Signature, Role and Function of Certifying Authorities, Legal implications.

Patent: Patents and methods of application of patents, The Science of Cryptography, Indian Patent act and rules,Pantentable and non-patentable inventions including product vs process patent. Traditional and indigenous knowledge.

Trade secret copyrights, Trademarks, Copyright and related rights under existing and prospective treaties and conventions (particularly Berne, WIPO Treaties, TRIPs). The challenges of the internet, Intellectual property over technology: scope of patent systems, biotechnology, access to medicines, limitations on patent rights.

WTO: Introduction to WTO, International institutions concerned with Intellectual Property: World Intellectual Property Organisation and the conventions it administers; World Trade Organisation: dispute settlement and TRIPs; European Union and other regional bodies. Intellectual property and global marketing: International arrangements concerning trade marks and unfair competition; Geographical and other denominations of origin, including types of collective marks.

EM542 FRACTURE AND FAILURE OF MATERIALS

Application of fracture mechanics in analysis of fracture, elastic – plastic fracture mechanics, plain strain

fracture toughness test, crack opening displacement test, Ductile – brittle transition, method of determination of transition temperature, factors affecting ductile – brittle transition temperature.

Objectives of Failure Analysis, Stages of analysis: collection of background data & selection of samples, preliminary examination of failed part (visual examination and record keeping), non destructive testing, mechanical testing, selection, presentation and cleaning of fracture surface, macroscopic examination of fracture surface, microscopic examination of fracture surface, scanning electron microscopy.

Fracture modes: Shear mode, cleavage mode, other fracture modes, factors affecting, the ductile-brittle relationship, stress systems related to fracture of ductile and brittle metals: Pure loading systems, Tension loading, Torsion loading, Compression loading, Bending, Fatigue, effect of stress concentration, study of fractograph of some common metals.

Determination of fracture type : Ductile and brittle fracture, Fatigue fracture, Distortion failure, Wear failure, Corrosion failure, liquid – erosion failure, stress – corrosion cracking, elevated temperature failure, liquid – metal embrittlement, hydrogen embrittlement, creep and stress rupture failures, complex failure, chemical analysis, simulated service testing.

Case studies of different failures: Failure of steel castings and weldments, Failure of Gears and shafts, Failure of pressure vessels and pipes, Failure of bridge components, Failure of fiber reinforced composites, ceramics and polymers, Failure of integrated circuits.

References:

1. Fundamentals of Fracture Mechanics J.F. Knott
2. Engineering Fracture Mechanics D. Broek
3. Mech. Behaviour of Materials K.K. Chawla
4. Elements of Fracture Mechanics Prashant Kumar
5. Fracture & Fatigue Control in Structure Rolfe & Barson

EM543 COMPOSITE MATERIALS

Types of Composites, Reinforcements, Whiskers, Laminar composites, Flake composites, Filled composites, Particulate reinforced composites, Cremates, Micro-spheres, Solidification of composites. Economics of Composites and Reinforcements, Design of Composite Materials, Mechanics of composites, Applications of Composites.

tress – strain relations for arthotropic, anisotropic materials, Plane stress problems, strength theories, mechanics of laminates, symmetric and non symmetric laminates. Unidirectional fiber composites, Critical volume fraction, Discontinuous fiber composites, Rule-of mixtures equation, Critical angle, Analysis of composite plates and shells.

Interfacial bonds, interfacial strength, Laminated metal composites, Ceramic materials, Ceramic-metal systems, Ceramic glass system, Geometric relationships, Ceramic-ceramic systems, Thermal conductivity, Thermal expansion.

Metal Matrix Composites, Reinforcement, Reinforcement selection, Matrix selection, effects of reinforcements, Properties, Fabrication, Whisker reinforcement, Whisker composite properties. Al-composite foam, functionally gradient composite materials. Composite material for automobile, aerospace and general Engineering applications.

Ceramic Matrix Composites: Particulate reinforced composites, Continuous fiber reinforced composites, Chopped fiber and whisker reinforced composites, Fabrication processes, Properties.

Reference

1. Composite Materials Lawrence J. Broutman
2. Composite Materials R.M. Jones

Open electives

EM551 ADVANCED MECHANICS OF MATERIALS

Stress concentration and its determination, Contact & Residual stresses, Rotating rims, discs, cylinders, With and Without Temperature variations, Bending of curved bars, Stresses and deflection calculations, Pressure Vessels, Unsymmetrical bending, Beam Columns, Bending of Beams of Variable cross Sections. Torsion of non-circular bars.

References

1.Advanced Mechanics of materials Boresi
2 Advanced Mechanics of materials Cook
3 Mechanics of Materials E.J. Heavan
4 Strength of Materials Timoshenko

EM 552 FINITE ELEMENT ANALYSIS

Various approaches in FEM, direct stiffness method, energy approach and galerkin's approach, detailed method for stress and vibration analysis problems, various elements, development of element stiffness matrices. Applications to bar, beam, truss, spring, shafts, plates and shells. Isoparmetric elements, plate bending and shell elements, Axi-symmetric problem, vibration problem, software such as IDEAS, ANSYS, Norton, used in FEM, Nonlinear FEA.

. **References:**

1. Finite element method O.C. Zienciwicz.
2. Finite element method C.S. Krishnamurthy
3. Finite element method Logon
4. Finite element method Heubner

ii) STRESS AND VIBRATION ANALYSIS (M.Tech)

SV 511 ADVANCED ENGINEERING MATHEMATICS & OPTIMIZATION 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 and partial differential equations.

Introduction to optimization by linear programming, solution by graphical and simplex method, concept of degeneracy and duality, artificial variable techniques-Big-method, transportation and assignment problem.

References

1. Numerical Methods for Engineers Stevan C. Chapra and Raymond P Canale.
2. Numerical Methods for Engineers Iyengar and M.K.Jain.
3. Operation Research S.D.Sharma.
4. Numerical Optimization Techniques with Applications Suresh Chandra.

SV512 THEORY OF ELASTICITY

State of stress and strain at a point in two and three dimensions, stress and strain invariants, Generalized Hooke's law, Plane stress and plane strain problems, equations of equilibrium, boundary condtions, compatibility equations, two dimensional problems in Cartesian coordinates, solution by Airy's stress function, Saint Venant's principle, solution of beam problems, two dimensional problem in polar coordinates, general equations, stress distributions symmetrical about an axis, pure bending of curved beam, stress concentration, problem of torsion, membrane analogy method.

References

1. Theory of elasticity Timoshenko & Goodier

2. Theory of elasticity Sadhu Singh
3. Structural Analysis L S Negi and R S Jangid
4. Structural Analysis P Dayaratnam

SV 513 THEORY OF VIBRATIONS 1

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. Transverse vibration of beams. 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 hystersis or structural & viscous damping.

Torsional vibration of one, two and three rotor system. Equivalent shafting. Torsional vibration of a geared system. Torssional vibration with harmonic excitation. Critical speed of a shaft having a single disc and multiple disc with damping. Rotating unbalance, whirling of rotating shafts.

References:

1. Theory of Vibration with Application Thomson.
2. Mechanical vibration V.P.Singh
3. Mechanical vibration Schaum Series.
4. Mechanical Vibrations G.S. Grover & Nigam

SV 514 VIBRATION ANALYSIS LABORATORY

Uses of pick-ups, oscillator and amplifiers for measurement of vibration and acceleration. Recording instruments. Studies in damping behaviour. Mechanical models.

SV515 SEMINAR

Second Semester

SV 521: EXPERIMENTAL STRESS ANALYSIS

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 slicking method.

Brittle coating methods and its application in evaluation of stresses

References:

1. Experimental Stress Analysis Dally and Riley.
2. Experimental Stress Analysis J. Srinath.
3. Experimental Stress Analysis A. Mubeen.

SV 522 THEORY OF PLATES

The Differential equation of bending of a thin plate, boundary conditions for simply supported, fixed and free edges, Rectangular plates with different boundary conditions, Navier solution, Levy's solution, solution for different loading conditions such as UDL, hydrostatic, point load and partially loaded plates.

Thin plates with built-in edges, Strain energy stored in plate, energy method for solution, Numerical methods- Finite difference method for stress analysis of plate. Bending of circular plates,differential

equation in polar coordinates and boundary conditions. Solution of symmetrical loaded circular plates.

References:

1. Theory of plates & shells Timoshenko
2. Stresses in plates and shells U.C. Ugural

SV 523: THEORY OF VIBRATIONS 2

Transient & self-excited vibrations, Numerical methods for multidegree of freedom systems. Influence coefficients Dunkerlay's method, matrix iteration method. Orthogonality of principal modes. Comparison of behaviour between linear & non-linear systems. Eigen value & eigen vector. Holzer method for three and multi rotors and branched torsional systems. Mykelstad method, Stodola Method, Effect of shear deformation and rotary inertia.

