ACADEMIC REGULATIONS
(UNDER-GRADUATE COURSES)

The students admitted in 2013-14 shall be governed by the relevant rules as indicated below:

1.0 DEFINITIONS

1.1 'Academic Year' or 'Academic Session' of the University shall ordinarily be between July to June and shall consist of two semesters.

1.2 'Semester' is an academic term of normally 18-20 weeks including examinations.

1.3 'Course' means a unit of instruction or a segment of a subject matter to be covered in a semester. Each course is assigned a specific number, title and credits.

1.4 'Credit Hour' also written as 'Credit' means the numerical weight allotted to the course, including its theory and practical parts. One credit will represent one hour of lecture and two to three hours of laboratory/field practical in each week.

1.5 'Grade point' is a numerical number which denotes students' performance in a course. It is obtained by dividing the percentage marks obtained by ten.

1.6 'Credit point' is the product of credit and grade point obtained by the student in a course.

1.7 'SGPA' (Semester Grade Point Average) is the average of the credit points of a semester.

1.8 'OGPA' is the overall cumulative grade point average obtained by the student in the courses taken in all the semesters completed by him/her.

1.9 'Year' means an academic session consisting of two semesters. Say, first year means the first academic session of the prescribed course of a degree programme. Similarly, second year, third year, and fourth year mean second, third and fourth academic sessions, respectively.

1.10 'Equivalent percentage' is the percentage obtained by multiplying grade point, SGPA, and OGPA respectively by ten.

2.0 THE PROGRAMME AND GRADUATION REQUIREMENTS

2.1 Minimum residential requirement and maximum period for all the programmes:

Minimum residential requirement	8 semesters
Maximum period for which a student can remain on the college roll	12 semesters

Note: In case a student does not complete his/her course work satisfactorily (5.0 OGPA out of 10) within the maximum prescribed period he/she shall no longer be a student of the university and the respective Dean of the college shall drop him from the college roll.

3.0 EXAMINATION

There shall be a main theory and/or practical examination conducted by the university at the end of each semester. The theory and practical examinations shall be of three hours duration except otherwise specified. Besides this, there will be a mid-term examination.

3.1 Mid-Term Examination:

A mid-term examination of 20 maximum marks shall be held after completion of about 50% syllabus in each course. The mid-term examination shall be of one hour duration.

"If a student misses the mid term examination due to any legitimate reason including deputation by the university, then he/she will be permitted to appear in a special mid term examination before the final examination". Only one special mid-term examination per course shall be conducted for all eligible students under this rule.

Students who are deputed by the university will have to submit the information in advance to the concerned department for awarding attendance.

3.2 The distribution of marks for the mid-term examination, final theory examination and practical examination shall be as follows:

Credit (Marks T/P)	Mid-Term Examination	Final (University) Examination		Total
		Theory	Practical	
1/2/3/4+1	20(T)	50	30	100
0+1/2/3/4	20(P)	-	80	100
1/2/3/4+0	20(T)	80	-	100
1+/2/3/4	20(P)	30	50	100

3.3 The distribution of marks for the final practical examination shall be as under

	Practical with Maximum Marks	**30**	**50**	**80**
(a)	Practical record and day-to-day assessment (Sessional work)	5	10	15
(b)	Practical exercises (may include any exercises as decided by the external examiner)	20	30	50
(c)	Viva-voce	5	10	15

3.4 Grading System

(i) A numerical grading system is followed for evaluation. Each course has a numerical weightage known as credit. The total marks obtained in each course (including its mid-term, theory and practical parts) are converted into percentage and divided by 10 to obtain the grade point for that course. The grade point when multiplied by the total course credit, gives credit points for the course.

(ii) Semester Grade Point Average (SGPA) is simply average of the credit points for a semester. The Overall Grade Point Average (OGPA) is the average for all courses upto the current semester.

If C_i and G_i are the credit and grade points for a course, then OGPA and SGPA are given by the following formulae:

$$\text{SGPA} = \frac{\sum C_i G_i}{\sum C_i} \quad \text{where the summation is for all courses in the semester}$$

$$\text{OGPA} = \frac{\sum C_i G_i}{\sum C_i}$$ where the summation is for all courses of preceding semester including the current one

(iii) The percentage equivalent of OGPA shall be determined by multiplying OGPA by ten.

(iv) The division of the under graduate student shall be determined by the OGPA at the end of successful completion of program as follows:

Division	OGPA
First	6.00 and above
Second	5.00 and above

3.5 Pass Requirements:

(i) Candidates are required to pass separately in final theory and/or practical examinations in each course

(ii) For a pass, a candidate is required to obtain at least 40% marks in each theory final examination as well as in each practical final examination and 4.00 grade point in the course.

(iii) The minimum OGPA required for degree is 5.00.

3.6 Promotion to Higher Classes:

(i) The promotion to next class shall be decided only at the end of an academic year.

(ii) A student will be promoted to higher class if he/she secures an OGPA as mentioned in the table below.

Year to which promotion is being Considered	**Minimum OGPA required for Promotion**
Second	4.00
Third	4.50
Fourth	4.75

(iv) A student who has been promoted to the first Semester of a class as a result of above rule, shall be automatically promoted to the second semester of that class regardless of the result of the year's first semester examination.

(v) If a student is not promoted to a higher class, he/shall become an ex-student of the failed class and has to clear the backlog and/ or improve his/her OGPA to be eligible for promotion.

(vi) Provisional Promotion **:**

(a) The Promotion will be provisional with the permission of Concerned Dean to higher class till the result of the previous semester is declared.

(b) Student has to register as per academic calendar, i e. Date of registration without late fee and date of registration with late fees would be applicable.

(c) Student has to give an undertaking that on declaration of result, if he/ she is not eligible, the registration would stand cancelled automatically.

(d) Student should have a minimum OGPA as per existing UG rules.

(e) Per-requisite courses, if any, have to be cleared prior to the regular courses.

3.7 Clearing of Backlogs and Repeating of Courses for Improvement of OGPA:

A. Clearing of Backlog:

(a) All the students with backlog (whether promoted or ex-students) shall have to appear in the examination of backlog courses in the main examination of the semester in which such courses are regularly offered. The student will be permitted to appear in backlog examination in failed part only whether it is theory or practical or both. He/she shall not be required to attend regular classes for such courses.

(b) Mid term marks obtained by a student will not be carried over for backlog examination and proportionate marks shall be awarded.

(c) The university shall conduct final examination as per current scheme of examinations. Students offered backlog courses would be required to appear in the equivalent course in the new programme. In case of variation in the course content, student has to do self preparation.

(d) If the backlog course is the result of being detained on account of shortage of attendance, the student has to appear in both theory and practical examinations by regularly offered courses or as a contact course, if time table adjustment is not possible

B. Improvement of OGPA:

(a) Student should apply to improve the OGPA within 11 days from the date of issue of mark sheet of last semester. They should surrender the original mark sheet issued to them and submit the same along with application form.

(b) A student would be given only one chance for improvement of OGPA.

(c) Student will be allowed to repeat two courses of his/her choice irrespective of grade obtained in the course (s) or semester, provided that the course is being offered as regular course in current semester.

(d) There will be a common examination for regular students and for those who have been offered courses for improvement.

(e) Students will not be issued PDC till the result of the courses offered for improvement is declared.

(f) The repeated course shall be marked as “Repeat” in the revised mark-sheet.

(g) In case PDC has been issued to the student he/she will not be eligible for improvement.

(h) The student would be required to pay regular semester fees if he/she wishes to attend the classes. Otherwise he/she shall be treated as Ex-student.

(i) The examination fee for courses offered for improvement will be Rs. 1000.00 (Rupees one thousand only) per paper irrespective whether it is a regular course or a special paper.

(j) The student has to submit an undertaking that the marks obtained in the examinations taken for improvement will replace the marks obtained in the original examination of the paper(s), if he/she gets more than previous result.

(k) In case a student fails in the improvement course, he/she will be awarded minimum pass marks in that paper.

(l) Mid term marks in improvement courses: In such cases, the student will be awarded proportionate marks based on marks obtained in final examination.

3.8 Special Backlog Examination:

A. In case student has completed 8th Semester and has backlog in only one course:

(i) Special examination will be conducted earliest possible after the declaration of semester result i.e. September/ October of 1st semester of the academic year for only that course.

(ii) Student will be charged fee as prescribed by the university, irrespective of whether it is a regular course or a special paper.

(iii) Student has to apply for special examination within 11 (eleven) days of declaration of result of 8th semester, failing which his/her application will not be considered.

(iv) If a student fails in a special paper examination, he/she would be allowed to reappear with regular examination of next semester only i.e. once in a semester.

B. In case a student has completed 8th semester and has got backlog of up to 6 courses irrespective of semester:

(i) Backlog examination will be conducted along with regular examination of the semester.

(ii) If regular examination is being conducted for a particular paper, he/she would have to pay normal fee for that paper and special fee of Rs. 1000/- per paper will be charged for the course which are not listed for conducting the examinations in that semester.

(iii) If a student does not clear one or more backlog course, he/she will have to appear as Ex-student along with regular examination in the next semester and fee will be charged at regular rate, if the courses are listed for conducting the examination in that semester, otherwise, special fee of Rs. 1000/- will be charged

C. Other rules like maximum number of semesters, minimum passing marks, etc will be applicable as per rules.

3.9 Re-evaluation for answer book:

(i) (a) Re-evaluation is permissible only in Theory paper of semester's final examination.

(b) Re-evaluation is not permissible in the Answer book of unfair means case (s)

(ii) The candidate may apply for re-evaluation within 11 days of the issue of the mark sheet on the prescribed form through Head of the institution depositing required fee and original mark-sheet. Incomplete and late submitted application shall not be considered.

(iii) The re-evaluation fee per paper shall be as prescribed and will not be refundable on any pretext.

(iv) Re-evaluation shall be done by an examiner of the subject to be appointed by the Vice Chancellor.

(v) If the marks obtained after re-evaluation increase / decrease within 20% of the maximum marks prescribed for the paper, the same will be taken as marks obtained after re-evolution. However, if the marks awarded by the re-evaluation increase /decrease by more than 20% of maximum marks prescribed for the paper then the answer book will be referred to the second re-evaluation and the average of two closest awarded marks (the middle award in case the three awards if uniformly spread) shall be taken as the marks obtained after re-evaluation and shall be awarded. However, a student who was declared Pass prior to re-evaluation and fails after re-evaluation, shall be awarded minimum pass marks.

(vi) Marks awarded after re-evaluation of the paper will be considered for award of merit.

(vii) (a) No one shall be admitted in the next higher class and considered for any beneficial claim only on account of submission of application of the re-evaluation of Answer Book(s) in the office.

(b) A student becoming eligible for admission on account of result of re-evaluation may be admitted in next higher class without late fee. He will be required to pay full fees for the year within 7 days of declaration of the result. Attendance in such case shall be counted from the date of admission.

3.10 Moderation of Results:

The result committee shall also act as Moderation Committee to review the results for the normal distribution of marks, the percentage of pass and failure. Any moderation suggested in a paper shall be uniformly applied to all the students registered in that paper, with the approval of the Vice Chancellor. Any moderation effected should not be more than 10 % of maximum marks in a paper. However, if after moderation or otherwise, if a student is failing only by one mark in a paper, Controller of Examinations may award one grace mark to pass the student in that paper.

4.0 GENERAL RULES PERTAINING TO EXAMINATIONS

4.1 A student who has been deputed by College/University authorities to represent at a national/international meet/ championship/tournament/extra curricular activities, does not appear in the final examination due to such participation, may be permitted to take missing paper(s) at next main examination, when such course(s) are regularly offered as a special case. He/she, however, will be required to seek prior permission from the Vice-Chancellor.

4.2 No special examination shall be held for students who miss the examination on account of police custody, court attendance or fail to attend for other reason, whatsoever.

4.3 Examinations will not be postponed due to failure of electricity.

4.4 The boycotted and walked out papers shall not be recounted. This authority rests only with the Chancellor of the university.

5.0 PRACTICAL WORK EXPERIENCE REQUIREMENTS

After successful completion of all the courses including practical trainings with minimum OGPA of 5.0, a student will become eligible for the degree.

Details of practical training (Training in factory, workshop, mine, engineering works/design, office etc.) which students are to undertake in different degree programmes are given below:

	Branch of Engineering	Duration	Year
(a)	Agriculture*	30 + 30 = 60 days	At the end of II & III year
(b)	Mechanical	30 + 30 = 60 days	- do -
(c)	Mining**	30 + 30 = 60 days	- do -
(d)	Electrical	30 + 30 = 60 days	- do -
(e)	Computer Science & Engg.	30 + 30 = 60 days	- do -
(f)	Electronics & Communication	30 + 30 = 60 days	- do -
(g)	Information Technology	30 + 30 = 60 days	- do-
(h)	Civil Engineering	30 + 30 = 60 days	- do-

* *In addition to the above 2 months training programme, the agricultural engineering graduates have to undergo experiential learning or Hands-on training (4 month) in the second semester of final year BE.(Ag.).*

In order to take policy decision and to solve the operational and administrative bottleneck, if any, there shall be a college level committee consisting of the followings. The committee will guide in selection of cafeteria courses and experiential learning/project.

Senior most Head of the Department	-	*Convenor*
Heads of concerned Department	-	*Member*
Training Officer	-	*Member*
Class Advisor of IV year	-	*Member*

Procedure for evaluating the students on all the above practical trainings will be followed as prescribed.

** *The Mining Engineering students shall have to undergo 12 days mining camp at the end of I semester of II year and 12 days survey camp at the end of I semester of III year, in addition to 60 days practical training.*

6.0 ATTENDANCE REQUIREMENTS

6.1 The student shall be permitted to appear in the university main examination only if a minimum attendance of 75% is maintained separately in theory and practical in each course from the date of registration in that course. However, in NCC/NSS/NSO the minimum attendance requirement would be 65%. In case of sickness or any other valid reasons, the vice-chancellor may condone the attendance to an extent of 10%.

6.2 A student who is short of attendance in one or more courses will be detained form appearing in the final semester examination of all such course(s) and will be awarded zero grade point. Such courses shall be denoted by letter ‘‘DE’’ in the mark sheet.

6.3 En-mass absence shall be treated as absent in the attendance record of the students and will be charged a fine of Rs. 2000/- on en-mass cutting of the classes for more than 3 days.

6.4 If a student absents continuously for 7 working days in a semester in any subject, his/her registration in the semester will be cancelled and parents informed accordingly. Such students will be provided an option for re-admission in the course/programme within 7 days of the cancellation of their registration by paying a fee of Rs. 500/-.