Vibration of continuous, longitudinal transverse and torsional systems. Vibrations of plates and shells. Static and dynamic balancing of Rotors. Balancing of thin discs. Field balancing of long rotors. Vibration Analysis by FEM.

References:

1. Vibration Problems in engineering S.Timoshenko & Young
2. Elements of Vibration-Analysis L.Meirovitch.
3. Mechanical Vibration F.S. Tse, Morse & Hinkle
4. Theory of Vibration Thomson

SV524 EXPERIMENTAL STRESS ANALYSIS LABORATORY

Use of strain gauges for determination of stress and forces. Load cells, strain indicators, CRO, Oscillograph and recorders for dynamic strain measurements. Photoelasticity-determination of isoclinics and isochromatics and photography. Material calibration. Reflection polariscope. Brittle coating and Moire's fringes studies. NDT methods

SV525 SEMINAR 2

Department Electives

SV531 ADVANCED MACHINE DESIGN

General consideration for design of machine elements. Types of loadings. Criteria for failure. Distinction between design approaches for static and fatigue loading and their influences on design criteria. Designing against fatigue, creep and impact loading.

Stress concentration and stress concentration factors. Residual stresses and their determination.

Types of drives. And their relative merits. Belt drives – design and performance. Chain drive. Gear drives. Strength of gear tooth surface. Beam strength. Strength, deflection and design of shafts.

Selection of bearings. Gear drive housing. Fluid power systems, pumps and accessories, circuit design and applications. Step less drives, P.I.V. drives. Power transmission in machine tools.

Stress intensification in presence of sharp notches and cracks. Design of machine elements in presence of cracks.

References

1. Advanced Machine Design Mubeen
2. Mechanical Engineering Design Shigley

SV 532 THEORY OF ELASTIC STABILITY

Differential equations for beam-columns, beam-column with concentrated lateral load, beam column with built-in ends, beam-columns with elastic restraints Elastic buckling of bars under axial loading, Energy method, Alternate form of the differential equation for determining critical loads.

Inelastic buckling of bars, Inelastic bending, Inelastic buckling of bars with end condition. Buckling of rings & curved bars. Bending of thin curved bar with a circular axis. Effect of uniform pressure on bending of a circular ring Buckling of thin plates. Methods of calculation of critical loads. Buckling of simply supported rectangular plates. Buckling of shells, symmetrical buckling of a cylindrical shells.

References

1. Theory of Elastic Stability Timoshenko and Gere

SV533 THEORY OF PLASTICITY

Plastic behavior, true stress and true strain, temperature and strain rate effects, Mechanism of plastic deformation, stress invariants, deviatoric stress, Elastic plastic stress-strain relations, yield and flow conditions, Von Mises yield criterion and determination of constants, flow rule, Generalized stress and generalized strain increment, Tresca yield criterion, Hill yield criteria

Plastic Anisotropy, slip line field theory, α and β lines, stress equations, Hencky's first and second theorems, stress discontinuities, Interface with sliding friction, construction of hodograph, Application of slip-line field technique Limit theorem, principle of virtual work, principle of maximum plastic work, lower bound theorem, upper bound theorem

References

1. Introduction to Engineering Plasticity G.K. Lal and N. Venkata Reddy
2. Finite Elements in Plasticity: Theory and Practice D.R.J. Owen and E. Hinton

SV 534 PRODUCT DESIGN & DEVELOPMENT

Elements of successful product design in their specialist market place. Study of Engineering / Marketing relationship. The buying motivation and perception of industrial buyers. Individual customers, industry and government departments. Presentation of designs to potential customers. Acclerated product development. Variety proliferation. Differential product "fast to market".

Forecasting and market research for a new product. Purchasing and sales procedure. Demand analysis for new product. Intellectual property right. Introduction to IPR laws, nature, types of intellectual property, IPPP as an economic entity. Ddevelopment of IPR copyright, patents, design, trademarks, forms, global IP structure and IPRS in India, Infringement and remedies available, patent search, contractual agreements involving patents. Case studies

References

1.

SV 535 EARTHQUAKE ENGINEERING

Elements of seismology: Definitions of the basic terms related to earthquake (magnitude, intensity, epicenter, hypocenter and earthquake waves), measurement of ground motions, Seismic regions, intensity and isosismals of an earthquake, seismic zoning, strong ground motion arrays.

Earthquake effects on structures: Sources of vibration, types of vibrations, degree of freedom (SDOFS/ MDOFS), equation of motion of single and multiple degrees of freedom, dry friction damping and negative damping, forced vibrations of a damped system, system subjected to transient forces

Continuous systems: Free vibration-frequencies and mode shapes, numerical techniques, forced vibration-earthquake excitations.

Earthquake motion and response: Strong motion earthquakes, numerical method for spectra, elastic spectra, concept of response spectra/ average response spectra/ design response spectra, inelastic spectra, evaluation of earthquake forces, IS Code 1893: 2002, effect of earthquake on different types of structures
Concepts of earthquake resistant design: Structural Systems/ Types of buildings, causes of damage, Earthquake resistant design of masonry buildings, Strength and structural properties of masonry, Design consideration Guidelines, Earthquake Resistant Design of R.C.C. Buildings, Material properties, Lateral load analysis, Design and detailing (IS:13920: 1993)
Aseismic design of structures: Design data and philosophy of design, seismic coefficients, multistory buildings, ductility provisions in reinforced concrete construction, water towers, bridges, gravity dams and retaining walls etc.

Reference

1. Elements of Earthquake Engineering — Jai Krishna and Chandrasekaran
2. Earthquake Engineering — A.K. Chopra
3. Earthquake Resistant of structures — Pankaj Agrawal and Manish Shrikande

SV 536 NON-LINEAR & RANDOM VIBRATIONS

Definition of non-linear systems and comparison between the behavior of linear and non-linear systems. Undamped and damped free and forced vibrations. Self excited oscillations, singular points, analytical methods. Stability concept, phase plane plots, limit cycle.
Probability density functions, characteristic functions. Stationary and non stationery random process, ergodic random process. Auto-correlation function. Power spectral density function.

References

1. Non-linear Oscillations — N. Minorsky.
2. Advanced theory of vibrations — J.S. Rao
3. Non linear vibrations — Stoker
4. Random Vibration — J.D. Robson
5. Application of Random Vibrations — NC Nigam & S.Narayana

SV 537 STRESS & VIBRATION ANALYSIS IN TURBO-MACHINERY

Stresses in rotating discs and blade, disc of uniform strength, temperature stresses, general blade stress equation, blade design for strength. Determination of blade natural frequencies. Coupling of torsional and bending vibrations due to pre-twist and eccentricity of shear center. Effects of rotor speed, disc-coupling, shrouding, lacing wires and geometry on natural frequencies of blades. Root fixing of blades to the disc.
Analysis of aerodynamic forces acting on the blades of gas turbines. Vibration of low aspect ratio blades. Vibration of aircraft wings.
Aerodynamic analysis of wind turbines. Load calculations in wind turbine design. Stress and Vibration analysis of blades, hub and axle and tower in wind turbine.

References

1. Mechanics of Materials Vol.II — E.J.Hearn
2. Theory of Vibraations — Thomson
3. Advanced Theory of Vibrations — J.S.Rao
4. Blaade Vibrations — J.S.Rao
5. Wind Engineering Design — Eaglestone

SV 538 ROTOR DYNAMICS AND BALANCING

Dynamic of rotating machinery: Critical speeds of rotors, Factors effecting the critical speeds such as gyroscopic action internal damping unequal moments of inertia of shaft section, bearing elasticity and

oil film cushioning. Torsional frequencies of multi-mass rotors. Vibration of discs, blades and propeller which affect the rotor motion.

Stability of rotors under various influences: stability of rotors on elastically mounted supports and combined effect of bending and torsion. Resonance vibration of rotors with non-linear factors taken into account stability of rotors in flow medium. Sources of unbalance in rotors, balancing machines, machines, balancing criteria, specification and tolerances. Balancing in two planes correction methods used in industries, cradle balancing of rigid rotors, automatic balancing field balancing of rotors

References

1. Rotor Dynamics J.S. Rao.

SV539: ANALYSIS & DESIGN OF SHELLS

Terminology related to theory of shells. Construction of shells of single and double curvature, shells of translation or rotation. Equation of bending of shells, equilibrium and compatibility equations. Stress, strain and displacement equations. Solution of cylindrical shells. Software for shells. Design aspects of shells

References

1. Theory of plates and shells S.Timoshenko.
2. Stresses in plates and shells U.C. Ugural

SV 541 ANALYSIS OF COMPOSITE STRUCTURES

Equations of anisotropic elasticity. Kinematics, Kinetics, thermodynamic and constitutive equations. Thermo elasticity, Electro elasticity and hygro thermal elasticity. Virtual work principles and variational methods. Classification of structural theories for composite plates. Classical Laminated Plate Theory. Lamina constitutive relations. Laminate constitutive equations. First order laminated plate theory. Shear correction factor, laminate stiffness, symmetric and anti symmetric laminates. Quasi isotropic laminates.