6.5 If a student who has been admitted to the 1st semester of a programme and fails to attend the classes continuously for a period of 30 days without the permission of the Dean of the college, the name of such a student will be removed from the college roll. No petition is permitted in this case. He/she may have to seek re-admission as a fresh candidate.

6.6 If a regular student of the college in subsequent semester fails to register on schedule time or fails to attend the class after registration continuously for 30 days without the permission of the Dean of the college, the student will be removed from the college roll and parents informed accordingly. A student so removed may apply to the Dean within 15 days of his/her removal for reconsideration for re-registration in the next academic session, giving valid and strong reasons for failing to take permission. His removal may be revoked, provided that, his/her advisor is satisfied with the performance of the student and the same is approved by the Dean. The period of removal shall be counted towards the number of semester, though no grade/marks would be awarded for this semester.

7.0 ADVISORY SYSTEM

Student will be required to report to the respective class advisors for getting registration form and examination form for the purpose of registration. Class advisors will also be responsible for distribution of marksheet obtained from the university.

8.0 SYMBOLS AND THEIR MEANING

Following symbols would be used to designate the status of the student:

Symbol	Significance
F	Fail
DE	Detained
UM	Unfairmeans
R	Repeat

Note - *All such courses which are cleared by repeating the same or repeated for improvement of OGPA to bring it to the minimum required level shall be marked by letter 'R' in the transcript.*

9.0 WITHDRAWAL FROM SEMESTER

(a) A student shall be permitted to withdraw from a semester only two times in the degree programme, on the grounds of ill-health and personal exigencies subject to the condition that the reasons for withdrawal are convincing. For this the student has to submit a written request at least one week prior to the commencement of the main examination of the semester from which the student wants to withdraw.

(b) A student who has withdrawn from a semester has to join the same semester during next year.

(c) The period lost due to withdrawal (one year for one withdrawal) shall not be counted towards maximum permissible period for which a student can remain on the college roll.

10.0 EXAMINATION OF PRACTICAL TRAINING, PROJECT AND SEMINAR

(a) For the examination of practical training (including industry visit, mining camp, survey camp, etc.) there will be an internal board appointed by the Dean. The board will comprise of concerned Head of the Department as chairman and one or two teachers of the concerned department(s) as members. The marks will be awarded on the basis of work report, practical record, quiz. viva-voce, etc. and added to the marks list in the Final year's examination.

(b) For project viva-voce examination there shall be a Board of examiners consisting of project committee and one/two external examiners. The concerned Head of the Department will be the Chairman of the committee. However, in Agriculture Engineering discipline, the Chairman will be the Project Chairman. The Chairman will then nominate two teachers as members. The Board may meet in one or two meetings according to the availability of external examiner(s). A candidate will be assessed for the work done during semester by the Project Advisor and the Project Committee.

As the project is assigned in the first semester of the final year and the student works on it during both the semesters the assessment of the project shall be done in both the semesters. The internal viva-voce of first semester and both the seminars shall be assessed by the Project Committee. However the marks shall be counted in the second semester only. The distribution of marks shall be as follows :

Particulars	I Semester	II Semester	Total
Day-to-day assessment by the major advisor	15	20	35
Seminar	10	15	25
Viva-voce	10 (Internal)	30 (External)	40
TOTAL	35	65	100

(c) For seminar, wherever prescribed as a course of study, there shall be a board of examiners consisting of the Head of the Department as chairman and two teachers of the department.

11.0 CHANGE OF BRANCH OF STUDY IN SECOND YEAR B.TECH.

The students, in the second year, can avail one opportunity to change their branch of study on merit basis in accordance with rules framed by the university from time to time.

12.0 ADMISSION OF DIPLOMA STUDENTS IN SECOND YEAR B.TECH.

The diploma holders from the Board of Technical Education, Rajasthan with 10+2 qualification can seek direct admission in second year B.Tech. The number of seats, admission procedure, educational and other requirement would be as specified by the Government and/or approved by the university from time to time.

13.0 GRADUATION REQUIREMENT AND AWARD OF DIVISION

(a) A student shall be awarded degree only if he has passed all the courses and completed other requirements prescribed for the programme and secured an OGPA of 5.00 or above.

(b) The division of the student shall be determined by the OGPA at the end of successful completion of the program as follows :

Division	OGPA
First	6.00 and above
Second	5.00 and above

SCHEME OF TEACHING AND EXAMINATION

(Electrical Engineering)

First Year B.Tech. (Common for All Branches)

I-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 111	Mathematics - I	3	0	3	0	0	80	-	20
ME 113	Mechanical Engg. - I	3	0	3	0	0	80	-	20
ME 114	Workshop Practice	0	1	0	0	3	0	80	20
CE 115	Engineering Drawing	0	1	0	0	3	0	80	20
	NCC/NSS/NSO[1]	-	-	0	0	2	-	-	-
GROUP I									
BS 100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engg. - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
GROUP II									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill	1	1	1	0	2	50	30	20
	Total	15	6	15	0	16	-	-	-
Total Credits/Hours/Marks		**21**		**31**			**800**		

[1] NCC/NSS/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

[2] The examination (Theory and Lab) shall be conducted internally by the college.

Note: *The courses BS 100P, CE 100, EE 100, ENVS 100, BS100C, EC 100, CS 100 and BS 100E shall be offered in both the semesters. The students will be divided in two groups in I semester itself and shall remain in the same group in II semester as well. However, they have to offer all the eight courses in first year.*

II-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 121	Mathematics - II	3	0	3	0	0	80	-	20
CE 122	Civil Engineering	1	1	1	0	2	50	30	20
ME 123	Machine Drawing - I	0	1	0	0	3	0	80	20
ME 124	Workshop Technology	2	1	2	0	3	50	30	20
	NCC/NSS/NSO[1]	-	-	0	0	2	-	-	-
GROUP I									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill	1	1	1	0	2	50	30	20
GROUP II									
BS100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engineering - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
	Total	15	7	15	0	18	-	-	-
Total Credits/Hours/Marks		**22**		**33**			**800**		

[1] NCC/NSS/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

SECOND YEAR B.Tech.

III-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 211 (All Branches)	Mathematics-III	3	0	3	0	0	80	0	20
EE 211	Circuit Theory-I	3	1	3	1	2	50	30	20
EE 212 (EE,CS)	Electrical Measurements & Instruments	3	1	3	0	2	50	30	20
EE 213	Electrical Workshop	0	1	0	1	2	-	80	20
EC 212 (EE)	Electronics-I	3	1	3	0	2	50	30	20
EC 216 (EC, EE)	Digital Electronics	3	1	3	0	2	50	30	20
CE 211 (AE, EE, MI)	Strength of Materials	2	1	2	1	2	50	30	20
	NSS/NCC/NSO[2]	-	-	0	0	2	-	-	-
	Total	17	6	17	3	14	-	-	-
Total Credits/ Hours/ Marks		**23**		**34**			**700**		

T - Tutorials do not carry any credit

IV-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 221 (EC, EE, ME, MI)	Mathematics-IV	3	0	3	0	0	80	0	20
EE 221	Circuit Theory-II	3	1	3	0	2	50	30	20
EE 222	Power System-I	3	1	3	0	2	50	30	20
EE 223	Electrical Machine-I	3	1	3	0	2	50	30	20
EE 224	Electrical Computation	0	1	0	1	2	0	80	20
EC 225 (EE)	Electronics-II	3	1	3	0	2	50	30	20
ME 223 (EE, MI)	Mechanical Engineering-II	2	1	2	0	2	50	30	20
	NSS/NCC/NSO[2]	-	-	0	0	2	-	-	-
	Total	17	7	17	1	14	-	-	-
Total (Credits/Hours/Marks)		**24**		**32**			**700**		

T - Tutorials do not carry any credit

[2] NSS/NCC/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: *Students have to undergo a practical training of 30 days at the end of IV semester for which assessment will be made at the beginning of the next semester.*

THIRD YEAR B.Tech.

V-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 311 (EE)	Mathematics-V	2	0	2	1	0	80	0	20
EE 311	Power System-II	3	1	3	0	2	50	30	20
EE 312	Power Electronics-I	3	1	3	0	2	50	30	20
EE 313	Electrical Machines-II	3	1	3	0	2	50	30	20
EE 314	Control System-I	3	1	3	0	2	50	30	20
EE 315	Computer Architecture & Industrial Control	3	1	3	0	2	50	30	20
	Total	17	5	17	1	10	330	150	120
Total Credits/Hours/Marks		**22**		**28**			**600**		

T-Tutorials do not carry any credit

VI-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 321 (EE)	Mathematics-VI	2	0	2	1	0	80	0	20
EE 321	Electromagnetic & Field Theory	3	0	3	0	0	80	0	20
EE 322	Power Electronics-II	3	1	3	0	2	50	30	20
EE 323	Instrumentation	3	1	3	0	2	50	30	20
EE 324	Control System-II	3	1	3	0	2	50	30	20
EE 325	Electrical Engineering Materials	3	0	3	0	0	80	0	20
EE326	System Design and Simulation Lab	0	1	0	1	2	0	80	20
	Total	17	4	17	2	8	390	170	140
Total Credits/Hours/Marks		**21**		**27**			**700**		

T-Tutorials do not carry any credit

Note: *Students have to undergo a practical training of 30 days at the end of VI semester for which assessment will be made at the beginning of the next semester.*

FOURTH YEAR B.Tech.

VII-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
EE 411	Electrical Machine Design	3	1	3	0	2	50	30	20
EE 412	Electric Drives and Control	3	1	3	0	2	50	30	20
EE 413	Elect. Engg. Economics and Management	3	0	3	0	0	80	0	20
EE 414	Electric Energy Systems Theory	3	0	3	0	0	80	0	20
EE 415	Generation of Electrical Power	3	0	3	0	0	80	0	20
EC 413 (EE)	Communication Engineering	3	0	3	0	0	80	0	20
EE425	Project[1]	0	-	0	0	4	-	-	-
	Total	18	2	18	0	8	420	60	120
Total Credits/Hours/Marks		**20**		**26**			**600**		

[1] The topic for the project (EE425) will be allotted in the VII semester but assessed in both the semesters. The total credits will however be counted in the VIII semester.

VIII-SEMESTER

Course No.	Title	Credit		Hours per week			Marks		
		Th.	P	L	T	P	Th.	P	MT
EE 421	Advanced Power System	3	0	3	0	0	80	0	20
EE 422	Neural & Fuzzy based Control System	3	1	3	0	2	50	30	20
EE 423	Elective-I	3	0	3	0	0	80	0	20
EE 424	Elective-II	3	0	3	0	0	80	0	20
EE 425	Project[1]	0	8	0	0	12	0	100	-
EE 426	Practical Training, Industrial Visit	0	4	0	0	0	0	100	-
EE 427	Seminar	0	2	0	0	4	0	100	-
	Total	12	15	12	0	18	-	-	-
Total Credits/Hours/Marks		**27**		**30**			**700**		

[2] The marks of the practical trainings conducted during summer breaks (at the end of IV and VI semester) will be considered in VIII semester out of 90 marks. The industrial visit will be assessed out of 10 marks. If the tour does not undergo, the trainings will be assessed out of 100 marks.

ELECTIVE – I

EE 423 (a)	Utilization of Electrical Power
EE 423 (b)	Robot Control and Sensing
EE 423 (c)	Non-Linear System
EE 423 (d)	Biomedical Instrumentation
EE 423 (e)	Optimal Control Theory

ELECTIVE – II

EE 424 (a)	Power System Reliability
EE 424 (b)	High Voltage Engineering
EE 424 (c)	Electro-Mechanical Energy Conversion
EE 424 (d)	Power System Dynamics
EE 424 (e)	Modern Control Theory
EE 424 (f)	Microwave Engineering
EE 424 (g)	Distributed Control System

Note: *The students have to take one elective each out of the lists (Electives I & II) given. However, the elective may not be offered if faculty expertise is not available or a minimum of 10 students do not opt for a particular elective.*

COURSE CONTENT

FIRST YEAR B.TECH. (I SEMESTER)

BS 111 MATHEMATICS – I

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Taylor's and Maclaurin's expansions; Asymptotes, Curvatures, Simple curve tracing.

Unit-II

Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions and total differential coefficient; Jacobians; Error and Approximations.

Unit-III

Double and Triple integrals; Change of order of integration; Rectification of standard curves; Volumes and surfaces of revolution of curves.

Unit-IV

Differential equations of higher order with constant coefficients: Methods of finding complementary functions and particular integrals; Homogeneous equations with constant and variable coefficient.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

ME 113 MECHANICAL ENGINEERING – I

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Thermodynamics: Thermodynamic properties, closed and open systems, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of First Law in heating and expansion of gases in non-flow processes. First Law applied to steady flow processes.

Second law of thermodynamics: Kelvin-Planck and Claussius statements. Reversible processes, Carnot cycle, Carnot theorem. Entropy, physical concept of entropy, change of entropy of gases in thermodynamic processes.

Unit-II

Properties of Steam: Difference between gas and vapour, change of phase during constant pressure process. Generation of Steam, triple point and critical point. Internal energy and entropy of steam. Use of steam tables and Mollier chart, heating and expansion of vapour in non-flow processes, measurement of dryness fraction.

Unit-III

Vapour Power Cycles: Introduction, Carnot Cycle. Desirable properties of working fluid used for power plants. Rankine cycle. Expansive and non expansive working.

Steam Generators : Classification of steam boilers. Cochran, Lancashire, locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

Steam Engines: Introduction to simple and compound steam engines, saturation curve and missing quantity, governing.

Unit-IV

Gas Power Cycles: Introduction. Air Standard efficiency, other engine efficiencies and terms. Otto, diesel and dual cycles. Calculation of efficiency, mean effective pressure and their comparison.

Internal Combustion Engines: Introduction. Classification, terminology and description of IC Engines. Four stroke and two stroke petrol, gas and diesel engines. Valve timing diagrams. Comparison of petrol and diesel engines. Simple carburettor. Ignition system of SI engine, diesel fuel pump and injectors.

Text Books/References

1. M. L. Mathur and F. S. Mehta. Thermal Engineering, (Vol. I, SI Edition), Jain Brothers, New Delhi.
2. R. K. Purohit. Thermal Engineering. 2nd Ed., Scientific Publishers, Jodhpur.

ME 114 WORKSHOP PRACTICE

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Carpentry Shop: Acquaintance with types of wood, tools and their uses. Simple exercises involving basic operations like sawing, planning, chiselling, etc. Preparation of simple joints, cross half lap joint, dovetail joint, bridle joint, tennon and mortise joint.