One dimensional analysis of laminated plates. Analysis of laminated beams.

Analysis of specially orthotropic plates. Bending of rectangular plates with various boundary conditions. Vibrations of composite plates. Transient analysis. Analytical solutions of rectangular plates using CLPT and FSDT. Finite Element Analysis of Composite plates. Refined theories of laminated composite plates.

References

1. Mechanics of laminated composite plates J.N.Reddy

SV542 Computer Aided Design

Computer aided design, hardware and software in CAD, solid modeling in CAD, computer graphics, generation of lines, curves, surfaces, two and three dimensional transformations, optimization methods, Integration of CAD and CAM, robotics, computer integrated systems, production management, NC programming, computer control, CAE systems and project management, computer aided project planning

References:

1. CAD/CAM Mikell P.Groover & E.W. Zimmers, Jr.
2. Optimization for Engg. Design Kalyanmoy Deb

SV543 MECHANICS OF COMPOSITE MATERIALS

Classification and characteristics of composite materials, Mechanical Behaviour of composite materials. Lamina and Laminates. Manufacture of Laminated fiber – reinforced. Composite Materials.

Macromechanical behaviour of lamina, stress strain relations for anisotropic, orthotropic and isotropic materials. Engineering constants. Stress strain relation for plane stress in orthotropic materials. Invariant properties.

Strength of an orthotropic lamina, Experimental determination of strength, Biaxial strength theories: Maximum stress theory, Maximum strain theory, Tsai-Hill theory and Tsai-Wu theory.

Classical Lamination theory. Special cases of laminate, stiffnesses, strength of Laminates. Design of Laminates.

Bending buckling and vibration of laminated plates. Governing equation. Deflection & buckling. Vibrations.

References:

1. Mechanics of Composite Materials R.M. Jones.

Open electives

SV 551 FINITE ELEMENT METHOD

Various approaches in FEM, direct stiffness method, energy approach and galerkin's approach, detailed method for stress and vibration analysis problems, various elements, development of element stiffness matries. Applications to bar, beam, truss, spring, shafts, plates and shells. Isoparmetric elements, plate bending and shell elements, Axi-symmetric problem, vibration problem, software such as IDEAS, ANSYS, Norton, used in FEM, Nonlinear FEA

References

1. Finite element method O.C. Zienciwicz.
2. Finite element method C.S. Krishnamurthy
3. Finite element method Logon
4. Finite element method Heubner

SV 552 CONDITION MONITORING

Need for condition Monitoring, Machine Signatures, various techniques for signature analysis, wear particle & oil debris analysis, Noise, Temperature, Corrosion, Monitoring; online & offline condition Monitoring techniques, Artificial neural network in condition Monitoring.

Vibration Signature:Rotating Machinery, Machine faults & frequency range of symptoms, localized & distributed faults; Impact Exited Resonance, vibration level classification, ISO standards, Peak & RMS level, Cepstral Analysis, Use of phase, Construct Percentage Bandwidth Spectra Envelope Detection, Time Domain Averaging, Rolling Elevent Bearings, Rotor Dynamics, orbit Analysis static & Dynamic Balancing, Induction Motors, Gear Box vibration, Reciprocating engines & Compressors.

References:

1. Vibration Monitoring & Dignosis R.A. Collacot
2. Hand book of noise Assessment .
3. Hand book of Condition Monitoring B.K.N. Rao.
4. Hand book of Non Destructive Application B.J. Boeing

13 DEPARTMENT OF CIVIL ENGINEERING

iii) STRUCTUREAL ENGINEERING (M.TECH)

STR 511 THEORY OF ELASTICITY

Elasticity: Stress tensor and transformation, equilibrium conditions, simple state of stress, Strain displacement relations, strain tensors and its transformation. Compatibility condition. Constitutive relations, energy principles, problems of linear elasticity- basic equation, boundary value problems, solution of basic equation and equation of plane problems

References

1. Theory of Elasticity Timoshenko and Goodier
2. Applied Elasticity Wang

3. Mechanics of deformable solids Irving Shames
4. Elasticity in Engineering Scholer

STR 512 ADVANCED STRUCTURAL ANALYSIS

Buckling loads of prismatic and non prismatic beam columns. Finite difference and integration methods. Newmark's approach. Extrapolation by Aitken's delta square procedure. Richardson's extrapolation.
Analysis of frames by Kani's method. Matrix methods of analysis for beams and frames. Flexibility and stiffness methods.

References

1. Matrix Computer Analysis of Structures Moshe F. Rubinstein,
2. Structural Analysis R.C. Coates & MG Coutie, FG Kong,
3. Analysis of frame structures J M Gere & W. Weaver,
4 , Advanced theory of structures. N. C. Sinha & P. K. Gayen.

STR 513 DESIGN OF R.C.C. STRUCTURES & STEEL STRUCTURES

Revision of basic concepts of limit State Design of prismatic members in flexure, shear and bond. Redistribution of moments in fixed and two span continuous beams. Calculation of deflection due to load shrinkage and creep and calculation of crack width as per IS code. Yield line theory for slabs, yield line mechanics , equilibrium and virtual work methods special.
Analysis and Design of axially loaded Short column and analycic with unaxial anf biaxial bending column interaction diagram , its construction and use. Introduction to design and analysis of slender columns.Introduction to analysis and design of folded plates and circular shells.
Design of steel structural elements in accordance with IS : 800-2007. Load and Resistance Factor Design.
Design of bolted and riveted joints . Block shear failure and shear lag . Design of welded joints.
Design of tension members. Design of compression members. Overall buckling strength and section strength. Combined direct and bending strength. Laced and battened columns. Design of columns bases.

References

1. Design of Steel Structures N.Subramanian

STR 524 STRUCTURAL LAB 1

List of Experiments

1. Field related structural design problems and their solutions by using software packages.
2. Field related testing of structural materials and components

STR 525 SEMINAR 1

Second Semester

STR 521 PRESTRESSED CONCRETE

Design of prestressed elements by working stress and Limit state approach.. Design of Beams : Critical load condition, Permissible stresses, Various suggested methods of design, Composite Beams and Continuous Beams, Partial prestressed beams.. Slabs: Design of various type of slabs.

Shear and Bond in Prestressed Concrete, Anchorages in Prestressing, Post tensioned Construction. Prestressing cable at the centroidal axis, Symmetric multiple cable, cable with eccentricity, Inclined cables, Spalling and bursting stresses.. Miscellaneous Structures : compression members, tension members, prestressed concrete pavements, folded plate and shells, arches, rigid frames, cylindrical tanks.

References

1. Prestressed Concrete. G. S. Pandit, S.P.Gupta.
2. Prestressed Concrete N. Krishna Raju.

3. Prestressed Concrete. Libby,

STR 522 STRUCTURAL DYNAMICS

Structures modelled as a single degree of freedom system. Structures Modelled as shear buildings. Framed structures modelled as discrete multi degree of freedom systems. Structures modelled with distributed properties. Random vibrations.

References

1. Structural Dynamics Theory and computation MARIO PAZ

STR-523 THEORY OF PLATES AND SHELLS

Pure Bending of Plates, Symmetrical Bending of Circular Plates, Rectangular Plates Different forms of shell structures, Analysis of Shell Structures, Membrane Analysis of Shells, Folded Plate Structures, Introduction to Grid Structures

References

1. Theory and Analysis of Plates, Rudolph Szilard,
2. Theory of plates and shells, S. Timoshenko and Woinowsky Krieger,
3Theory of plates . K. Chandrashekhara,
4. Beam plates and Shells Lloyd Hamilton Donnell,

STR-524STRUCTURAL LAB –II

Field related structural design problems and their solutions by using software packages.
Field related testing of structural materials and components.

STR 525 SEMINAR

Department electives

STR 531 SOIL STRUCTURE INTERACTION

Soil Foundation interaction, soil foundation – structure interaction, soil – fluid structure interaction, idealization of soil by various linear and non-linear, isotropic and anisotropic models, soil – parameters : Interpretation of parameters encountered in various idealized soil models, experimental investigations. Finite difference solution to problems of beams on linear and non – linear winkler models. Soil – structure Interaction in framed structure, FEM Modelling. Use of appropriate software packages. Introduction to dynamic soil structure interaction as well as non linear soil / concrete behavior.

References

1. Dynamic Soil-Structure Interaction John, P. Wolf,
2. Soil-Structure Interaction in Time Domain John, P. Wolf,
3. Constitutive Modelling of Soil and Rocks. Desai, C.S. Srivardhane,

STR 532 DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES

Introduction to steel concrete composite structures. Composite beams. Composite columns. Composite floors.

References

1. Composite structures of steel and concrete. Johnson, R. P

STR-533 MAINTENANCE AND REHABILITATION OF STRUCTURES

Quality assurance for concrete construction, concrete properties: strength, permeability, thermal properties and cracking.

Influence on Serviceability and Durability, Maintenance and Repair Strategies, Materials for Repair, Techniques for Repair.

References

1 Concrete Structures, Materials, Denison Campbell

2. Repairs of Concrete Structures, Allen, R.T. and Edwards, S. C.,
3.. Concrete Technology Shetty, M.S.,
4.. Training Course notes on Damage Assessment and repair inLow Cost Housing, Santhakumar, A.R.,

STR-534 TALL STRUCTURES

Principles of Planning of Tall Buildings, Loads on Tall Buildings, Analysis of Tall Buildings (With and Without Shear Walls), Design of Tall Buildings, Soil Structure Interaction

References

1. Tall Building Structures – Analysis and Design Bryan Stafford smith and Alex Coull,

STR-535 BRIDGE DESIGN

Bridge System, Considerations in alignment, planning, economic consideration, aesthetics and selection of type of bridge. Loading Standards, Super Structure Analysis, Design of Bridge Decks and Bearings, Connections, Substructure Analysis and Design, Foundations, Construction & Maintenance, Dynamic Behaviour, Long Span Bridges, Design of Aqua-duct & Box culverts.

References

1Concrete Bridge Practice . Raina, V. K.,
2. Essentials of Bridge Engineering, Victor, D.J.,
3. Bridge Engineering Demetrios E. Tonias,

STR-536 SAFETY IN CONSTRUCTION

Accident prevention, Cost of accidents, Safety and productivity, Safety provisions in the factories act, Accident reporting investigation and statistics. Safety Equipment, Safety Systems, Safety in Hand Tools, Safety in Demolition Work

References

1. BHEL Safety Manual, BHEL, Trichy.
2. Construction Technology Akaev, S.S.,
3.. Construction Hazard and safety Hand Book Hudson, R.,
2. Safety in the Build Environment Janathen D. Sime,

STR537 ADVANCED STEEL STRUCTURES

Communication and transmission line steel towers, masts. Design of Industrial structures, composite steel and insitu concrete beams and slabs.

References

1. Design of Steel structures P.Dayaratnam,
2. Composite Structures R.P.Johnson,
3. Design of steel structures N.Subramanyam,.

STR538 EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES

Earth Quake ground motion. Structural Dynamics. Concepts of earth quake resistant design of Reinforced concrete buildings. Seismic analysis and modelling of reinforced concrete building. Earthquake resistant design of reinforced concrete buildings. Earthquake resistant design of masonry buildings. Seismic evaluation and retrofitting of reinforced concrete and masonry buildings.

References

1. Earth Quake Analysis And Design Of Structures Pankaj Agrawal and Manish Shrikhande.

STR539 DESIGN OF FOUNDATION SYSTEM

Shallow foundations: Bearing capacity equations, special footing problems, I.S. Codes, Design of foundations and computation of settlements. Pile foundations: Type of piles, estimating pile capacity, pile load tests, negative skin friction, modulus of sub-grade reaction for laterally loaded piles, lateral

resistance. Pile group considerations, efficiency, settlement of pile groups, pile caps, I.S. Codes Well Foundations: Types, shapes, bearing capacity and settlements, determination of grip length by dimensional analysis, stability of well foundations by IRC Method, construction, Tilts & shifts.

Sheet pile Structures: Types, Design / methodology Anchors Braced Sheeting, Cofferdams, single well cofferdams, cellular cofferdams, stability of cellular cofferdam, instability due to Heave of Bottom.

References

1. Soil Mechanics Lamb and Whitman
2. Soil Engineering Alam Singh,
3. Foundation Engineering Bowles

STR541 ADVANCED RCC STRUCTURES

Multi-storeyed building systems, grid floors , tubular structures, RCC domes and shell roofs.

References

1. Advanced Reinforced concrete design, N.Krishna Raju,
2. Design of R.C.C structures P.Dayaratnam,

Open Elective

STR 551 ADVANCED MATHEMATICS

Ordinary and Partial Differential equations: Application to boundary value problems, Laplace and wave equations, time dependent equations with vibratory systems.

Theory of complex variables and conformal mappings: Complex numbers, the elementary functions, cauchy's theorem, infinite series. Elementary conformal mapping - conformal transformation of harmonic functions and boundary conditions. Matrix Theory : System of linear equations, determinate, finite dimensional vector, space matrices- matrix rotation. Calculus of tensors with its applications to differential geometry. Application of matrices and tensors to simple problems. Numerical methods in engineering analysis : Interpolation and relaxation methods. Methods of minimum potential energy, variational principles, Rayleigh-Ritz Method, Galerkin's Method, Treffitz's Prcedure, Pargers Functions. Percubation and collection procedures. Solution of linear and nonlinear equations by numerical methods. Numerical Integration – Newton Cotes, Gauss Integration.

References

1. Higher Engg. Mathematics S Grewa
2. Engineering mathematics S S Shastri
3. Advanced Mathematics for Engineers Gorakh Prasad

STR552 ADVANCED SOFT COMPUTING TECHNIQUES

Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back propagation network – The generalized delta rule – Practical considerations – BPN Geomatic applications. Hopfield nets – Cauchy training – Simulated annealing – The Boltzmann machine. Associative memory – Bidirectional Associative Memory Network – Geomatic Applications.

Counter propagation network and self organizing maps: CPN building blocks – CPN data processing. SOM data processing - Adaptive Resonance Theory network - Geomatic Applications

Fuzzy logic**:** Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy mebership functions – Operators Decomposition – Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making

Neuro – fuzzy modeling: Adaptive networks based Fuzzy interface systems – Classification and Regression Trees – Data clustering algorithms – Rule based structure identification – Neuro-Fuzzy controls – Simulated annealing – Evolutionary computation - Geomatic Applications.

References

1. Neural Networks – Algorithms, Applications & Programming Techniques — James Freeman A. and David Skapura M.
2. Fuzzy Logic with Engineering Applications — Timothy J.Ross,
3. Artificial Neural Networks — Yegnanarayana B.
4. Fundamentals of Neural Networks — Lqurene Fausett
5. Neuro-Fuzzy and soft computing — Jang J.S.R., Sun C.T. and Mizutani E

STR 553 PROBABILITY AND STATISTICAL METHODS (STR-523)

One dimensional random variables: Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable, weighting of observations. Two dimensional random variables: Joint distributions– Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

Estimation theory: Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines, Propagation of systematic and accidental errors, theory of least squares and its application to adjustment problems.

Testing of hypotheses:Covariance matrix – Correlation Matrix – Multivariate Normal density function – Principal components – Sample variation by principal components – Principal components by graphing.

Multivariate analysis: Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

References

1. Probability and statistics for Engineering and the Sciences — Jay L. Devore
2. Applied multivariate methods for data analysis — Dallas E Johnson et al
3. Probability and Statistics for Engineers — Richard Johnson
4. Applied Multivariate Statistical Analysis — Richard A. Johnson and Dean W. Wichern

STR 554 FINITE ELEMENT METHODS IN STRUCTURAL ANALYSIS

Introduction to Finite Elements, Plane Stress and Plane Strain, Axi-Symmetric Stress Analysis, Elements in 2– D and 3-D Problems, Three Dimensional Stress Analysis, Nonlinear analysis.

References

1. Finite Element Analysis Theory and Programming — Krishnamoorthy, C.S.
2. Introduction to Finite Element Method — Desai, C.S. and Abel, J.F.
3. The Finite Element Method in Engineering. — S.S.Rao
4. The Finite Element Method — Zinkiewicz, O.C. and Taylor, R.L
5. An Introduction to Finite Element Method. — Reddy, J. N.,

v) GEOTECHNICAL ENGINEERING (M. Tech.)

First Semester

GEO 511 ADVANCED GEOTECHNICAL ENGINEERING

Definition of Soil, Geological cycle of formation of soil, differences in behaviour of soil and other engineering materials. Common clay minerals, development of plasticity in soils, significance and range of index properties of coarse and fine soils. Empirical connection of index properties with engineering parameters. Common soil deposits in Madhya Pradesh and their typical characteristics. Problems of black cotton soil.

Flow of water through saturated soil- permeability, derivation of Poiseuille's law and discussion of factors affecting permeability. Flow nets, quick conditions, flow of water in unsaturated form. Mechanism of consolidation, consolidation test, determination of field compression index for normally and over consolidated soils, coefficient of consolidation and its determination. Calculation of settlements, calculation of time rate of settlement. Three dimensional consolidation, design of sand/rope drains.

Mohr-coulomb equation, determination of shear strength, Behavior s of sands under shear, dilatancy, behaviour of clays under shear, pore pressure coefficients and their use. Introduction to rock mechanics- Difference in behaviour of rock and soil, physical properties of rock, classification of rock, mechanical properties of rock, in-situ stress in rock behaviour of rock in triaxial compression.