Smithy Shop: Acquaintance with types of tools and their uses. Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting, and riveting.

Fitting Shop: Acquaintance with tools, measuring and marking tools, precision measuring tools and their uses. Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.

Sheet Metal and Plumbing Shop: Demonstration of basic tools, pipe fittings and operations.

Texts/References

1. S. K. Hajra Choudhury and AK Hajra Choudhury. Elements of Workshop Technology (Vol. I), Media Promoters & Publishers Pvt. Ltd., Bombay.

CE 115 ENGINEERING DRAWING

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Introduction and letter writing. Construction and use of plain, diagonal and vernier scale. Methods of drawing ellipse, parabola and hyperbola. Methods of drawing cycloids, spirals. Orthographic projection and projection of points.

Projection of lines, projection of planes, projection of solids. Introduction of prism, pyramid, cylinder and cone.

Section of solids, introduction of intersection of surfaces. Development of plane and curved surface. Isometric projection.

Text/Reference

1. N.D. Bhatt. Elementary Engineering Drawing, Rupalee Publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, Satry Prakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

BS 100P ENGINEERING PHYSICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Unit-I

Electric Field: Line integral of electric field, Potential difference, Field as gradient of potential, Divergence of a vector function, Differential form of Gauss's law, Laplacian, Laplace equations, Curl of a vector function. Gauss's divergence theorem.

Magnetic Field: Curl and Divergence of a magnetic field, Magnetic scalar and vector potential.

Unit-II

Varying Field: Faraday's law-integral and differential form, Self and mutual inductance, Neumann's equation, Charge and discharge of a capacitor through register, Growth and decay of current in LR circuit, Energy stored in electric and magnetic field, Displacement current, Maxwell's equations.

Unit-III

Laser: Coherence, Einstein's coefficient, Spontaneous and stimulated emission, Population inversion, Laser gain (pumping), Spectral narrowing in laser, Coherence length, Ruby and He-Ne laser.

Interference: Division of amplitude, colour of thin films, Newton's ring, Febry-Perot interferometer-principle, operation, determination of wave length and difference in wave length.

Unit-IV

Diffraction: Double slit Fraunhofer diffraction pattern, Fraunhofer diffraction by a plane transmission grating, Formation of spectra.

Polarization: Analysis of linearly, circularly and elliptically polarized light (Half wave and quarter wave plates), Optical activity, specific rotations, Laurent's half shade and its use for determination of specific rotation of sugar solution.

Practicals

1. To find refractive index and dispersive power of material of prism by spectrometer.
2. To find wave length of light by Newton's ring.
3. To find wave length of light by diffraction grating.
4. To find specific rotation of sugar solution by polarimeter.
5. To find wave length of light by Fresnel Biprism.

6. To find frequency of A.C. mains.
7. To determine dielectric constant of liquid using series resonance method.
8. To study charge and discharge of condenser through a resistor (C.R. Circuit).
9. To study LCR resonant circuit, resonance, quality factor and sharpness in (i) series circuit (ii) parallel circuit.

Text Books/References

1. K.K. Tiwari. (1995). Electricity and Magnetism, S. Chand and Company, New Delhi.
2. N. Subrahmanyam and Brijlal. (1993). A Text Book of Optics, S. Chand and Company, New Delhi.
3. Ahmed and Lal. (1966). Electricity, Magnetism and Electronics, Unitech House, Lucknow.
4. D.S. Mathur. (1993). Mechanics, S. Chand and Company, New Delhi.
5. Gupta and Kumar. (1995). Practical Physics, Pragati Prakashan, Meerut.

CE 100 ENGINEERING MECHANICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.

Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium

Practical Applications: Levers, Cracked levers, Steel yards. Sagging chains and toggle joints.

Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.

Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw jacks, Rolling friction.

Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double purchase crab, Worm and Worm wheel, System of pulleys.

Frames: Statically determinate plane frames, Method of joints, Method of sections, Graphical method.

(B) DYNAMICS

Unit-III

Rectilinear Motion, Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.

Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practicals

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound level.
3. Verification of principle of moment in case of bell crack level.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of different wheel and Axle.
8. Study of single purchase crab.
9. Study of worm and worm wheel.
10. Study of Weston's pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single purchase crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double purchase crab.

13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys Flywheel.

Text Books/References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, Satya Prakashan, New Delhi.

EE 100 ELECTRICAL ENGINEERING – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

D.C. Networks: Kirchoff's law, node voltage and mesh current methods, delta-star and star delta transformation, source conversion; solution of DC circuits by network theorems: Thevenin's, Norton's, superposition, Reciprocity and Maximum Power Transfer theorem.

Unit-II

Single Phase A.C.Ciruits : Single Phase EMF generation, average and effective values of sinusoidal and linear periodic wave forms, instantaneous and average power, power factor, reactive & apparent power, solution of R-L-C, series, parallel, series-parallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

Three Phase A.C., Circuits : Three phase EMF generation, delta and star-connection, line and phase quantities, solution of the 3- phase balanced circuits, Phasor diagram, measurement of power in three phase balanced circuits.

Transformer: Faraday's laws of Electromagnetic induction, construction and principle operation of single phase transformer, EMF equation, voltage and current relationship and Phasor diagram for ideal transformer.

Unit-IV

Electrical Measuring Instruments : Introduction; type of measuring Instruments, Deflecting controlling & Damping Torque, D.C. PMMC instruments, shunts and multipliers, Moving iron ammeters and voltmeter, Dynamometers wattmeter, Induction type energy meter.

Practicals : Based on theory

Text Books/References

1. B. L. Therja. Electrical Technology, S. Chand
2. M.E.Van Valkenberg. Network analysis, PHI
3. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher
4. R.A. Gupta and Nikhal Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH, Ist Edition,
5. H.P. Tiwari. (2002). Electrical & Electronics Engineering, College Book Centre, Jaipur.
6. J.B. Gupta. (2002). Fundamentals of Electrical & Electronics. S.K. Kataria and Sons. Dehli.

ENVS 100 ENVIRONMENTAL STUDIES

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Unit–I

The Multidisciplinary nature of environmental studies:

Definition, scope and need for public awareness. Environmental problems and their consequences

Natural Resources:

Renewable and non-renewable resources
Natural resources and associated problems

a) Forest resources: Use over-exploitation, deforestation, and case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams, benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land and a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use resources for sustainable lifestyles.

Unit-II

Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem.

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rovers, oceans, estuaries)

Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, and aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III

Environmental Pollution

Definition, Causes, effects and control measures of: -

Air pollution

Water pollution

Soil pollution

Marine pollution

Noise pollution

Thermal pollution

Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of

pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

Unit-IV

Social Issues and the Environment - From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment

Population growth, variation among nations, Population explosion- Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Practicals

Visit to river, forest, hill, mountain, local polluted plant, pond ecosystem

Text Books/References

1. K. C. Agarwal. (2001). Environmental Biology, Nidi Publications, Bikaner.
2. B. L. Chaudhary and Jitendra Pandey. (2005). Environmental Studies, Apex Publishing House, Udaipur.
3. H Jhadav & V. M. Bhosale. Environmental Protection & Laws, Himalaya Pub. House, Delhi
4. M. N. Rao and A. K. Datta. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
5. B. K. Sharma. Environmental Chemistry. Goel Publishing House, Meerut
6. Pratap Singh, N. S. Rathore and A. N. Mathur. (2004). Environmental Studies.
   Himanshu Publications, Udaipur.
7. R. K. Trivedi and P. K. Goel. Introduction to Air Pollution, Techno Science Publications.

BS 100C ENGINEERING CHEMISTRY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Unit-I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sedimentation, sterilization, break point chlorination. Hardness, determination of hardness by Complixemetric (EDTA) method, degree of hardness, chloride, dissolved oxygen, carbon dioxide and sulphate, control of pH of water used in industry, Boiler troubles, carry over corrosion, Sludge and scale formation. Caustic embrittlement, cause of boiler troubles and their prevention.

Unit-II

Classification of fuels, solid fuels, coal origin and its classification, Proximate and ultimate analysis of coal, significance of constituents, Gross and net calorific values. Liquid fuels- advantages, Petroleum origin, classification, Refining of Petroleum, Gasoline, knocking, octane number, anti knock agents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit-III

Corrosion: Definition and its significance, theories of corrosion, protection of corrosion use of inhibitors and passavasion, Alloying protective coatings -Metallic, inorganic and Organic.

Refractories: Definition, Properties, Classification. Properties of Silica and Fireclay refractories.

Unit-IV

Chemical Kinetics- Order and Molecularity of reaction, first and second order reaction, Derivation of equations for first and second order reaction, determination of order of reaction, Energy of activation and Arrhenius equations, Numericals of first and second order reactions.

Practicals

1. Determination of viscosity of a liquid.
2. Determination Surface Tension of a liquid by Stalagmometer method.
3. Determination of carbonate and non carbonate hardness by soda reagent method.
4. Determination of temporary and permanent hardness by EDTA method.
5. Estimation of free chlorine in a water sample.
6. Determination of copper sulphate iodometrically.

7. Estimation of potassium dichromate iodometrically
8. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
9. Determination of Potassium Dichromate using Potassium Ferrycyanide as an external indicator.
10. Estimation of available chlorine in bleaching powder sample
11. Analysis of Brass
12. Analysis of Iron ore
13. Analysis of Pyrolusite
14. Analysis of common salt.

Text Books/References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai & Sons, Nai Sarak, Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry, Jaipur Publishing House.
3. B.K. Sharma. Engg. Chemistry, Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand & Co., New Delhi.
5. M.A. Uppal. A Text Book of Engineering Chemistry, Khanna Publishers, Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations Engg. Chem. Ram Nagar, Delhi.
7. S.K. Banerji and S.K. Jain. Hand Book of Technical Analysis, Jain Brothers, New Delhi.

EC 100 ELECTRONICS AND INSTRUMENTATION

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Passive Components: Construction and characteristics of carbon composition, wire wound and film resistors. Potentiometer, color codes and rating of resistors. Characteristics and rating of capacitors for electronics circuits.

Semi conductor: Basic electrical characteristics of semi conductors. Theory of p-n junction. Characteristics and ratings of junction diodes.basics of zener diode, photo diode and LED.

Unit-II

Bipolar Junction Transistor: npn and pnp transistors,, Various configurations (CB, CC,CE) of BJT. Transistor biasing (Fixed, self, potential dividers) Basic classification of amplifier (Voltage and power amplifier). Basic concept of Class A, B , AB and C amplifiers.

Unit-III

Generation of waveforms: Concept of positive and negative feed back. Introduction of oscillators like R-C , L-C and Crystal oscillators.
Power supply: Circuit configuration and analysis of Half wave , Full wave and Bridge rectifier .Basic concept of regulation, Zener diode voltage regulator.,Transistor serier regulator.

Unit-IV

Transducers: Definition, classification : Active and passive transducer, primary and secondary transducers, Analog and digital transducers. Measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples, bourden tube, LVDT, strain gauge and techogenerator.

Practicals : Based on theory

Text Books/References

1. Millman and Halkias. Integrated elecronics: Mc Graw Hill
2. W.D Cooper. Electronics Instrumentation and Measurement : PHI
3. M.L.Gupta. Electrical Engineering Materials
4. Malvino. Principles of Electronics
5. Jhon D. Ryder. Electronics Fundamentals

CS 100 INTRODUCTION TO COMPUTER PROGRAMMING AND DATA STRUCTURE

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit–I

Computer Fundamentals: History of Computers; Organization of Computers: input unit, output unit, Storage Unit, Arithmetic Logic Unit, Central Processing Unit; CPU Operation; Memory Subsystem: RAM, ROM, Cache Memory & memory Hierarchy; Instruction Format and Instruction Execution Cycle; Number System & Codes: Binary, Decimal, Octal & Hexadecimal Number System, Conversion from one number system to another, sign magnitude, 1's Complement & 2's Complement representation of numbers; Numerical & Character codes: BCD, Excess – 3, Gray, ASCII & EBCDIC Codes.

Unit-II

Basics of Programming in C: Constants, Variables and Data Types, Operators and Expressions, Input and Output operations, Decision making & Branching: if-else, switch statement; Decision making and looping; Arrays.

Unit-III

Character Arrays & strings, User defined function, Structures & Unions, Pointer Management, Dynamic Memory allocation & linked lists.

Unit–IV

Introduction to Data Structures : Introduction to Linear Arrays & Representation of Linear Array in Memory, Traversing, Insertion & Deletion in Linear arrays, Bubble Sort, Linear & Binary search; Introduction to linked list – Representation of linked list in memory, Traversing, Searching, Insertion & Deletion in a linked list.

Practicals : Based on Theory

Text Books/References

1. E. Balagurusamy. "Programming in ANSI C", Tata McGraw Hill.
2. Kernighan and Ritchie. "The C Programming language", Printice Hall
3. P.M. Jat. "Programming with C", Apex Publishing House, Jaipur.
4. Dharm Singh. "Fundamentals of Compute Organization", Paragon International Publishers, New Delhi.
5. P.K. Sinha & P. Sinha. "Computer Fundamentals", BPB Publication.
6. Seymour Lipschutz. "Data Structure", Schaum's outline series, McGraw Hill.

BS 100E ENGLISH AND COMMUNICATION SKILL

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Unit –I

Grammar and Usage : Tenses, Agreement of Subject and verb, Passive Voice, Basic Sentence Patterns, Prepositions, Phrasal verbs , Common Grammatical Errors, Use of articles, Punctuations, Modals, Gerund, Participle, Infinitive, Word Formation (affixes, prefixes, suffixes, synonyms and antonyms), Idioms, Synthesis & Transformations of Sentences, Sentences Linkers.

Unit-II

Comprehension : Unseen Passage

Composition : Precise writing, Personal Letters, Business letters, Job Applications, Writing of technical Report, Essay writing.

Unit-III

Introduction to sounds : Vowels, Diphthong, Consonants, Phonetics, Transcriptions. Word stress and exercises on pronunciation, Group discussion on current topics and Presentation of Technical report.

Unit-IV

Communication Skills : Meaning and process of communication, Verbal and non-verbal communication: Quality of good communication; Writing skills, Group discussion: Organizing seminars and conferences.