References:

1. Soil Mechanics. Lambe and Whitman
2. Physical properties of soils. Means and Parcher
3. Soil Mechanics Bowles
4. Foundations on expansive soils. Chem

GEO-512 FOUNDATION ENGINEERING – I (SHALLOW FOUNDATIONS)

Introduction: The components of foundation, classification of foundation, steps involved in choice of foundation. Soil Design Parameters: Bearing capacity, settlement, depth of foundation, depth of soil exploration, footings subjected to moments, footings subjected to Tension. Study of IS Codes: IS : 1498,1982,IS : 1888, IS : 2131, IS: 6403 and IS : 1904, All other relevant codes with latest editions. Shallow Foundations in clay: Soil design of footings in clay with settlement calculations,

Shallow foundations in sand: Soil designing of footings in sand. Raft Foundations: Rafts in clay and in sand. Floating rafts, buoyancy rafts and basement rafts. Retaining Structures: Types, Stability Analysis, Anchored- bulkheads.

GEO 513 MACHINE FOUNDATION VIBRATIONS

Terminology used in study of vibrations: Accelerating bodies (acceleration, velocity, displacement), amplitude (displacement, vibration) Static and Dynamic Balancing of a rotating body, phenomenon of beat, damping, different types of excitation- impulse, inertial, harmonic, periodic, transient, Type of machine foundation structure- block type, Frame type, mat type, Overturned & under turned machine Foundation.

Frequency: Angular, damped, natural, operating, fundamental, Magnification or Amplification Factor. Mass: Continuous and equivalent lumped mass Motion: Periodic, aperiodic, simple harmonic, sub-harmonic, super harmonic.

Modes of vibration: Phases angle, resonance, spring stiffness, degree of freedom. Fundamentals of theory of vibrations, single degree of freedom system- calculation of parameters for mathematical model: Equivalent mass, equivalent spring constant, Equivalent forcing function.

Formulation of Mathematical Model: Transient or free vibrations, steady state solution of forced vibration. Dynamic system subjected to rotating mass type Excitation. Two degree of freedom system without and with damping, multi degree of freedom

system. Vibration of block foundation. Induced Vibrations due to Vehicular traffic and blast waves, vibration of structures due to earth quake and man made ground vibration, structural damage and human sensitivity to the vibration. Vibration isolation- active and passive, various methods of vibration isolation.

Suggested Text Books and References:

1. Soil dynamics and machine foundation Swami saran

2. Soil dynamics Shamser Prasad
3. Mechanical Vibration Grover

Second Semester

GEO 521 SOIL DYNAMICS

Historical development of soil dynamics, Damage to foundations and earthen structures due to vibrations and other dynamic forces. Earthquakes and related terminology. Propagation of Elastic waves in soil.
Dynamic soil properties factor affecting, Determination using various laboratory and field methods, selection of appropriate value of dynamic soil property for the Design of Structure subjected to vibration.
Dynamic earth pressures: Active and Passive Pressures, Retaining wall problems under Dynamic loads. Dynamic Bearing Capacity of soils. Dynamic characteristics of Pile Foundation.
Laboratory Work: Laboratory experiments to cover the above course. List o experiments will depend on the facilities available.

References:

1. Soil dynamics and Machine foundation Swami saran,
2. Soil dynamics Shamser Prasad,
3. Analysis and design of foundation for vibration P. J. Moore,

GEO522 DESIGN AND CONSTRUCTION OF MACHINE FOUNDATIONS

Classification of machine foundations and fundamental principles for the design of machine foundation under static and vibratory systems. Criteria for design. Dynamic Soil investigation: Theoretical and practical determination of elastic properties of soil, Behaviour of soil under dynamic loads, determination of allowable soil stress for dynamic loads.
Computation of machine foundations taking into consideration the vertical, horizontal and rotational vibrations for heavy machines like mechanical hammers, reciprocating engines, turblnes, rolling mills, forging presses and crushing machines. Structural details for machine foundations- Concreting of foundations and their connection to superstructure including details of form work-reinforcements. Floors and their connection to buildings. Prestressed concrete, brick work and shallow foundations. Plants and equipments used for the construction of machine foundations. Examples of heavy machine foundations in one major design of heavy machine Isolation
of machine foundations.

GEO 523 FOUNDATION ENGINEERING – II (DEEP FOUNDATION)

Introduction to various types of deep foundations, cofferdams, diaphragm walls and foundation dewatering. Piles: Types, mechanics of load transfer, negative skin friction, determination of ultimate load capacity of individual and group of piles, under reamed piles.
Study of Codes: Study of all the codes of Indian Standards relevant to deep foundations, such as IS: 8009, IS: 3955, IS 2911 latest editions. Well Foundations: Classification, forces acting and stability construction techniques, tilt and shift, dewatering.
Piles: Analysis and design of flexible piers, Drilled Piers. Supporting system for cuts, Heave at the bottom of cuts. Arching of soils. Earth Pressure in Tunnels, Soil Pressure on conduits.

Department electives

GEO- 531 ADVANCED STRUCTURAL ANALYSIS

Analysis of beams and plates for static and dynamic loads. Introduction to matrix method of analysis- Force and displacement method. Introduction to finite difference methods.
Approximate methods for analysis of frames under static and dynamic loads

GEO- 532 STRUCTURAL DYNAMICS

Simple structures, single degree of freedom system, mass spring-damping system, equation of motion: external force and earthquake excitation, static and dynamic response. Free vibration, undamped free vibration viscously damped free vibration, energy in free vibration, coloumb damped free vibration.

Response to harmonic and periodic excitations, Numerical evaluation of dynamic response. Earthquake response of linear systems.

Multi degree of freedom systems general approach for linear system, static condensation, symmetric and unsymmetric plan systems-ground motion. Structural dynamics in Building codes.

References

1. Dynamics of Structures — Anil K. Chopra,
2. Dynamics of Structures — R. W. Clough and J. Penzien,
3. Dynamics of Structures — J. L. Humar Printice Hall

GEO- 533 REINFORCED SOIL STRUCTURES

Reinforced Earth: History, field of applications, natural fibres, overview of Geotextiles, Geomembranes, Geogrids, Geonets, Geowebs, Geomats and Gecompsites, economic aspects of their applications Production of Geotextiles, composites, physico-mechanical, hydraulic and chemical Properties. Functions of Geosynthetics, fluid transmission, filtration, separation,protection. Soil Reinforcement: Basic principle of soil reinforcement, shear strength of reinforced soil, theoretical strength models, factors affecting, requirements on synthetic reinforcement, installation techniques.

Calculation methods: Basic concepts, 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 Geosynthetics in Roads and Railways, drainage system- Control of groundwater level, dewatering and reclamation of land, use of Geomembranes – For lining applications, management and maintenance.

References:

1. Geo-textiles and Geo-membranes in Civil Engg. — Gerard P.T.M. Van Santvrot A. A.
2. Reinforced Soil and Geo-textiles- — J. N. Mandal,
3. Geosynthetics: Applications, Design and construction — R. J. Tarmat
4. Geosynthetics World. — J. N. mandal

GEO 534 ROCK MECHANICS & ENGG. GEOLOGY

Sub surface Exploration: General Principles, Geophysical explorations, Structural features of Rock Masses, Engineering Properties of intact/in-situ rock, Rock mechanics. Clay Mineralogy: Definition, Classification, identification and structure of clay minerals, base-exchange, PH values, clay water system. Model Simulation of Rock mechanics Problems: General Principles of mechanical similitudes in elastic and ultimate load ranges, Development of a model for rock mass. Rock mass joints behaviour and stability of slopes. Dynamic behaviours of Rock mass: Dynamic sources and effects in rock earthquake intensity scales Mechanism of earthquake and vibrator and vibration of structures, lateral forces of an earthquakes. Rock as a structural foundations: Foundation problems in Igneous, Sedimentar and metamorphic rocks, Geotechnical investigation for dam, Tunnels, Bridges and pavements. Ground water Geology: Classification and distribution of ground water, Geologic control of Ground water, free and confined ground water, hydrologic properties of water bearing material except soil.

GEO 537 GEOTECHNICAL INVESTIGATION AND FIELD TESTING OF SOILS

Need and importance of site investigations, sits exploration and phasing of site exploration programme, Spacing and depth of bore holes, significant depth. Methods of site exploration-soundings, bore holes, drilling methods and equipment wash boring, rotary boring and percussion boring in soils at stabilization of bore holes Procuring and handling od disturbed and un disturbed samples- various types of samplers and sampling techniques, their relative merits and suitability in particular cases, lowering of water table. Geophysical methods of soil exploration. Observation of ground water level and pressure Soil testing techniques used in Laboratory, Simple field tests for permeability, in place density, vane test, plate bearing test, standard penetration test.

Discussion and seminar on published papers of recent origin connected with exploration and testing of soils, case histories of failure of structures.

GEO-538 CRITICAL STATE SOIL MECHANICS

Introduction to constitutive modelling of soils, stress and strain parameters, elasticity (including anisotropy), plasticity and yielding (yield surface, hardening law, flow rule), volume changes under isotropic stress states or one-dimensional straining (normal compression line, swelling lines), shearing and the critical state line, drained and undrained shearing of normally consolidated and overconsolidated samples, Modified Cam Clay as an example of a simple elasto-plastic model, strength of soils, index tests interpreted through critical state soil mechanics, application of critical state soil mechanics, complexities of real soil behaviour and development of advanced constitutive models.

References:

1. Soil behaviour and critical state soil mechanics — Wood, D.M.
2. An introduction to the mechanics of soils and foundations — Atkinson, J.H.,
3. The mechanics of soils: an introduction to critical — Atkinson, J.H. and Bransby, P.L.,
4. Finite element analysis in geotechnical engineering, — Potts, D.M. and Zdravkovic, L

GEO-539 EARTHQUAKE ENGINEERING

Introduction to tectonic plate theory. Definitions : Focus, Epicenter, Magnitude, Intensity, etc. Geotechnical aspects of Earthquake Engineering. Codal provisions for Earthquake resistant design and construction of R.C.C. Structures, Masonary Structures, etc. Case studies of previous Earthquake Geotechnical engineering problems.

References

1. Dynamics of Structures — Anil K. Chopra,
2. Geotechnical Engineering Principles and Practices — Donald P. Coduto,
3. Geotechnical Earthquake Engineering — Steven L. Kramer
4. Geotechnical modelling, — Muir Wood, D.,

GEO-541 STRENGTH AND DEFORMATION DEHAVIOUR OF SOILS

in Clays and Sands, Behavior of Normally Consolidated Clay, Behavior of Overconsolidated Clay, Soil Composition, Water Absorption, Clay-water Forces and Measurement of Soil Suction, Soil Structure, Basic Strength Principles and Stress-Strain Behavior of Simple Clay; Soil Modeling, Types of Triaxial Tests and Strength Principles, Mechanisms of Volume (Pore Pressure) Change Hvorslev Parameters and Extension Tests Modified Cam-Clay Model, Consolidation Behavior of Saturated Soils:

2-D and 3-D Settlement (Initial, Amount and Rate of Consolidation) Problematic Soils (Sensitive, Organic, Expansive, Collapsing, Varved, etc.) Stability Problems and Drained Strength Analyses Effective Stress Parameters for Drained Analyses Undrained Strength-Deformation Behavior of Saturated Clays and Undrained Strength Analyses, Conventional Practice for UU Case (In Situ and Lab

Techniques) Sample Disturbance, Stress System (s2 and Anisotropy), Staged Construction (CU Case), Strength-Deformation Behavior of Cohesionless Soils Strength Components and Steady-state Line, Effects of Density, Confinement and □2 on Drained and Especially Undrained Behavior Effects of Sand Structure (Anisotropy, Stress History, Heterogeneity etc.) Compacted Clays, Compaction Process (Fundamentals) Structure and Engineering Properties, Effective Stress with S < 100%, Constitutive Modeling, Miscellaneous including Precompression, Vertical Drains, and Case Histories

GEO-542 MODERN GEOTECHNICAL PROCESSES

Soil Stabilization- Mechanical Stabilization, role of fine and coarse fraction, method of mixing soils to get designed plasticity index and particle size distribution stabilization using cement, lime, fly ash etc., effect on soil properties. Compaction. Laboratory compaction, comparison of properties of oil compacted to wet -of and dry-of omc. Field compaction- Available equipments and their suitability, methods for shallow surface compaction, deep compaction. Difficulties in compaction. Specification for compaction requirements, compaction central tests, Dewatering Methods-Dewatering of excavation and drainage of slopes, electro-kinetic dewatering. Pre loading and use of vertical drains. Grouting- Grout materials, grouting techniques and central methods. Reinforces Earth- Principles method. Use in retaining wall, design of retaining wall. Geosynthetics- various types, testing of geosynthetics, case studies.

References

1. Engineering Principles of Ground Modification- M. R. Hausemann
2. Soil Stabilization Ingles and Metcallf.
3. Soil Engineering Her Mayesties Stationary Office.
4. Earth and Rockfill Dams Sherard et. al.
5. Earth and Rockfill Dams Bharat Singh and Sharma

GEO-511 COMPUTER METHODS

Roots of Equation: Graphical Methods, Newton Raphson's Method, Solution of Ordinary differential equation by Runga Kutta Mehtod, Solution of linear algebraic equation by Relaxation Methods. Numerical Interpolation: Linear and Lagrangian Interpolation. Numerical Integration: Trapeqoidal and Simpson's Rule. Curve Fitting: Linear and Polynomial regression. Evolution of program desing concepts: Basic object oriented concepts. Object oriented languages: C++, constructs & syntax: Algoritm development and implementation: Application of object oriented programming in Civil Engineering Systems. Introduction to data structures, computer graphics and graphical user interfaces. Overview of technical application software: Spread sheets, databases, CAD and GIS Formulation of the various problems of Geotechnical Engineering.

GEO-512 COMPUTER AIDED ANALYSIS AND DESIGN OF FOUNDATION AND RETAINING STRUCTURES

Computer aided limit state design of sub structures and retaining walls, shallow and deep foundations under vertical, horizontal and eccentric loadings, analysis and design of foundations for earthquake motions,

Use of computers and computer related equipment to develop the knowledge and skills necessary for the design and drafting, Use of available software to develop three-view, three-dimensional drawings.

Reference

1. Analysis and Design of Sub structures Swami Saran
2. Foundation Design and Construction Tomilson

EXPANSIVE AND SHRINKABLE SOILS (GEO-513)

Clay Minerals, Concepts of composition, classification and nomenclature. Structure of clay minerals. Identification of clay minerals X – ray diffraction. Electron microscope. Chemical and differential thermal analysis. Recognition and identification of expansive soils. Origin, distribution, depth of moisture fluctuation. Site investigations, drilling and sampling. Free swell test, shrinkage index test. Mechanics of swelling. Moisture migration. Measurement and prediction of swelling potential and swelling pressure. Factors affecting volume change and swelling pressure. Stabilization of expansive soil mechanical. Foundations in Expansive soils. Under-reamed pile foundation general conditions for under-reamed piles design and construction. Case Histories. Detailed field case studies of foundation failure in expansive soils and emedial measures.

References

1. Behaviour of Saturated Expansive Soil- R. K. Kathi and A. R. Khati
2. Foundation on Expansive Soils Chen.

GEO531 REMOTE SENSING, GPS & GIS TECHNIQUES AND THEIR APPLICATIONS IN GEOTECHNICAL ENGG.

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, repeativity, row/path and ground swath and coverage.

Various remote sensing platforms like ground based, air borne and satellite based. Passive and active remote sensors: Return Beam Videocon (RBV), Multi–Spectral Scanners (MSS), Thematic Mapper (TM), push broom scanners, Linear Imaging Self Scanner (LISS), thermal infrared scanning systems, radiometers, Radar, Lidar and SAR. Spectral and spatial resolution of various remote sensors with special relevance to Indian Remote Sensing satellites. Different types of remotely sensed data products.

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.

Global Positioning System (GPS): Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys –Map datums, GPS receivers, GPS observation methods and their advantages over conventional methods. Geographic Information System (GIS) – Definition of GIS, Geographical concepts and terminology, Components of GIS, Data acquisition, Raster and vector formats, scanners and digitizers. Advantages of GPS and GIS in the storage thematic information extracted from remotely sensed images.

Role of remote sensing and GIS in terrain investigation and advantages over conventional mapping techniques. Extraction of topographic information from remotely sensed data and generation of digital terrain model from stereo pairs of images. Resource mapping for engineering project: selection of sites for construction materials, water resources, soil, buildings, railways, and highways etc. using remotely sensed data. Geological mapping for the geotechnical investigation of soil strata. Monitoring of areas prone to landslides using remote sensing, digital model and GIS. Application of visible, infra-red and microwave remote sensing for the identification of soil types, grain size and moisture studies.

References

1. Remote Sensing and image interpretation Lillesand T.M. and Kiefer R. W
2. Introduction to remote sensing J. B. Campbell .

3. Introductory digital image processing J. R.Jensen
4. Remote Sensing in Civil Engineering, Kennie, T. J. M. and Matthews M. C. Surrey

Open elective

ADVANCED MATHEMATICS (GEO-521)

Ordinary and partial differential equations: Application to boundary value problems. Laplace and wave equations, time dependent equations with vibratory systems. Theory of complex variables and conformal mappings:Complex numbers, the elementary functions, cauchy's theorem, infinite series. Elementary conformal mapping – conformal transformation of harmonic functions and boundary conditions.