Text Books/ References

1. Thomson and Martinet. (1997). A Practical English Grammar Exercise Book, Vol. I and II, O.U.P. Publication.
2. Michal Swan. (1995). Practical English Grammar, O.U.P. Publication.
3. David Green. (1990). Contemporary English Grammar Structure Composition, Macmillan Publication.
4. S. Allen. (1997). Living English Structures, Orient Longmans.
5. Daniel Jones, Drills and Tests in English Sound, ELBS.
6. Hornby. (1990). Advanced Learners Dictionary, O.U.P. Publication.
7. Kirshan Mohan. Speaking English Effectively; Macmillan Publication.
8. Audio-Video Tapes prepared by the British Council, New Delhi and Central Institute of English and Foreign Language, Hyderabad to be used in a Language Laboratory.
9. A. Adivi Reddy. Extension Education, Sree Lakshmi Press, Bapatla (A.P.)
10. G.L. Ray. (2005). Extension Communication and Management, Kalyani Publishers.

FIRST YEAR B.TECH. (II SEMESTER)

BS 121 MATHEMATICS – II

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Differentiation of Vectors: scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of vector point functions; Directional derivatives; Line, Surface and Volume integrals; Gauss, Stoke's and Green theorems (Statement only) and their applications.

Unit-II

Ordinary Differential Equations: Second order differential equations with variable coefficients; Exact form; Part of complimentary function is known; Change of dependent and independent variables; Method of variation of parameters.

Unit-III

Partial Differential Equations: Formation of partial differential equations; Lagrange's linear equations; Higher order linear partial differential equations with constant coefficients. Standard forms of partial differential equations.

Unit-IV

Matrices: Elementary transformations; Rank of a matrix; Reduction to normal form; Gauss Jordan method to find inverse of a matrix; Consistency and solutions of linear equations; Eigen values and Eigen vectors; Cayley-Hamilton theorem.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. J.L. Bansal and H.S. Dhami. (2005). Differential Equation, (Vols.-I), Jaipur Publishing House, Jaipur.
3. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

CE 122 CIVIL ENGINEERING

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Chain Surveying : Instrument for chaining, Direct & indirect ranging. Methods of chain along plane & sloping ground, Base line, check line, Tie line, Offset, Chain angle & recording in field book.

Compass Surveying : True & Magnetic meridian, whole circle bearing & quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Unit-II

Level and leveling : Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy and Tilting levels, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks. Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.

Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.

Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.
Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete, Water cement ratio, curing and consolidation of concrete.

Practicals

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Chining along sloping ground.
4. Chain surveying, field book recording and taking offsets for location details

5. Study of prismatic and surveying compass and taking bearings.
6. Study of Dumpy level, temporary adjustment and R.L. calculations.
7. Study of Tilting level, temporary adjustment and R.L. calculations.
8. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
9. L-section and cross sectioning, fly leveling operation.
10. Plotting of working profile.

Text Books/References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi Publications, New Delhi.

ME 123 MACHINE DRAWING – I

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Introduction, conventional representation of different materials used in machine drawing, Introduction to BIS codes.

Orthographic Projection: First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views.

Dimensioning: Different methods of dimensioning.

Sectional Views: Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts

Riveted and Welded Joints: Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints.

Screw Fastenings: Nomenclature, thread profiles, multistart threads, left and right hand threads. Square headed and hexagonal nuts and bolts. Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.

Different types of joints: Knuckle joint, cotter joint and universal joint.

Text Books/References

1. N. D. Bhatt. Machine Drawing, Charotar Book Stall, Anand.
2. V. Laxminarayan and ML Mathur. A Text Book of Machine Drawing, Jain Brothers, New Delhi.
3. P. S. Gill. Machine Drawing: S. K. Kataria & Sons, New Delhi.

ME 124 WORKSHOP TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**3**

Unit-I

Welding: Introduction to welding, types of welding. Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools. Soldering and Brazing.

Unit-II

Lathes: Classification, constructional details of centre lathe. Main operations and tools used on centre lathes.
Shaper: Types of shapers. Constructional details of standard shaper, shaper tools and main operations.

Unit-III

Drilling Machines: Types of drilling machines. Constructional details of pillar type, and radial drilling machines. Main operations. Twist drills, drill angles and sizes.
Measurement and Inspection: Classification of measuring instruments, linear and angular measurement, comparators.

Unit-IV

Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.
Foundry: Moulding tools and equipments. Moulding sands, properties of moulding sand, sand mould making process.

Practicals

Practical exercises on welding, pattern making, foundry and machining operations.

Text Books/References

1. S.K. Hajra Choudhury and A.K. Hajra Choudhury. Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

SECOND YEAR B.TECH. (III SEMESTER)

BS 211 (All Branches) MATHEMATICS – III

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation. Interpolation with equal intervals; Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.
Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.
Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV

Laplace Transform: Laplace transforms of elementary functions; Basic properties of Laplace transform; Initial value theorem, final value theorem and convolution property of Laplace transform; Inverse Laplace transforms. Applications of Laplace transform to solve ordinary differential equations.

Text Books/References

1. H.C. Saxena. Text Book of Finite Differences and Numerical Analysis, S. Chand and Co.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd.
3. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics,
Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).
4. S.P. Goyal and A.K. Goyal. Integral Transforms, Jaipur Publishing House, Jaipur.

EE 211 CIRCUIT THEORY – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**1**	**2**

Unit-I

Basic circuit element and waveform: circuit component, ideal and practical voltage and current sources and their inter conversion, independent and dependent sources, unilateral and bilateral, active and passive, linear and non linear, distributed and lumped parameters Network theorem for AC network: Mesh and Nodal analysis, thevenin, Norton, superposition, maximum power transfer, milliman, telegen, compensation, reciprocity theorem.

Unit-II

Resonance in series and parallel circuit, Q factor, selectivity, Transient and steady state response, solution of differential equation, Effect and determination of initial conditions and time constants, analysis of coupled circuit under sinusoidal excitation, coefficient of coupling, analysis of 3 phase balanced and unbalanced circuit, measurement of 3 phase active and reactive power.

Unit-III

Two port Network: open circuit, Short circuit, transmission, Hybrid parameters, their inter- relationship and interconnection, Two port symmetry, Input Impedance, output impedance, Image Impedance, Brune's test

Unit –IV

Fourier series: Periodic function, Trigonometric Fourier series, Evaluation of Fourier coefficient, waveform symmetry Analysis of simple circuit with non sinusoidal excitation

Practicals: Lab experiments based on theory

Text Books/References

1. M.E.Van Valkenberg. Network analysis, PHI
2. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher.

EE 212 (EE, CS) ELECTRICAL MEASUREMENTS & INSTRUMENTS

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Measuring Instruments: Principle of operation, construction detail, torque equation, scale shape, uses and error in Moving iron, Electrodynamics and induction instruments for the measurement of voltage, current, power and energy.
Galvanometers: D'Arsonval, Vibration and Ballistic galvanometers, Dynamic equation of motion and its solution for various conditions, Relative damping, logarithmic decrement and galvanometer sensitivities.

Unit-II

Potentiometers: Theory of operation and construction of D.C. and A.C. potentiometers (polar and coordinate type), Their standardization and applications.
Measurements of Resistance: Methods of measurement of medium, low and high resistances, three and four terminal type resistance, Kelvin's double bridge, Price's guard wire and Loss of charge method.

Unit-III

A.C. Bridges-Four arm A.C. Bridge for the measurement of inductance, capacitance, quality and dissipation factor. Screening, Wagner earthing.
Instrument Transformers: Theory and construction of current and potential transformers, Ratio and phase angle errors and their minimization, effects of variation of power factor, secondary burden and frequency on errors, Testing of CTs and PTs.

Unit-IV

Magnetic Measurements-Determination of B-H curve and hysteresis loop of ring and bar specimens, Measurement and separation of iron losses.
Electronic Instruments-Transistor voltmeter, TVM using FET in input stage, Digital voltmeters: Ramp type, integrated type, Measurement of time, phase and frequency using digital counters, Principle and working of cathode ray oscilloscope.
Wave analyzers: Frequency selective and heterodyne wave analyzers and its applications.

Practicals: Lab experiments based on theory

Text Books/References

1. A.K. Sawhney. Electrical & Electronics Measurements & Instrumentation. Dhanpat Rai & Co.
2. H.S. Kalsi. Electronic Instrumentation
3. E.W.Goldin. Electrical Measurements

EE 213 ELECTRICAL WORKSHOP

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**1**	**2**

Accessories & ratings of the wiring materials, wiring circuits: stair case, fluorescent tube lighting circuit, flasher for moving lights circuits, connection of sodium vapors and mercury vapor lamp, wiring layout of simple domestic and commercial buildings; Preparation of detailed estimation in the standard format for installation of surface conduit/casing and capping wiring in a small house/office, *Study the various types of electrical appliances*: electric iron, Geyser, mixer/systems, table fan & ceiling fan, principles of thermostats, regulators; Practice of earthing; Study of U.P.S, Battery Charger; Design small single -phase transformer of given rating; *Printed Circuit board:* Design guideline General components, layout scheme, PCB size, design rules for digital circuit and analog circuit PCB's single and multiplayer boards, Automation and Computer in PCB design, CAD packages and tools, Electronic circuit and minimum system design by using PCB design software packages.

Text Books/References

1. K.B.Bhatia. Study of Electrical Appliances and Devices, Khanna Publishers
2. H. Pratap. Electrical Gadgets, Dhanpat Rai and Sons
3. Arora and B.Das. Electrical Wiring and Industrial and Domestic Wiring, New Heights
4. S.L.Uppal and Larcia. Electrical Wiring, Estimating and Costing, Khanna Publishers

EC 212 (EE) ELECTRONICS – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**1**	**2**

Unit-I

Semiconductors: Intrinsic and extrinsic semiconductors, Mobility and conductivity, types of doping and its effect on properties of semiconductor, Diffusion, Mass-action Law, Graded semiconductors.

Theory of PN Junction Diodes: The open circuited junction, space charge region. The biased p-n junction, the volt-ampere characteristics and volt-ampere equation and effect of temperature on V-I characteristic, junction diode switching times, diode capacitance.

Unit-II

Diode circuits: Half wave and full wave single-phase rectifiers and their analysis, peak inverse voltage, various types of filters their analysis and applications. Voltage multipliers, Clipping and clamping circuit.

Other Types of Diodes: Zener and avalanche breakdown phenomenon in zener diodes, photo-diodes, light emitting diodes, solar cells, varactor diodes.

Bipolar Junction Transistors: The ideal current controlled source, The junction transistor, Ebermoll representation of the BJT, The common base (CB) and common emitter (CE) configuration and their input and output characteristics, current gains alpha & beta, common collector, the forward active, reverse active, cut off and saturation, Modes of BJT.

Unit-III

BJT biasing and d.c. models, stabilization techniques. BJT as a switch and as an amplifier, The BJT small signal models, h-parameter and hybrid pi model, BJT as a diode, Transistor ratings.

Field effect Transistors: Ideal voltage controlled current source, junction field effect transistor and its VI characteristics and its construction. The JFET transfer characteristics. MOSFET: Enhancement and depletion type. Brief idea about construction of MOSFETs, V-I characteristic.

Unit-IV

Small signal Amplifiers at Low Frequency: Analysis of BJT and FET in various modes; input and output resistance, voltage and current gain, Miller theorem and its dual. Cascaded BJT amplifiers, Differential amplifiers and its analysis, composite transistor stages: Darlington pair and others, Boot strapping.

Practicals: Lab experiments based on theory

Text Books/References

1. J. Millman & C.C. Halkias. Integrated Electronics: analog & Digital ciruits system, TMH
2. Jacob Millman and Arvin Grabel. Microelectronics, McGraw Hill
3. Robert L.Boyle sted & Louis Nashelshky. Devices and Circuit Theory, PHI

EC 216 (EC, EE) DIGITAL ELECTRONICS

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**1**	**2**

Unit-I

Number System & Codes: Radix and Radix conversion, Sign, magnitude and complement notation, Arithmetic shift weighted codes,Excess-3 code, Gray code, ASCII & EBCDIC codes, Fixed and floating point arithmetic, BCD addition and subtraction.

Unit-II

Boolean Algebra And Digital Logic Gates: Features of logic algebra, postulates of Boolean algebra, Theorems of Boolean algebra, Boolean function drive logic gates, Exclusive- OR, NAND, NOR gates, their block diagrams and truth tables, logic diagrams from Boolean expressions and vice –versa, converting logic diagrams to universal logic, positive, negative and mixed logic, logic gate conversion.

Minimizing Techniques: Minterm, Maxterm, Karnaugh Map, K map up to 4 variables, simplification of logic function with K map, conversion of truth table of POS and SOP form, Incomplete specified functions, Variable mapping, Quinn-Mc Klusky minimization techniques.

Unit-III

Combinational Systems: Combinational logic circuit design, half and full adder, subtractor, Binary serial and parallel adders, BCD adder, BCD to 7-segment decoder, multiplexer, De-multiplexer, encoder, octal to binary, BCD to excess-3 encoder, Diode switching matrix, Design of logic circuits by multiplexers, encoder, decoders, and de-multiplexer.

Unit-IV

Sequential Systems: Latches, flip flops, R-S, D, J-K, Master Slave flip flops, Conversion of flip- flops, Asynchronous (ripple), Synchronous decade counter, Modulus counter, skipping state counter, counter design, Ring counter, Counter applications, Registers, buffer registers, shift register.

Practicals: Lab experiments based on theory.

Text Books/References

1. A.P. Malvino & D.P. Leach. Digital Principles & Applications, Tata Mc-graw Hill, Delhi.
2. Morris Mano. Digital Circuit & Logic Design; Prentice Hll of India.
3. Tocci. Digital Systems, Pearson Education
4. Gree. Digital electronics, Pearson Education
5. Msno. Digital Desigh, Pearson Education
6. Bartee. Digital Computer Fundamentals, Tata mcGraw Hill
7. R.P.Jain. Modern Digital Electronics

CE 211 (AE, EE, MI) STRENGTH OF MATERIALS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**1**	**2**

Unit-I

Fundamentals : Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagram's, mechanical properties of materials, elasticity and plasticity. Shear stress. and strain, pure shear. Complementary shear. Linear elasticity and Hooke's law. poison's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulic. Stress and strain in axially loaded members. Temperature stresses and effects.

Unit-II

Analysis of stress and strain : Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress.

Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads : Bending moment and shear force, relation between load,. Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion : Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns : Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor's formula. Rankine's formula. column under concentric loading. Secant, Perry's and Indian standard Formulae.

Practicals

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Lzod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.

Text Books/References

1. S.B. Junarkar and H.J. Shah. (1997). Mechanics of Structures Vol.-I Charoter Publishing, Opp.- Amul Dairy, Court Road, Anand.
2. B.C. Punima. (1990). Strength of Materials and Mechanics of Structures, Vol-I edition, Standard publisher distributors, Nai Sarak, New Delhi – 19.