Matrix Theory: System of linear equations determinate, finite dimensional vector, space matrices- matrix rotation. Calculus of tensors with its applications to differential geometry. Application of matrices and tensors to simple problems in soil mechanics. Numerical methods in engineering analysis: Interpolationand relaxation methods. Methods of minimum potential energy, variational principles, Rayleigh – Ritz Method, Galerkin's Method, Treffitz's Procedure, Pargers Function, Percubation and collection procedures. Solution of linear and nonlinear equations by mechanical methods.

References:

1. Higher engg. Mathematics S Grewal-
2 Engineering Mathematics S. S. Shastri
3. Advance Mathematics for engineers Gorakh Prasad

ADVANCED SOFT COMPUTING TECHNIQUES (GEO-522)

Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back propagation network – The generalized delta rule – Practical considerations – BPN Geomatic applications. Hopfield nets – Cauchy training – Simulated annealing – The Boltzmann machine. Associative memory – Bidirectional Associative Memory Network – Geomatic Applications. Counter propagation network and self organizing maps: CPN building blocks – CPN data processing. SOM data processing - Adaptive Resonance Theory network - Geomatic Applications

Fuzzy logic**:** Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy mebership functions – Operators Decomposition – Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making

Neuro – fuzzy modeling: Adaptive networks based Fuzzy interface systems – Classification and Regression Trees – Data clustering algorithms – Rule based structure identification – Neuro-Fuzzy controls – Simulated annealing – Evolutionary computation - Geomatic Applications.

References

1. Neural Networks – Algorithms, Applications & Programming
James Freeman A. and David Skapura M.,
2. Fuzzy Logic with Engineering Applications Timothy J.Ross, "
3. Artificial Neural Networks Yegnanarayana B.,
4. Fundamentals of Neural Networks Lqurene Fausett

GEO-523 PROBABILITY AND STATISTICAL METHODS

One dimensional random variables: Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable, weighting of observations.

Two dimensional random variables: Joint distributions– Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

Estimation theory: Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines, Propagation of systematic and accidental errors, theory of least squares and its application to adjustment problems.

Testing of hypotheses Covariance matrix – Correlation Matrix – Multivariate Normal density function Principal components – Sample variation by principal components – Principal components by graphing.

Multivariate analysis Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

References :

1. Probability and statistics for Engineering and the Sciences Jay L. Devore
2. Applied multivariate methods for data analysis Dallas E Johnson et al
3. Probability and Statistics for Engineers Richard Johnson. "Miller & Freund's
4. Applied Multivariate Statistical Analysis Richard A. Johnson and Dean W. Wichern

GEO-561 ENVIRONMENTAL GEOTECHNIQUE

Soil Formation, Solids composition and characterization, Mineral composition, Role of Composition and soil structure in the Engineering Behaviour of soils. Flow of water in soils; Energy states of water in soil, principles of flow in saturated soils, Governing equation for saturated flow, principle of flow in unsaturated soils, Governing equation for unsaturated flow. Mass Transport; mass transport mechanisms, mass transfer mechanisms Site characterization and contaminant release mechanism – Site contamination, characterization of site, Geo statically applications, contaminant release mechanisms: Vaporization, dusting, leaching.

Principles of site and Geo-material treatment techniques: - Treatment approaches, basis for treatment technology selection, in situ soil flushing, in situ vitrification principles, natural attenuation principles, phyto remediation and bioremediation principles, ex-situ stabilization and chemical treatment principles. Waste containment system implementation – Essentials of waste containment, hydraulic and physical containment, containment effects on source terms, site selection techniques for containment, containment site improvement.

Introduction to Landfills: Environmental impact assessment and management – Initial environmental evaluation, Elements of EIA, preparation of environmental base map, classifications of environmental parameters. Identification of hazardous waste; Introduction to exposure assessment, Riskbased estimation of required cleanup levels. Non aqueous – phase liquids in soils: Introduction, Principles of NAPL entrapment in soils, Conceptualization of field-scale transport of NAPLs, phase diagram for soil – water – LNAPL – Air systems, Mobilization of residual NAPLs.

References

1. Geo-Environmental Engineering Lakshmi N. Reddy
2. Principles and Applications Hilary. I. Inyang

GEO-562 THEORY OF ELASTICITY AND PLASTICITY

Theory of Elasticity: Analysis of stress, stress vector at a point across an area components of stress tensor and sign convention. Definition of surface and body forces. Principal stress, Mohr's circle, Stress invariants, transformation of axes complementary shear. Equations of stress equibrium. Faint venant's Principles. Strain tensor, strain invariants, spherical and Deviator stress and strains, Tdransformation of

axes, Mohr's Diagram for strain, Relations between strain and displacements, Equations on compactibility – Physical significance of.

Generalised Hooke's law. Relationship between the various elastic constants e.g. between Young Modulus of Elasticity, Poisson's Ration. Modulus of Rigidity and Buld modulus. Plain stress and Plain strain: Formulation of problem in two dimension. Airy's stress function. Polynomial and series solutions to the Biharmonic equations. Airys stress function in polar Coordinates. Solutions for displacements. Two dimensional problems will include the following: (1) Cantilever loaded at ends (2) Stress in a plate with a circular hole (3) Concentrated load on a semi infinite plate. Introduction to the general three –dimention problem in theory of Elasticity. Equations expressed in terms of displacements. Boussines's solution.

Theory of Plasticity: The stress strain curve. The ideal plastic body. Theories of failure and Criterion for yielding (plasticity conditions) Material, Reuss's and Henky's theories of plastic deformations work of plastic deformation. Two dimensional plastic flow problems: incompressible two dimensional flow, Stresses in plastic Materials in conditions of place strain. Eqilibrium equations referred to slip lines. The simples stop line fields. Example- strip load on a semi infinite body.

GEO 571 FINITE ELEMENT METHODS

Fundamental concepts: Introduction, stresses & equilibrium, Boundary conditions, Stuers-displacement relations, stuers strain relations, Galerkin method, St. Venant's principle. Matrix algebra & Gaussian Eliminaton, one dimensionals problems, Co-ordinates, Shape functions, Potential energy approach, Assembly of global stiffeners, Matrix & Load Vector, The finite Element equations and treatment of boundary conditions. Two Dimensional Problems: F. E. Modeling, Problem modeling & boundary conditions, Orthotropic materials Numerical Treatment of some geomechanical problems in two dimensions. Three dimensional Problems: Introduction to 3-D problems, Problem & boundary conditions development.

GEO 591 LABORATORY PRACTICE- II SOIL DYNAMICS

Laboratory Practice II, Soil Dynamics

This will include

1. Determination of cyclic/ dynamic soil parameters such as coefficient of elastic uniform compression, coefficient of elastic uniform shear, shear modulus, elastic modulus and damping ratio by block resonance test, cyclic plate load test, surface wave propagation test, cyclic Triaxial test and Standard penetration test etc.

2. Data interpretation and selection of appropriate value from the results of tests, salient features of different methods, merits and demerits

Reference

IS 5249-1992: Code of Practice for Determination of Dynamic properties of soils

IS 1888-1982: Code of Practice for Load test on soils

IS 2131-1981: Code of Practice for Standard Penetration Test

Soil dynamics by Swami Saran, Galgotia Public

viii) WATER RESOURCE ENGINEERING (M..TECH)

MTH511 ADVANCED MATHEMATICS

Elementary conformal mapping, conformal transformations of harmonic functions and boundary conditions, , solution of linear and non-linear equations, Runge-Kutta method, relaxation method, applications to problems of fluid mechanics, mathematical probability, probability distributions, quality control and acceptance sampling, estimation and testing hypotheses, variance analysis, collection and

representation of experimental data, numerical solution of ordinary differential equations, statistical methods of experiments planning

References

1. Probability and Statistics for Engineers — R.A. Jhonson,
2. Numerical Methods for Scientist and Engineers — H.M. Anita

WRE512 ADVANCED FLUID MECHANICS

Ideal fluid Flow: Two- and Three dimensional flow; Kinematics including super-imposition of flow; Conformal mapping and Schwartz-Christoffel transformations. Real-Fluid Flow: Viscous incompressible flow; Navier-Stokes equations. Classification and characteristics of turbulent flows, Reynolds equations, statistical theories of turbulence, Flow Between Parallel plates and in a pipe, turbulence models. Laminar and Turbulent boundary layer, Turbulence and Coherent structure of flow; Reynolds stresses; Skin friction; Form drag and Lift.