SECOND YEAR B.TECH. (IV SEMESTER)

BS 221 (EC, EE, ME, MI) MATHEMATICS – IV

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Fourier Series: Fourier series, even and odd functions; Half range series; Change of interval; Exponential form of Fourier series; Harmonic analysis.

Unit-II

Roots of Nonlinear (Algebraic and Transcendental) Equations: Bisection method, False position method, Newton Raphson method; Convergence of False position and Newton Raphson method. Complex roots of polynomials by Bairstow's method.

Unit-III

Partial Differential Equations: Classifications of partial differential equations; Method of separation of variables to solve Heat equation, Wave equation and Laplace's equations.

Unit-IV

Statistics: Correlation and regression; Principle of least square method and curve fitting.

Probability Distribution Functions: Random variable; Mathematical expectations; Moment generating functions; Discrete and continuous distribution functions; Binomial, Poisson and Normal distributions.

Text Books/References

1. J.L. Bansal and H.S. Dhami. (2005). Differential Equations (Vols.-II), Jaipur Publishing House, Jaipur
2. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics (VII Edition), Laxmi Publication Pvt. Ltd., New Delhi.
3. S.C. Gupta and V.K. Kapoor. Mathematical Statistics, Sultan Chand & Sons, New Delhi.

EE 221 CIRCUIT THEORY – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Laplace transform and its application to network analysis, transform networks and sources, initial and final value, and inverse transform, Unit impulse response, unit step response, the time shift theorem, convolution.

Unit-II

Network functions and complex frequency plane- transfer functions, concepts of complex frequency, poles and zero and restrictions on their location in s-plane, relation between natural transient frequencies and resonance. Time domain behavior from pole-zero configuration ,frequency response , magnitude and phase of network functions ,a relation between time domain and frequency domain analysis .

Unit-III

Filters –two port reactance networks, image impedance, attenuation, phase shift and insertion loss, characteristics and design of constant –k and m-derived filters

Unit-IV

Fourier integral and continous spectra – the Fourier Integral spectrum analysis for recurring pulse, relationship between fourier and laplace transform, analysis of circuit using fourier transforms ,sinusoidal transfer function.

Network synthesis – the positive real concept , brune 's positive realness , properties of function , Hurwitz polynomials , synthesis of two elements networks LC ,RC and networks, cauer and foster networks .

Practicals: Lab experiments based on theory

Text Books/References

1. Soni & Gupta. Electrical Circuit Analysis, Dhanpat Rai Publisher.
2. Sudhakar. Circuit Analysis & Synthesis, TMH.

EE 222 POWER SYSTEM – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Basics of power system; Insulators: Type of insulators, bushings, voltage distribution over an insulator string, grading and methods of improving string efficiency, pollution flashover; Corona: Electric stress between parallel conductor's, Disruptive critical voltage and visual critical voltage, calculation for three phase overhead lines for corona power loss, factors effecting corona, effect of corona.

Unit-II

Parameters of transmission lines: Resistance, inductance and capacitance of overhead lines, effect of earth on capacitance, line transposition, geometric mean radius and distance, calculation of inductance and capacitance of single phase transmission line, Skin and Proximity effect.

Unit-III

Performance of transmission lines: Steady state analysis of short, medium and long transmission lines, Generalized ABCD line constants, receiving end and sending end power circle diagrams, Ferranti effect, interference with communication circuits.

Unit-IV

Underground cables: Type of cables, insulation resistance and capacitance calculation, reduction of maximum stresses, causes of breakdown, idea about oil and gas filled cables, thermal rating of cables.

Traveling waves: Traveling waves on transmission lines, wave equation, specification of traveling waves, reflection and refraction of traveling waves, typical cases of line terminations

Practicals: Lab experiments based on theory

Text Books/References

1. B.R Gupta. Power System Analysis & Design
2. Soni Gupta and Bhatnagar. A course in Electrical power
3. C.L Wadhwa. Electrical Power Systems
4. Naghrath & Kothari. Modern Power System Analysis
5. J.J Grainger & W.D stevenson. Power System Analysis

EE 223 ELECTRICAL MACHINES – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Transformers: Constructional features, emf equation, phasor diagram, equivalent circuits, open circuit and short circuit test, Sumpner's test, efficiency, voltage regulation, all-day efficiency, separation of losses, parallel operation, autotransformers.

Unit-II

Polyphase Transformers: standard connections for three-phase operation, single phasing and unbalanced load conditions on a three-phase transformer, Scott connection and six-phase transformation.
Electromechanical Energy Conversion: Basic principles of electromechanical energy conversion, energy balance, basic principles of operation of electric generators and motors.
DC Machines: Fundamentals of DC machine, construction, armature windings, simple lap and wave windings, chording, equalizing connections.

Unit-III

DC Generators: EMF equation, Types of DC generators, no load and load characteristics, parallel operation.
Armature Reaction: Distribution of armature and field mmfs, cross-magnetizing and demagnetizing mmfs and their approximate estimation.
Commutation: Introduction to commutation, reactance voltage, resistance commutation and interpoles.

Unit-IV

DC Motors: Principle of operation, production of torque, back emf, torque-current and torque-speed characteristics, starting of motors, speed control by variation of armature voltage, field current and Ward Leonard method, electric braking, losses and efficiency, direct and indirect tests, Swinburne's test, Hopkinson's test, field test and retardation test, Rosenberg generator.
Cross-Field Machines: Basic principles of operation of metadyne and amplidyne and their applications.

Practicals: Lab experiments based on theory

Text Books/References

1. B.R. Gupta & Vandana Singhal. Fundamentals of Electric Machines.
2. I.J. Nagrath & D.P. Kothari. Electric Machines (Second Edition).
3. P.K.Mukherjee & S.Chakravorti. Electrical Machines.

EE 224 ELECTRICAL COMPUTATION

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**1**	**2**

Review of C fundamentals: Data Structure in C: manipulating strings of character, input & output of strings. Using structures in arrays & arrays in structures, Pointer data type, pointers and arrays, pointer and functions. Enumerated data type, creating new data type names, simulation & application of stack,. List data structure, manipulation of linked list, Files-sequential & unformatted files, Projection preparing & running complete 'C' Program; Introduction to MATLAB and Simulink: To design and simulate various of electrical circuits and system; Introduction to PSIM: To design and simulate various of electrical circuits and system; Introduction to PSCAD: Modelling, Simulating and Designing HVDC & AC transmission system using CB, Relays, faults, with no. of buses.

Text Books/References

1. Ira Pohl. Object –oriented programming using C++
2. Herbert Schildt. Teach yourself C++
3. Rudra Pratap. Getting started with MATLAB.

EC 225 (EE) ELECTRONICS – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

High Frequency Amplifiers: Hybrid pi model of common emitter transistor, Hybrid pi conductance and capacitances, Variation of hybrid pi parameters, CE short circuit current gain, current gain with resistance load. Single stage CE transistor amplifier-response, gain bandwidth product, Emitter follower at high frequencies.

Unit-II

Feedback Amplifiers: Classification, Feedback concept, transfer gain with feedback, General characteristics of negative feedback amplifiers. Analysis of voltage series, voltage shunt, current series and current shunt feedback amplifiers, Stability criterion.

Oscillators: Classification, Criterion for oscillation, RC-phase shift, Hartley-Colpitts, tuned collector, wein bridge and crystal oscillators; Astable, monostable and bistable multibrators, Schmitt trigger.

Unit-III

Linear Integrated circuits: Operational amplifier-inverting and non-inverting modes, Characteristics of ideal op-amp. offset voltage and currents, Basic op-amp applications. Differential DC amplifiers, stable ac coupled amplifiers. Integrator and differentiator. Analog computation, comparators, sample and hold circuits, logarithmic and antilog amplifiers. Analog multipliers, precision AC/DC converters-precision limiting, fast half wave and full wave rectifiers. Active average and peak detectors. IC 555 timer and its applications.

Unit-IV

Active fitters-low pass, high pass, band pass, notch, Butterworth, Basic principle of PLL, block diagram, transfer characteristic of PLL.

Power Amplifiers: Class-A large signal amplifiers, second harmonic distortion, higher order harmonic generation, Transformer coupled audio power amplifier, collector efficiency.

Push Pull Amplifiers : Class A, Class B and Class AB operations. comparison of performance with single ended amplifiers, Regulted power supplies, series and shunt voltage regulators, Brief idea of Monolithic regulator.

Practicals: Lab experiments based on theory

Text Books/References

1. J.Millman & C.C.Halkias. Integrated electronics: analog and Digital circuits systems (TMH)
2. Jacob Millman and Arvin Grabel. Micro electronics. (McGraw Hill)
3. Robert L.Boyle sted and Louis Nashleshky. Electronic devices and circuit theory (PHI)

ME 223 (EE, MI) MECHANICAL ENGINEERING – II

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Unit-I

Transmission of Power: Belts, ropes and chains, length of belt, tension in belt, centrifugal tension and maximum power transmitted by belts, Spur gear nomenclature, involute and cycloidal profiles, helical, bevel and worm gears. Gear trains.

Brakes and Dynamometers **:** Band brake, block, band and block brake. Single and multiple disc clutches. transmission and absorption type dynamometers.

Unit-II

Balancing **:** Balancing of rotating mass in single multiple and planes. partial primary and secondary balancing of reciprocating masses.

Vibrations **:** Free, longitudinal, transverse and torsional, Critical speed.

Bearing and Couplings **:** Main types of bearing and coupling. Antifriction bearings; *Lubrication***:** Laws of friction for dry and lubricated surfaces, Methods of lubrication of bearings.

Unit-III

Steam Boilers **:** High pressure boilers of natural and forced circulation type, La Mont, Benson, Loeffiler, Velox Boilers;

Steam Turbine **:** Expansion of steam through nozzles with and without friction. Throat pressure for maximum discharge. Working of impulse and reaction turbine. Compounding. Velocity diagrams. Governing of turbines. Emergency governing;

Condensers **:** Types, classifications and details. Vacuum efficiency. Cooling towers and spray ponds.

Unit-IV

Gas Turbines **:** basic principles, simple gas turbine cycle, application of gas turbines.

Refrigeration and Air Conditioning **:** Bell-Colleman refrigerator, vapour compression and absorption refrigerators. Psychrometric chart. Introduction to comfort air-conditioning.

Water Turbine: classification & characteristics of various water turbines, governing of turbine, problems of cavitations, selection of turbine for hydropower schemes.

Centrifugal Pumps: Classification, characteristics & selection of various centrifugal pumps.

Practicals

Study of gears, brakes and dynamometers. Study of various types of clutches and antifriction bearings. Study of critical speed of shaft. Study of air compressors. Study of high pressure boilers and condensors. Study of steam and gas turbines. Study and experiments on refrigeration systems. Study of air conditioner.

Text Books/References

1. M.L. Mathur and F.S. Mehta. Thermal Engineering, (Vol.I& II, SI Edition), Jain Brothers. New Delhi.
2. R.K.Purohit. Thermal Engineering.
3. R.S.Khurmi and J.K.Gupta. Theory of Machines, Eurasia publishing House (Pvt.) Ltd. New Delhi.
4. P.L.Ballaney. Theory of Machines, Khanna Publishers, Delhi.

THIRD YEAR B.TECH. (V SEMESTER)

BS 311 (EE) MATHEMATICS – V

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**1**	**0**

Unit-I

Difference Equations: Homogeneous linear difference equations with constant coefficients; Non-homogeneous linear difference equations with constant coefficients, method of undetermined coefficients, method of operators; Homogeneous\ Non-homogeneous linear difference equations of first order with variable coefficients.

Unit-II

Z-Transforms: Basic properties of Z-transforms; Initial value theorem, final value theorem and convolution theorem of Z-transforms; Inverse Z-transforms; Applications of Z-transforms to solve difference equations.

Unit-III

Solutions of Simultaneous Linear Equations: Gaussian elimination method, pivoting; Gauss-Jordan method; Gauss-Seidal method; Cholesky's method. Eigen values and Eigen vectors**:** Power and inverse power method.

Unit-IV

Fourier Transforms: Complex Fourier transforms, Fourier sine and cosine transforms; Inverse Fourier transforms; Simple properties of Fourier transforms; Applications of Fourier transforms to solve partial differential equations.

Text Books/References

1. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics (VII Edition), Laxmi Publication Pvt. Ltd., New Delhi.
2. R.K. Jain and S.R.K. Iyengar. Advanced Engineering Mathematics (II Edition), Narosa Publishing House, New Delhi.
3. S.P. Goyal and A.K. Goyal. Integral Transforms, Jaipur Publishing House, Jaipur.

EE 311 POWER SYSTEM – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Per Unit System: Percent and per unit quantities, single line diagram & impedance diagram for a balance system; Symmetrical Fault Analysis: Transient in R-L Circuit, symmetrical and asymmetrical short-circuit current in synchronous generation, equivalent circuit of synchronous machine in different conditions, analysis of three phase fault.

Unit-II

Symmetrical Component: Fortesque theorem and symmetrical component transformation, phase shift in star delta transformer, sequence impedance and sequence circuit for synchronous machine, transformer and transmission line, sequence network of a power system.

Unsymmetrical fault analysis: Single line to ground fault, Line to line fault, Double line to ground fault.

Unit-III

Switchgear & Protection: Fuses, Selectivity, Discrimination, Sensitivity, Reliability, Fastness, Time grading & current grading, Primary & back up protection.

Construction & operation of relays: Electro magnetic over current relays, Reverse Power Directional relay, Instantaneous Earth Fault Relay, Buchholtz Relay.

Distance protection of transmission lines, C. T. & P. T. connection for distance relays.

Unit-IV

Unit Protection: Protection of Transformer, stator winding of alternator, Protection against Excitation failure, Prime mover failure, Frame Leakage, Differential protection of: Generator-Transformer unit, 3-phase transformer, Buchholz protection.

Circuit Breakers: Theorem of current interruption, Recovery theory, Construction and operation of Bulk oil, Air blast, MOCB, SF6, Vacuum circuit breaker, Advantages & disadvantages of static relay.

Practicals: Lab experiments based on theory

Text Books/References

1. I.J. Grainger. Power system analysis. W.D. Stevenson.
2. Nagrath, Kothari. Power system engineering.
3. B.R. Gupta. Power system Distribution.
4. H.C. Rai.. Numerical Problem and Objective. Evaluation in Power system.
5. C.L. Wadhwa. Electrical Power system.