References

1. Fluid Dynamics — Daily J.W. and Harlaman, D R F
2. Turbulent Flow — Garde R. J..
3. Engineering Fluid Mechanics Vol. I — Narasimhan S.
4. Fluid Mechanics for Hydraulic Engineers — Rouse H
5. Boundary layer theory — Schlisting H. and Gersten K. ,

WRE 513 APPLIED HYDROLOGY

Hydrological processes, Mechanism, Atmospheric water vapour, computation and measurement of precipitation, evaporation, evapotranspiration, abstraction from precipitation., spatial and temporal distribution of rainfall. Unsaturated flow models- Horton's equation, Philips equation and Green-Ampt model, Computation of excess rainfall hyetograph from observed flood hydrograph, Green-Ampt infiltration equation and SCS method. Unit hydrograph theory, derivation of instantaneous unit hydrograph and synthetic unit hydrograph. Design flood PMT storm transportation, Tech. PMP and FPF for project by using conceptual models. Lumped flow routing, distributed flow routing models and dynamic wave routing. Hydrologic statistics and flood frequency analyses.

References

1. Applied Hydrology — Chow V T, Maidment David R. and Mays Larry W
2. Applied Hydrology — Mutreja K.N
3. Rainfall atlas — IMD
4. Engineering Hydrology — Subramanya K,
5. Elementary Hydrology — Singh Vijay. P,

WRE 514 LABORATORY

WRE 515 SEMINAR

Second semester

WRE 521 ADVANCED HYDRAULIC STRUCTURE

Planning and investigations of reservoir and dam sites. Forces acting on solid gravity dam, modes of failures, stability analysis, elementary and practical profile of gravity dam, internal stresses and stress concentrations in gravity dam, joints, seals, keys in gravity dams, dam safety and hazard mitigation. Homogeneous and zoned embankment dams, factors influencing design of embankment dams, criteria for safe design of embankment dam, steps in design of embankment dam, seepage analysis and its control through body and dam foundation, classification of rock fill dams and their design considerations. Arch

and buttress dams. Capacity of spillways, components and profile of different types spillways, Non conventional type of spillways, selection and design of energy dissipaters. Components of diversion head works and their functions, design of weirs and barrages on permeable foundations Canal regulation structures and design of cross drainage works, canal drops, operation and maintenance of canals. River Training works: Objectives of river training, river training methods, design . EIA for water resources .Review of codes of practice

References

1. Design of gravity dams USBR
2. Design of small dams USBR
3. Engineering for dams Creager W P, Justin J D and Hinds J
4. Hydraulics of spillways and energy dissipaters Khatsuria R M
5. Hydraulic Structures Novak P,

WRE522 WATER RESOURCES SYSTEM

Introduction: The nature of water resources systems.Water Resources Planning and Development: Steps of planning and development, Conjunctive use planning, planning for operation, Integrated planning and developments. System Analysis Techniques in Water Resources: Optimization, Linear programming, Dynamic programming, Simulation. Application of System Analysis in Water Resources: Applications of various optimization techniques to water resources engineering problems.Economic Considerations in Water Resources Systems: Basic principles of economics, Project feasibility and optimality, Cost allocation

References

1. Water Resources Systems Subhas Chander and Rajesh Prasad
2. Water Resources System Planning and Management S.K.Jain and V.P.Singh
3. Water Resources Systems S. Vedula and P. P. Majumdar
4. Water Resources System Planning and Analysis D.P.Loucks, J.R.Stedinger and D.A.Haith.
5. Design of Water Resources Systems A.Masses et al. Macmillan.

WRE 523 OPEN CHANNEL HYDRAULICS

Review of open channel flow concepts.Concept of specific energy, computation of critical flow, channel transitions, critical flow venturi-flume, standing wave flume and broad crested weir in discharge measurement.Hydraulic jump in open channel and its characteristics.Gradually varied profile and its computations using direct step method, advanced numerical methods, Location of hydraulic jump in GVF profiles, Delivery of canal systems.Unsteady open channel flow: Wave celerity, classification of water waves according to relative depth, orbital motions, superposition, wave trains and wave energy, transformation of waves, dissipation of wave energy. Positive and negative surges in rectangular channel.Governing equation for one dimensional, two dimensional unsteady flows and their solution by numerical techniques.Spatially varied flow: Basic principles and assumptions, dynamic equation and analysis of flow profiles, Numerical integration method, Isoclinal method, spatially varied steady and unsteady surface flows.

References

1. Open Channelflow Chaudhary Hanif M.
2. Flow through open channel Chow V T
3. Flow in open channels Subrmanya K

4. Flow through open channels Srivastava Rajesh,

WRE 524 LABORATRY

WRE525 SEMINAR 2

Department electives

WRE531 IRRIGATION & DRAINAGE ENGINEERING

Introduction, Kinds of soil water, Soil moisture constants, Measurement of Soil Water and Rooting Characteristics, Movement of Soil Water, Evapotranspiration, Estimation of Reference Crop Evapotranspiration from Climatological Data, Estimation of Crop Evaporatranspiration, Field Irrigation Schedules.Various methods of water application, Design criteria, Phases of Irrigation, Irrigation Efficiencies, Design of Basin, Border and Furrow irrigation methods. Sprinkler Irrigation System, Introduction, Type of sprinkler, Sprinkler irrigation system layout, Design and Evaluation of Sprinkler System. Drip Irrigation System, Introduction, Selection of emitter discharge and emitter spacing, Drip irrigation system layout, Design and Evaluation of Drip System.Principles of Drainage Engineering, Need and purpose of drainage, Surface drainage systems, Sub surface drainage systems, Water logging, Types of salt affected soils, Reclamation of salt affected soils, Drainage water use, conjunctive use. Soil Erosion and Conservation. Design of various types of soil conservation measures.

References

1. Irrigation and Water Resources Engineering, G.L. Asawa
2. Irrigation theory and practices A.M. Michael
3. Irrigation system design – An Engineering Approach Richard H Cuenca
4. Hand book of Irrigation Technology H.J. Finkel Vol.I,

WRE532 WATER SUPPLY DISTRIBUTION SYSTEM

Type of distribution systems, equivalent pipe, parameters in distribution system analysis, parameters interrelationship, formulation of equation. Gravity and Rising main, location and design principles. Analysis of water distribution system. Methods of analysis : (i) Hardy – Cross method (ii) Newton Raphson method and (iii) Linear theory method. Design and optimization of water distribution system: Design: Trial and error method of design, cost- head loss ratio method. Optimization using linear programming techniques.Surge analysis in water distribution systems, Pump duty stations and detailing valves.

References

1. Analysis of Flow in Water Distribution Network Bhave P R,
2. Optimal Design Of Water Distribution Networks, Bhave P R
3. Fluid Transients Streter V L and Wylie E D,

WRE 533 GEOTECHNICAL INVESTIGATIONS IN WATER RESOURCES PROJECTS

Problems and phases of foundation investigations; Methods of exploration, geophysical and conventional methods; Sounding, drilling and boring technique; Ground water table determination; Field tests – penetration tests, vane shear tests, pressuremeter test, plate load test, field permeability test, critical evaluation of different tests; Preservation and transportation of samples; Selection of type of laboratory tests, analysis and interpretation of results, Site evaluation and reporting.Suitability of soils for different water resources projects, Study of various relevant I.S. codes. Application of Remote sensing in geotechnical investigation.

References

1. Soil Mechanics & Foundation Engineering K.R. Arora.
2. Engineering for Embankment Dams, Bhart Singh & R.S. Varshney.

3. Soil Machines & Foundation Engineering V.N.S. Murti.

WRE534 INTEGRATED WATERSHED MANAGEMENT

Principles of watershed management through distributed hydrological modelling, soil water conservation practices, integrated planning, multidisciplinary approach, management of agricultural land, structural and non structural measures, erosion and soil salinity problems and controlling techniques, gully control, landslide and correction techniques, watershed modeling Application of remote sensing in water resources mapping, area assessment and watershed management Preparation of land drainage scheme, types and design of surface drainage as well as subsurface drainage in coastal and interior basins, types and design of water conservation and water harvesting structures for different types of catchments

References

1. Watershed management and Field manuals FAO
2. Watershed Management – Guidelines for Indian conditions Tideman, E. M.,

WRE 535 HYDRAULIC MEASUREMENT SYSTEMS

General characteristics of a measurement system, measurement system and stages, 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. 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. Measuremnt and Instrumentation Systems W. Bolton

WRE 536 FLOOD CONTROL AND RIVER TRAINING WORKS

Alluvial streams and their hydraulic geometry, bed level variation of alluvial streams, variation in plan form of alluvial streams, Analytical models of river morphology, Numerical models for morphological studies, flood plain analysis, morphology of some Indian rivers.Computational of peak floods, flood frequency analysis, Floods in major Indian river basins, types and design of flood forecasting and protection systems, operational hydrology, reservoir operation for flood control and management, flood damage estimation models.Guide lines for planning and design of river training works, Planning, design, construction and maintenance of river training works and bank protections for alluvial rivers. Application of Geo- synthetics in river training works.

References

1. Applied Hydrology Chow V T, Maidment David R and Mays Larry W
2. Mechanics of sediment transportation and alluvial streams problems Garde R J and Ranga Raju K G ,
3. River Morphology Garde R J Mays Larry W.,
4. Hydraulic Design Handbook Garde R J ,