EE 312 POWER ELECTRONICS – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Semiconductor Power Devices: Characteristics of power Diodes, power Transistors like BJT, MOSFET& IGBT, Diac, SCR and UJT

Unit-II

Thyristor: Principle of operation, Construction and characteristics, specification and ratings, pulse transformer, optical isolators, methods of turn on, Protection of SCR protection against over voltage, over current, dv/dt, di/dt, switching surges, over heating. Gate protection, SCR mounting, Heat transfer process in SCR, *Thyristor firing circuit*- Principle features of a typical gate triggering circuit R & R-C, UJT relaxation oscillator

Unit-III

Converters: Half wave converters for single, two, three, six phase; Single phase and three-phase full wave converrtor with R, R-L and RLE loads; Performance factors for line commutated converters; Inversion operation semi converters, dual converter; Effect of source impedance; Microprocessor based firing scheme for three phase fully controlled bridge converter.

Unit-IV

Power supplies: Basic series and shunt voltage regulators, Integrated circuit regulators. Switch mode d.c. Power supplies, Fly back converter, forward converter, push-pull converter, half and full bridge converters, A.C. power supplies; UPS configurations, On-line and Off-line UPS.

Practicals: Lab experiments based on theory

Text Books/References

1. Berdi. Power Electronics
2. Bhimbra. Power Electronics

EE 313 ELECTRICAL MACHINES – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Induction Motors: Rotating magnetic fields, construction, basic principal of induction motor, induction motor as a generalized transformer, phasor diagram, equivalent circuits, no-load and blocked rotor tests, circle diagram, calculation of performance, Torque-slip characteristic, effect of rotor resistance, operating characteristics of induction motor, speed control, starting and braking, cogging, crawling.

Unit-II

Single Phase Induction Motor: Basic Principle, revolving field theory, methods of starting, equivalent circuit. Induction generator, Induction regulators.

Synchronous Generators- Constructional features, general equation of induced emf, effect of distribution, chording, armature reaction, theory of cylindrical rotor machine, saturation effects, phasor diagram, open circuit, short circuit and zero power factor characteristic, Potier triangle, regulation by synchronous impedance, M.M.F. & A.S.A. methods and their relative comparison. Theory of Salient pole machines Blondel's two reaction theory, phasor diagram, direct and quadrature-axis reactance their determination; parallel operation of alternators, synchronizing operation of infinite bus, synchronizing power, power-angle characteristics, stability.

Unit-III

Synchronous Motor: Construction, principle of operation, equivalent circuit, phasor diagram, power flow equation, V curves, starting, hunting & damping.

Commutator Motors-Effects of injected EMF, commutator as frequency changer, single phase series motor and schrage motor.

Unit-IV

Fractional Horse Power Motors: Construction, principle of operation, elementary analysis, characteristics and applications of universal motors, repulsion motors, hysteresis motor, brush less motors, linear induction and stepper motors.

Practicals: Lab experiments based on theory

Text Books/References

1. H. Cotton. Advanced Electrical Technology.
2. I.J. Nagrath & D.P.Kothari. Electric Machines (Second Edition).
3. P.K. Mucherjee & Scharkravorti. Electrical Machines.
4. P.S. Bhimbhra. Electrical Machinery.
5. M.G. Say. Performance and design of AC machines
6. B.R. Gupta & Vandana Singhal. Fundamentals of Electric Machines.

EE 314 CONTROL SYSTEM – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Representation of simple open loop and closed loop system, electrical analogs, Laplace transforms, Mathematical modeling, transfer functions, block diagram reduction techniques, signal flow graphs, mason's gain formula, control system components – error detectors, potentiometers, synchros, d.c. and a.c techogenerator , d.c .and a.c. servo motors.

Unit-II

Time Response analysis and Design specifications: Transient and steady state response, standard test signals, Time response of a first order and second order system to standard signals, steady state error, error coefficients, generalized error series sensitivity, control actions (proportional, derivative and integral controls)

Unit-III

Concept of stability, Absolute stability, relative stability, Routh Hurwitz criteria, Characteristic equation, Root Locus Technique

Unit-IV

Frequency Response Analysis: Frequency Domain Specification, correlation between time and Frequency Response, Polar plot, Bode Plot, Gain Margin, Phase Margin Nquist stability criteria, Compensation: Lag, Lead and Lag-Lead Network

Practicals: Lab experiments based on theory

Text Books/References

1. C. Kuo Benjamim. Automatic Control System.
2. Ogata Katsuhika. Advance Control System.
3. I.J. Nagrath & M. Gopal. Control System Engineering. Wiley Eastern Ltd., New Delhi.
4. B. S. Manke. Linear Control System.

EE 315 COMPUTER ARCHITECTURE & INDUSTRIAL CONTROL

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Microprocessor Architecture: Inter 8085 Architecture, Buses, Registers, status flag, Opcode & operands, Word size, Pin configuration, Instruction cycle, Fetch operation, Machine cycle & state, Instruction & data flow. Timing diagram for-opcode fetch, Memory read & write, I/O read and write, Instruction & data formats, Addressing modes, Instruction set, Stack & subroutines, Data Transfer Schemes, *Programming the 8085*, Programming techniques-looping, counting, indexing, counters and time delays, subroutines.

Unit-II

Programming the 8085: Programming techniques looping, counting, indexing, counters and time delays, subroutines. Interrupts of 8085, Debugging of programs. Modular & structured programming, Macro, Micro programming. *Micro controllers*-Introduction & applications, *Computer memories*-Tape, disk and floppy disk storage, semiconductor memories systems, bubble memories- CCD memory. Input –output devices- VDU, graphic display, magnetic tape unit, printers, mouse, plotters & digitiser.

Unit-III

Programmable logic controller: Principles of operation, architecture of Programmable controller, programming the programmable controller, software, configurations, applications, conclusions.

Unit-IV

Distributed Digital Control: Fundamental requirements of distributed process control system, system architecture, distributed control system, configuration, and some popular distributed control system
Industrial Control Applications: Introduction, cement, thermal power, water treatment, steel plant.

Practicals: Lab experiments based on theory

Text Books/References

1. S. Gaonkar Ramesh. Microprocessor Architecture, Programming, and Applications with the 8085; 4th ED; Prentice Hall
2. D.V. Hall. (1986). Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York.
3. G.A. Gibson, Y.C. Liu. (1986). Microcomputer System the 8086/8088 Family, Prentice Hall India Pvt. Ltd., New Delhi (second edition).

THIRD YEAR B.TECH. (VI SEMESTER)

BS 321 (EE) MATHEMATICS – VI

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**1**	**0**

Unit-I

Complex variables: Analytic functions; Cauchy-Riemann equations; Polar form; Construction of analytic functions, Milne-Thomson construction method. Conformal mapping: Elementary transformations; bilinear mapping.

Unit-II

Complex integration: Properties of Complex integrals; Cauchy's integral theorem; Cauchy's integral formula and derivatives of an analytic function; Morera's theorem; Cauchy's inequality; Liouville theorem; Poisson's integral formula.

Unit-III

Power series: Circle of convergence and radius of convergence for power series; Theorems on power series. Taylor's and Laurent's series expansions.

Unit-IV

Classifications of singularities; Residue of functions, Cauchy's residue theorem; Evaluation of real integrals by means of calculus of residue.

Text Books/References

1. G.N. Purohit and S.P. Goyal. Complex Analysis, Jaipur Publishing House, Jaipur.
2. B.S. Tyagi. Functions of Complex Variables, Kedarnath Ramnath, Meerut.
3. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics (VII Edition), Laxmi Publication Pvt. Ltd., New Delhi.
4. R.K. Jain and S.R.K. Iyengar. Advanced Engineering Mathematics (II Edition), Narosa Publishing House, New Delhi.

EE 321 ELECTROMAGNETIC & FIELD THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Vector relation in rectangular, cylindrical, spherical and general curvilinear coordinate system, line, surface & volume integral; Concept and physical interpretation of: Gradient, Divergence, Curl, Stokes Theorem, Helmholtz Theorem.

Unit-II

Electrostatics: Introduction to Electric field vectors, Electric field due to charge configuration, Potential function and displacement ratio; Gauss law, Poison's and Laplace's equation's, Uniqueness theorem, continuity equation, Capacitance & electrostatic energy, Field determination by method of image, Boundary condition, Field mapping and concept of field cell.

Unit-III

Magnetostatics: Introduction to magnetic field vectors, Bio-Savart and Ampere's law, Magnetic scalar and vector potential Self and mutual inductance energy stored in magnetic field, Boundary condition, Analogy between electric and magnetic field, Field mapping and concept of field cell.

Unit-IV

Time-Varying Fields: Faraday's law, Displacement current & equation of continuity, Maxwell's equation, UPW: Free space, dielectrics and conductors, Skin effect and sinusoidal time variation, Reflection, refraction and polarization of UPW, standing wave ratio, Poynting vector and power consideration .Radiation and Transmission, Retarded potential and concepts of radiation, radiation from small current elements, Transmission line parameters, Introduction to EMI & EMC. EMI coupling nodes, methods of eliminting interference, shielding, grounding, conducted EMI.EMI testing, emission testing, susceptibility testing.

Text Books/References

1. Hayt Jr, William. Engineering Electromagnetics 5/e TMH.
2. Kraus, Fleish. Electromagnetics with application, 5/e, Mcgraw Hill.
3. Griffith David J.. Introduction to Electromagnetics 3/e, PHI.

EE 322 POWER ELECTRONICS – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Converters: Performance measures of single and three-phase converters, discontinuous conduction in two quadrant converters, power factor improvements: Extinction angle control, symmetrical angle control, pulse width modulation control, and sinusoidal pulse width modulation control; Thyristor commutation scheme- Line commutation, load commutation, forced and external pulse commutation

Unit-II

Cycloconverter: Basic principle of operation, single phase to single phase, three phase to three phase and three phase to single phase cycloconverters, Output equation.

Unit-III

Choppers: Principle of chopper operation, control strategies, step-up chopper, reversible chopper, Steady state time domain analysis of type-A chopper, Chopper configuration, and chopper commutation. AC Chopper, Multiphase chopper.

Unit-IV

Inverters: Inverter classification, Voltage source thyristor inverters, single phase half and full bridge inverters with auxiliary communication and with complementary communication, Three phase bridge inverters with 180 mode & 120 mode, Pulse width modulation inverters, Current source inverters, single phase capacitor-commutated CSI with restive load, single phase auto-sequential commutated inverter, three phase auto-sequential commutated inverter, single phase series inverters & parallel or push pull inverters, Voltage control of inverters

Practicals: Lab experiments based on theory

Text Books/References

1. P.S. Bimbhra. Power Electronics.
2. Berde. Power Electronics.
3. P.C. Sen. Power Electronics.

EE 323 INSTRUMENTATION

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Theory of errors: Accuracy and precision, systematic and random errors, limits of errors, probable errors and standard deviation, Gaussian error curves, Combinational errors.

Unit-II

Transducers: Constructional features, operating characteristics and selection. Criteria of active, passive and digital transducers, block diagram representation for the instrumentation of strain, displacement, velocity, acceleration, force, torque, flow, pressure and temperature.

Unit-III

Signal conditioning: a.c. & d.c. Bridges, analysis of unbalanced bridges, Instrumentation amplifier, operational amplifiers, choppers, established and carrier amplifiers, charge amplifiers, A/D & D/A converters. Phase sensitive detectors, shielding and grounding.

Unit-IV

Signal recovery: Signal filtering, averaging, correlation and coding.

Signal transmission and telemetry: Modulation and encoding methods, transmission media, Time division and frequency multiplexing.

Signal recording and display- Analog and digital display, Recorders, storage oscilloscopes, printers and plotters, Data acquisition system (analog and digital).

Practicals: Lab experiments based on theory

Text Books/References

1. A.K. Shawney. Electrical Measurement & Instrumentation .
2. Kalsi. Electronic Instrumentation .
3. Albert Cooper. Electronic Instrumentation.

EE 324 CONTROL SYSTEM – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

State Space Analysis: Concept of state, state space representation of systems, phase variable form, canonical variable form, physical variable form, Diagonalization, relationship between state equation and transfer function, solution of state equation, concept of controllability and observability, eigen values and eigen vector.

Unit-II

Sampled Data System: importance of sampling, mathematical analysis of sampling, spectrum analysis of sampling process, Shanon's Theorem, signal reconstruction, hold circuit, Z transform, inverse Z transform, difference equation, pulse transfer function, state variable representation of sampled data system, solution of discrete state equation.

Unit-III

Non linear system- characteristic of non linear system, type of Non linearity, jump resonance, limit cycle, describing function method of analysis.

Unit-IV

Liapunov stability criteria- introduction, stability definitions and theorems, Liapunov function for linear system.

Practicals: Lab experiments based on theory

Text Books/References

1. Nagrath & M.Gopal. Control System Engineering .
2. B. S. Manke. Control System Design.
3. Ogata. Modern Control Engineering.
4. D. Roy Choudhary. Modern Control Engineering.

EE 325 ELECTRICAL ENGINEERING MATERIALS

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Conductor Materials: Electrical, thermal and mechanical properties of conductive and resistive materials. Important characteristics and applications of specific conductor materials like copper, aluminium, AAC, ACSR, silver, gold, platinum and tungsten, study of important resistance materials, carbon and nicrome, standard resistance materials. Soldering alloys.

Unit-II

Super-conducting Materials: Introduction, critical field and critical current density, type I and type II superconductors, intermediate state, penetration depth and thin films, Superconductivity at high frequencies, application of superconductivity. Advancements in super conducting materials.

Dielectric materials: Dielectric behavior of materials under static and dynamic field, Polarisation, induced and permanent dipole moments, Surface resistivity. Breakdown processes. Thermal properties Electrical properties of important dielectric materials including plastics and ceramics, ferroelectric and piezo-electric materials.

Unit-III

Magnetic Materials: characteristics of diamagnetic, paramagnetic, ferro-magnetic, ferrimagnetic and anti-ferromagnetic materials, Properties and applications of common nonretentive and retentive magnetic materials including various alloys, ferrites and powder cores. Eddy current and hysteresis losses, Curie point.

Unit-IV

Semiconductor materials: Electric properties of semiconducting elements and compounds and their application. Zone refining and crystal growth.
Miscellaneous materials: important electronic properties of electron emitting materials, photosensitive materials and luminescent materials.

Text Books/References

1. C.S Indulkar & S. Thriuvengadam. An introduction to Electrical Engineering Materials, S.Chand.
2. S.P.Seth & P.V.Gupta. A course in Electrical Engineering Materials, Dhanpat Rai & Sons.
3. B.D.Indu. Electrical Engineering Materials, Jain Brothers.
4. A.J.Dekkar. Electrical Engineering Materials.
5. R.M.Rose et al. Structure and properties of Materials, Wiley Eastern Ltd.

EE 326 SYSTEM DESIGN & SIMULATION LAB

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**1**	**2**

Design & Simulation of rudimentary electrical system using MATLAB, PSIM, PSCAD, software packages; Study of emerging trends in Design and control of different electrical system: HVDC, HVAC systems design, harmonic analysis, Interfacing problems & design of fuel cell, solar and wind based system; Design & Simulation of recent trends in drive control technology: Vector and DTC controlled system, Non –linear system designing, design and simulation of ALFC and AVR, Simulation of power flow and stabilities problems.

Text Books/References

1. Rudra Pratap. Getting Saterted with MATLAB.
2. Hadi Saadat. Power System Analysis, McGraw-Hill
3. B. K. Bose. Modern Power Electronics and AC Drives, Prentice Hall.

EE 411 ELECTRICAL MACHINE DESIGN

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Principle of electrical machine design- Design factors, limitations in design, magnetic circuit calculations, magnetic leakage calculations, magnetising current calculations, unbalanced magnetic pull.

Heat dissipation, Heating, cooling curve, Estimation of minimum temperature rise, cooling media, quantity of cooling media, design of fan, Ratings.

Unit-II

General features of armature winding, single layer, Double layer & commutator winding, integral & fractional slot winding, winding factors, harmonics, Eddy current losses in conductors.

Design of D.C. Machines, output equation, main dimensions, staggering of buses, selection of no. of poles, airgap, specific magnetic & electric loading.

Unit-III

Design of transformers,. General consideration, output equation, EMF per turn, main dimension conductor size, window yoke & over all dimension, tank design, choice of electric & magnetic loading.

Unit-IV

Design of Induction motors, output equation, selection of frame size, selection of no. of stator slots, calculation of air gap length & conductor size. Design of squirrel cage motor, Rotor bar, elimination of harmonic torque.

Design of synchronous machine, output equation, selection of no. of slots, Runaway speed, main dimension, Effect of SCR on machine performance, airgap.

Practicals: Lab experiments based on theory

Text Books/References

1. M.G. Say. A.C. Machine Design
2. A.K.Shawney. Machine Design

EE 412 ELECTRIC DRIVES AND CONTROL

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-1

Switching Mode Regulators: Buck, boost, buck-boost and Cuk regulators; Ac Voltage Controllers: Single-phase AC controllers with R and RL load, sequence control of AC controllers, three phase AC controllers.

Unit-II

Dynamics Of Electric Drives: Fundamental Torque Equations, Speed-Torque conventions And Multi-quadrant Operation, Equivalent Values Of Drive Parameters, Components Of Load Torques, Nature And Classification Of Load Torques, Calculation Of Time And Energy Loss In Transient Operation, Steady State Stability, Load Equalization.

Unit-III

D.C. Drives: Characteristics of separately exited D.C. Motor and its operating modes for motoring regenerating braking & dynamic braking. Types of Electrical braking, Phase control drives, chopper control drives. Block diagram and explanation for close loop control of d.c. drive. Soft start, acceleration control and current limiting, various industrial applications of drive

Unit-IV

A.C. drive-Speed control of Induction motor, stator voltage control & soft start, variable frequency control from current sources, rotor resistance control, slip power recovery. Block diagrams & their explanation for closed loop control, stator voltage control, volts hertz control with current limiting, volts hertz control with slip regulation, static cramer drive. Synchronous motor drive-volts hertz control & brushless d.c. and a.c. motors. Sensor less control Electric drives.

Practicals: Lab experiments based on theory

Text Books/References

1. P.S.Bimbhra. Power Electronics .
2. Berde. Power Electronics
3. Rasid. Power Electronics

EE 413 ELECTRICAL ENGINEERING ECONOMICS AND MANAGEMENT

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Definition of Economics, Income, Investment, Assets, Liability, utility, Market and its types, Money, Price, value, wants, wealth, capital and its types, supply and demand , Law of Returns, Concept of physical and financial efficiency of electrical goods and services, Importance of Engineering economics, Annuities and its kind, Profit, supply & demand, elasticity, necessity & luxuries, free competition and monopoly, law of diminishing returns.

Unit-II

Depreciation and its various method for calculating- Straight line, diminishing balance, Sinking fund, sum of the Year Digit method, Depreciation in utilizing electrical energy. Element of cost, Direct and Indirect expenses, component of cost, Depreciation and its various method for calculation-Straight line, diminishing balance, Sinking fund, sum of the Year Digit. Linear break-even analysis Comparison of alternatives- Annual cost, Present worth, Rate of return, payback & benefit to cost ratio methods.

Unit-III

Economical choice of electrical apparatus, economic life of electrical machine. Economic choice of motors, Transformers, Electrical lamps, Economic choice of Transmission Line and Distribution substation, Kelvin Law for cables.

Unit-IV

Management-, Functions of Management, office management, Human Resource Management, store management

Text Books/References

1. Banga and Sharma. Industrial organization and Engineering Economics, Khanna Publisher.
2. G.P. Chhalotra. Electrical Engineering Economics, Khanna Publisher.

EE 414 ELECTRIC ENERGY SYSTEMS THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Fundamental concept of electric energy system theory; electric supply systems; economics of power transmission.

Unit-II

Load flow analysis: Static load flow equation, system variable and its solution, Bus admittance matrix, Bus classification, Solution of load flow problem by gauss siedal, Newton Rephson and fast decoupled method, Comparison of above method.

Unit-III

The energy system in steady state-Basic generator control loops, Mathematical modeling and description of various components of automatic voltage regulator, steady state and dynamic performance of AVR.

Unit-IV

Automatic load-frequency control of single area system, Mathematical modeling and description of various components of ALFC, steady state and dynamic performance of ALFC, steady state, dynamic and transient stabilities, Equal Area criterion, step by step method of solving swing equation.

Text Books/References

1. Olle L. Elgerd. Electric Energy Systems Theory, PHI
2. C.A. Ggross. Power System Analysis, TMH

EE 415 GENERATION OF ELECTRICAL POWER

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Method of Bulk Energy Generation: Introduction to thermal, hydel, nuclear and gas power plants with their layouts, Concept of co-generation, Impact of thermal, hydro and nuclear stations on environment.

New Energy Sources: Elementary ideas of electric energy generation by wind, solar, tidal and geothermal energy and fuel cell, Open and close cycle MHD power generation.

Unit-II

Load And Load Curve: Types of load, chronological load curves, load duration curve, energy load curve, mass curve, maximum demand, demand factor, load factor, capacity factor, utilization factor, diversity factor.

Power Plant Economics: Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost, Role of load diversity in power system economics, off peak energy utilization. Energy cost reduction.

Unit-III

Tariffs: Objectives of tariffs. General tariff form, flat demand rate, straight meter rate, block meter rate, two part tariffs, power factor dependent tariffs, three part tariff, spot (time differentiated) pricing.

Power Factor Improvement: Causes and effects of low power factor, advantages of power factor improvement, power factor improvement using shunt capacitors and synchronous condensers. Calculation of most economical power factor when kW demand is constant and kVA demand is constant.

Unit-IV

Selection Of Power Plant: Comparative study of thermal, hydel, nuclear and gas power plants. Base load and peak load plants, Size of generating units, types of reserve and size of plant, Selection and location of power plants.

Text Books/References

1. B.R. Gupta. Generation of Electrical Energy (4/e)
2. S.L. Uppal. Electrical Power (13/e)
3. V.K. Mehta. Principles of Power system (3/e)
4. Soni, Gupta and Bhatnagar. Generation of Electrical Power
5. L. Elgerd Olle. Electric Energy Systems Theory, PHI
6. C.A. Gross. Power System Analysis, TMH

EC 413 (EE) COMMUNICATION ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Modulation techniques: Amplitude modulation, AM-DSB, AM-DSB/SC.AM/SSB & their generation and detection. Angle (FM& Phase) modulation, modulation and demodulation techniques, PLL–applications in modulating and receiver circuits,

Unit-II

Pulse modulations- PAM, PDM, PPM, PCM, delta modulations. Performance of analog modulation schemes under noise, non-linearity and their comparison. Radio Receiver systems.

Unit-III

Digital communication system: Basic information theory-Units of information entropy, Uncertainty & information, rate of communication, redundancy relation between system capacity & information content of messages.

Unit-IV

Introduction to satellite and optical fiber communication system. Noise-Atmospheric, thermal, shot & partition noise, white noise, Noise figure & experimental determination of noise figure, minimum noise figure networks.

Text Books/References

1. B.P. Lathi. (1998). Modern digital and Analog communication system, Oxford University Press.
2. Kennedy Davis. Electronics and communication systems, TMH.

FOURTH YEAR B.TECH. (VIII SEMESTER)

EE 421 ADVANCED POWER SYSTEMS

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

EHV AC Transmission: Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, bundled conductors geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise.

Unit-II

HVDC Transmission: Types of D.C. links, advantages and disadvantages of HVDC transmission, Basic scheme and equipment of converter station. Analysis of HVDC Converters, twelve-pulse converter. Ground return. Basic principles of DC link control and basic converter control characteristics, system control hierarchy, various controls of HVDC like VDCOL, firing angle control, current and extinction angle control, gamma controller, power controller.

Unit-III

Introduction to multi-terminal DC systems, application of MTDC Systems, types of MTDC systems, Control and protection of MTDC systems.

Description of various converters and inverters circuits, HVDC circuit breakers, Harmonics and filters, Measurement of HVDC quantities, Reactive power requirements and sources of reactive power. Converter Faults and protection against over currents, over voltages.

Unit-IV

FACTS: Problems of AC transmission lines. Phenomena of voltage collapse, basic theory of line compensation. Basic features of FACTS controllers, Basic schemes and operations of thyristor controlled series compensator phase angle regulator and dynamic brake, Introduction to static synchronous compensator (STATCOM) and unified power flow controller (UPFC).

Text Books/References

1. J J Grainger and W D Stevenson. Power system analysis, McGraw Hill Pub.
2. Wooden Woollen Berg. Power system analysis, John wiley and sons.
3. R Bergen. Power system analysis.
4. A S Pabla. Electric power Distribution, 4th Ed. TMH Pub.
5. K. R. Padiyar. Flexible AC transmission systems-A status review summer school on "Recent Advances in power Electronics". August 10-21, 1998, IISc Bangalore, Page 10.1 to 10.16.
6. A Adris. FACTS Technology Development. An Update, IEEE Power Engineering Review, March 2000, pp 4-9.

EE 422 NEURAL AND FUZZY BASED CONTROL SYSTEM

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Unit-I

Artificial neural systems : Preliminaries, fundamental concepts & models of artificicalsystem, neural networks learning rules, Hebbian, perceptron, delta Widrow-Hoff learning rules; Single layer percepton classification : Classification model, features & decision regions training & classification using discrete perception, algorithm & examples, single layer continuous perceptron networks for linear separable classification; Multilayer feedback work networks : Generalized delta learning rule, feedforword recall & error back propagation training, learning factors.

Unit-II

Single layer feedback networks : basic concepts of dynamical systems mathematical modeling of discrete time & gradient type Hopfield networks, transient response of continuous time network solution optimization problems.

Neural network in control system : Neuro-control approaches, training algorithm evaluation of training algorithms, through simulation, self tuning neuro-control scheme, self tuning PID neural controller, neuro-control scheme feed water bath temperature control system.

Unit-III

Mathematical of fuzzy control: fuzzy sets, fuzzy set theory, properties of fuzzy sets, Operations of fuzzy sets, fuzzy relations .Non linear fuzzy control: The control problem, FKBC as non linear transfer element PID & sliding mode type FKBC, some typical application of fuzzy based control systems.

Unit-IV

Adaptive Fuzzy control: Introduction, design & performance evaluation, performance monitor, main approaches to design. Stability of fuzzy control system: state space approach, stability and robustness indices, input-output stability. FKBC design parameters: Structure of FKBC fuzzification and defuzzification module, rule based choice of variable and contents of rules, derivation of rule data based, choice of membership function and scaling factors.

Practicals: Lab experiments based on theory

Text Books/References

1. J.M. Zurada. (1997). Introduction of artificial neural systems - Jaico Publication House.
2. S. Iiaykin. (1994). Neural networks. Comprehensive foundation - McMillian College Publishing company inc.
3. S. Omatu, M. Khalid, R. Yusof. (1996). Neuro control and its application - Spring Verlag London Ltd.
4. D. Driankov, H. Hellendoorn and M Reinfrank. (1997). An introduction to fuzzy control - Narosa Publication House, 2nd reprint.
5. Hagan, Demuth Deak. Neural Network Design. Thomson Learning.
6. Neuro. Fuzzy and soft computing, PHI publication.
7. John Yen, Fuzzy logic. Intelligence control and Information, - Pearson publication.

ELECTIVE – I

EE 423 (a) UTILIZATION OF ELECTRICAL POWER

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Electric drives- Characteristics of load, characteristic of different drives, size and rating of electric drives, load equalization and flywheel, Selection of electric drives for specific application, Electric braking, Behavior of motor during starting, acceleration braking & reversing operation.

Unit-II

Different methods of electric heating, principle of high frequency induction and dielectric heating, Arc furnace & induction furnace.

Unit-III

Principles of illumination, electric light sources, Designing scheme for commercial, Industrial street & flood lighting.

Unit-IV

Systems of electric traction, track electrification, Means of supplying power & train lighting, substation equipment & layout, over head equipment, D.C. & A.C. traction motor, speed control, various method of starting, Metadyne control series-parallel starting methods of electric braking of traction motor speed-time curve, Tractive efforts specific energy conversion, Mechanics of train movement.

Text Books/References

1. H. Pratap. Utilisation of Electrical Power.
2. Soni, Gupta, Bhatnagar. Electrical power systems, Dhanpath Rai and company.

EE 423 (b) ROBOT CONTROL AND SENSING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

*Introduction***:** Background, Historical development; *Robot Arm Kinematics***:** Introduction, The direct Kinematics Problem, The Inverse kinematics solution; *Robot Arm Dynamics***:** Introduction, Lagrange-Euler Formulation, Newton-Euler formation, Generalized D'Alembert equations of motion.

Unit-II

*Planning of Manipulator Trajectories***:** Introduction, General Considerations on trajectory planning, Joint-interpolated Trajectories, Planning of Manipulator Cartesian path trajectories.

Unit-III

*Control of Robot Manipulators***:** Introduction, Control of the Puma Robot Arm, Computed Torque technique, Near-minimum-time control, Variable structure control, Non-linear decoupled feedback control, Resolved motion control, Adaptive control; *Sensing:* Introduction, Range sensing, Proximity sensing, Touch Sensors, Force and torque sensing.

Unit-IV

Basic Concepts of robot vision and robot programming languages and learning. Industrial applications of robots selection and use of robots for foundry and casting, welding, material banding, machining Inspection, assembly and painting.

Text Books/References

1. F U K.S. Gonzalez / Lee. Robotics, controlling , sensing , vision and intelligence.
2. Yoren Koren. Robotics for Engineers.
3. Engel Berger. Robotics in practice.

EE 423 (c) NON-LINEAR SYSTEM

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Linear versus nonlinear systems. Describing function analysis: Fundamentals, common nonlinearities (saturation, dead-zone, on-off non-linearity, backlash, hysteresis) and their describing functions. Describing function analysis of nonlinear systems, Reliability of describing method analysis, Compensation and design of nonlinear system using describing function method.

Unit-II

Phase plane analysis: Phase portraits, Singular points characterization. Analysis of non-linear systems using phase plane technique, Existence of limit cycles. Linearization: Exact linearization, input-state linearization, input-output linearization.

Unit-III

Concept of stability, Stability in the sense of Lyapunov and absolute stability. Zero-input and BIBO stability. Second (or direct) method of Lyapunov stability theory for continuous and discrete time systems.

Unit-IV

Popov's stability criterion, generalized circle criterion, Kalman-Yakubovich-Popov Lemma. Popov's hyperstability theorem. Disturbance issues in nonlinear control, non-linear control system design problem; Approximate solution of nonlinear system using the perturbation method and averaging method.

Text Books/References

1. Gopal Nagrath. Control System Engineering.
2. Ogata. Modern control systems.
3. H. K. Khalil. (1995). Nonlinear Systems. Prentice Hall, Englewood Cli_s, NJ, second edition.
4. S. S. Sastry. Nonlinear Systems: Analysis, Stability and Control.

EE 423 (d) BIOMEDICAL INSTRUMENTATION

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Basic theories: Error contributions and analysis, effects of noise and evaluation.

Unit-II

Transducers and sensors Basic principles –magnetic, pressure, optical etc. Blood flow, pressure, cardiac rate etc bioelectric potentials, biopotential electrodes, biochemical transducers, medical surface electrodes.

Unit-III

Signal conditioning-Bioelectric amplifiers, differential amplifiers, Op amps and their applications, isolation and chopper stabilized amplifiers, other signal processing circuits. Display devices.

Unit-IV

Instrumentation schemes for respiratory system, cardiovascular system, Brain functions, Human nervous system, neuro muscular system measurement. Assisting and therapeutic devices, X-ray and radioisotope instrumentation, MRI scanner, ICU equipments, patient monitoring. Biotelemetry. Applications of fiber optics and lasers in medicine.

Text Books/References

1. L.C. Cromebel. Biomedical instrumentation and measurement.
2. R.S. Khadpur. Handbok of biomedical test.

EE 423 (e) OPTIMAL CONTROL THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Optimality Problem in Control Theory :Introduction; Examples of optimality problems; The 'n-interval' theorem, Mathematical models; Classification of problem constraints, Conditions of optimality.

Unit-II

Calculus of Variations: Basic concepts; Variations of functionals; Extremals, Fundamental theorem of the calculus of variations; The Euler equation, Problems with constraints; Constraints of integral and boundary condition types; Differential equation constraints, Variational approach to optimal control; Costate equations; The Hamiltonian equation; Necessary conditions of optimality, Boundary conditions; Linear regulators.

Unit-III

Pontryagin's Minimum Principle: The needle variation method, Minimum principle optimality conditions, Time-optimal and energy-optimal systems. Nonregular Cases: Singular optimal problems, Non-convex optimal problems; Optimal sliding modes.

Unit-IV

Dynamic Programming: Bellman's optimality principle, Discrete time systems, Continuous time systems; Bellman's function; The Hamilton-Jacobi-Bellman equation, Linear optimal systems; The Riccati equation; Singular problems.

Text Books/References

1. D. Kirk. Optimal Control Theory: an introduction, Prentice-Hall.
2. Arthur E. Bryson. (1999). Dynamic Optimization, Jr., Addison-Wesley.

ELECTIVE – II

EE 424 (a) POWER SYSTEM RELIABILITY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

System Reliability: Introduction, definition of reliability, failure, probability, concepts, power quality variation, reliability measurements, power supply quality survey, Reliability aids, and recent development.
Reliability Concepts: Measure of reliability rules for combining probabilities, Mathematical expectation. Distributions, reliability theory series and parallel systems, Markov processes. Static generating capacity reliability.

Unit-II

Outage Definition: Loss of load probability methods, loss of energy probability method. Load forecast, System Design and planning, Strategies for generation, Transmission & Distribution networks. Transmission system reliability evaluation-Average interruption rate method. The frequency and duration method.

Unit-III

Interconnected System: Generating capacity reliability evaluation introduction. The loss of load approach, reliability evaluation in two and more than two interconnected systems, Interconnection benefits.

Unit-IV

Load Forecasting: Necessity short-term forecasting by preliminary analysis control, medium term forecasting by field survey method, and long-time forecasting by statistical method. Regression analysis. Analysis of time series. Factors in power system loading.

Text Books/References

1. Billinton Roy & Ronald N.Allan. Reliability Evaluation of power system volume-I .
2. Billinton Roy & Ronald N.Allan. Reliability Evaluation of power System volume-II .
3. J Endreny. Reliability modelling in electric power system.
4. A.S. Pabla. Electric power distribution.

EE 424 (b) HIGH VOLTAGE ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Mechanism of breakdown in gases, liquids and solids, Townsands, and Streamer theories, Paschin's law, Impulse generator circuit. Techniques to observe wave front on CRO.

Unit-II

Method of generation of power frequency high voltages-cascade transformers and resonance methods. Generation of H.V.D.C. voltage stabilization, tesla coil.

Unit-III

Measurements of high voltage: Potential divider, sphere gap, electrostatic voltmeter, oscilloscope and their application in high voltage measurements, Measurement of loss angle and partial discharge measurement techniques.

Unit-IV

H.V. testing: Wet and dry flash over test, testing of insulators in simulated pollution conditions. Accumulation of charges in clouds, direct and indirect strokes, isokeravnic level,. Switching surges, protection of system against surges.

Text Books/References

1. K. Naidu. High voltage engineering.
2. C.L.Wadhwa. High voltage engineering, New Age.

EE 424 (c) ELECTRO-MECHANICAL ENERGY CONVERSION

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Dynamic equation of electromagnetic and electrostatic systems, energy balance equation. Introduction to state functions for electromechanical conservative and non-conservative systems.

Unit-II

Energy conversion force and torque calculations in coupled coils in translatory and rotating motion. Mutual and motional inductance. Energy storage in coupled stationary coils.

Unit-III

Generalized relations for a distributed winding. Generalized rotating machines energy conversion equation. Derivation of D.C. machine characteristics from generalized equation.

Unit-IV

Generalized equations for two phase and three phase a.c. machines coordinate transformation. Derivation of characteristics of two phase and three phase synchronous machine from generalized equation. Cross-field D.C. machines and their characteristics.

Text Books/References

1. P.S. Bimbhra. Electrical Machine Theory, Khanna publisher.
2. J.B. Gupta. Electrical Machine, Katariya and Sons.

EE 424 (d) POWER SYSTEM DYNAMICS

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Dynamic models of synchronous machines, excitation system turbines, governors, loads.

Unit-II

Modeling of single machine infinite bus system, mathematical modeling of multi-machine system.

Unit-III

Dynamic & transient. Stability analysis of single machine & multimachine systems. Power system stabilizer design for multimachine systems.

Unit-IV

Dynamic equi-valencing, voltage stability techniques for the improvement of stability. Direct method of transient stability analysis: transient energy function approach.

Text Books/References

1. Olle L. Elgerd. Electric Energy Systems Theory, PHI.
2. C.L Wadhwa. Electrical Power Systems, New Age.

EE 424 (e) MODERN CONTROL THEORY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

State variable method and design of linear systems: Concept of state, state variable, and state model, state space representation using physical, phase and canonical variables and their block diagram representation, state model and transfer function, diagonalisation, solution of state equation, state transition matrix its properties and computation, concept of controllability and observability and their test criterion, pole placement design using state feedback, state observer, reduced order and full order observer design.

Unit-II

Adaptive Control: Definitions, essential aspects of adaptive control, and classifications of adaptive control systems.

Model Reference Adaptive Systems: Different configurations of model reference adaptive systems: Classifications of MRAS, mathematical description equivalent representation as a nonlinear time-varying system, direct and indirect MRAC.

Continuous time MRAC systems: Introduction, MIT Rule, Lyapunoy approach, hyper stability approach, Monopoly's augmented error approach, narendra's and convergence studies.

Unit-III

Optimal Control Concept of optimization, static and dynamic optimization, parameter optimization Lagrange multiplier, and concept of optimal control.

Calculus of variation: Problem of Lagrange, mayers & bolze. Fixed end point problem – Euler Lagrange equation, variable end point problem and transerversality condition, limitation of calculus of variation.

Unit-IV

Non – linear system analysis: Behavior of non-linear systems, common physical non linearities, describing function method, concept derivation of describing function method, phase Plane method, singular points, stability of non-linear systems, and construction of phase Trajectories by isoclines method, non-linear system analysis by phase plane method.

Text Books/References

1. M.Gopal. Modern Control System Theory: New Age Publications.
2. K. Ogata. (1997). Modern Control Engg. Third Edition, and PHI.
3. M. Gopal. (1997). Control System, Principles & design:, TMH New Delhi,
4. B .C .Kuo. (1996). Automatic Control Systems: Sixth Edition, PHI.
5. Anderson & Moore. Optimal control:, PHI.
6. K.J. Astron. Adaptive Control system, 2nd Edition Pearson.

EE 424 (f) MICROWAVE ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Maxwell's equations, wave equations and their solutions in rectangular and cylindrical co-ordinates, wave guides, microwave resonators, attenuators, phase shifter, directional coupler, E-plane, H-plane and magic trees, coupling probes and loop. Slotted lines as standing wave detector. Discontinuities in wave-guides.

Unit-II

Microwave solid state devices: Ferrite devices, Tunnel diodes, Varactor, diodes, Crystal detectors and miners, Gunn diodes, Impatt diodes, Laser and Maser. Microwave generators and Amplifiers: Klystrons reflex Klystrons, Magnetrons.

Unit-III

Microwave Measurements: Frequency, power, attenuation, phase shift, impedance, noise figure, standing wave ratio and dielectrics at microwave frequency. Rapid broadband measuring techniques, calibration techniques.

Unit-IV

Microwave communication links, propagation of microwave, effect of earth and its curvature Duct formation. Transmission line equation. Introduction to troposcatter communication and Satellite communication.

Text Books/References

1. Rizzi. Microwave Engineering : Passive Circuit.
2. Gupta & Srivastava. Microwave Devices and Circuit Design.
3. Das, Annapurna & Sisir K Das. Microwave Engineering.
4. Robert Collin. Foundations for Microwave Engineering.

EE 424 (g) DISTRIBUTED CONTROL SYSTEM

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Unit-I

Programmable Logic Controllers: Ladder Diagrams Fundamentals, Basic Components and their Symbols, Fundamentals of Ladder Diagrams, Machine Control Terminology. The Programmable Logic Controller A Brief History, PLC Configurations, System Block Diagram, Update-Solve the Ladder-Update, Update, Solve the Ladder.

Fundamental PLC Programming: Physical Components vs. Program Components, Example Problem – Lighting Control, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding (also called Sealed, or Latched) Contacts, Always-ON and Always-OFF Contacts, Ladder Diagrams Having More Than One Rung.

Advanced Programming Techniques: Ladder Program Execution Sequence, Flip Flops, R-S Flip Flop, One Shot, D Flip Flop, T Flip Flop, J-K Flip Flop, Counters, Sequencers, Timers, Master Control Relays and Control Zones. Mnemonic Programming Code: AND Ladder Rung, Entering Normally Closed Contacts, OR Ladder Rung, Simple Branches, Complex Branches.

Unit-II

Wiring Techniques: PLC Power Connection, Input Wiring, Inputs Having a Single Common, Isolated Inputs, Output Wiring, Relay Outputs, Solid State Outputs.

Analog I/O: Analog (A/D) Input, Analog (D/A) Output, Analog Data Handling, Analog Input Potential Problems Discrete Position Sensors Sensor Output Classification, Connectivity Discrete Sensors to PLC Inputs, Proximity Sensors, Inductive Proximity Sensors, Capacitive Proximity Sensors, Ultrasonic Proximity Sensors, Optical Proximity Sensors.

Applications of PLC: Motor Controls AC Motor Starter, AC Motor Overload Protection, Specifying a Motor Starter, DC Motor Controller, Variable Speed (Variable Frequency) AC Motor Drive.

Unit-III

Distributed Computer Control for Industrial Automation: Introduction and Overview: Aims of Plant Automation, Classical Approaches, to Plant Automation Computer-Based Plant Automation Concepts, Distributed Computer Control System Architecture: Evolution of Hierarchical System Structure, Functional Levels, Database Organization, System Implementation Concepts, And Human Interface System Elements: Field Stations, Intermediate Stations, Central Computer Station, Monitoring and Command Facility.

Data communication links: Transfer of process data, communication within the system, MAO – Manufacturing Automation Protocol, Buses and communication networks of DCS.

Unit-IV

Software: Real-time Operating System, Communication Software, Process-Oriented Languages, Application Software, Software Configuration and Parameterization, Knowledge-Based Software Algorithms: Data Acquisition and Signal Processing Algorithms, Closed-Loop and Sequential Control, Optimal and Adaptive Control, Implementation Examples, Algorithms Available Within DCCS.

Applications: Brief overview of applications of PLC, SCADA & DCS in Power Plants, Iron and Steel Plants, Pulp and Paper Plants.

Text books/References

1. P. Bhatkar Vijay. Distributed computer control for industrial Automation.
   Marcel Dekker, Inc. New York and Basel.
2. John R. Hackworth, D. Frederic, J.R. Hackworth. Programmable logic controllers: Pearson education.
3. D. Gary. Programmable Logic Controllers, Thomson Pub., 2nd Edition.
4. John W. Web. Programmable Logic Controllers, PHI Pub. 5th Edition.
5. Krishna Kant. Computer Based industrial Control: PHI.
6. S.K. Singh. Computer Aided Process Control: PHI.