REGULATIONS AND COURSE DESCRIPTION

BACHELOR OF TECHNOLOGY

Computer Science Engineering

Effective from 2020-21

COLLEGE OF TECHNOLOGY AND ENGINEERING

Maharana Pratap University of Agriculture and Technology

Udaipur (Rajasthan) – 313 001

College of Technology and Engineering

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AND
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VISION OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

- To contribute to India and the World through excellence in the Domain of Computer Science and Engineering education and research and to serve as a valuable resource for Computer Science and Engineering based Industry and society at-large.

MISSION OF COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

- Committed to excellence, the department seeks to impart knowledge to develop latest technological skills with value based education among students to facilitate their development as successful and competent professionals for the nation.
- Promote excellence, foster high standards and orient the education towards future needs and opportunities through strong Academia, Industry and Stakeholder linkages.
- Strengthen the curricula as per the current needs of the industry and academia to promote research and development in frontier areas of Computer Science & Engineering.
- Provide opportunities for research, continuing education, faculty up-gradation and development of human resources in new and cutting edge technologies, especially through national and international collaboration.
- Strengthen non-formal training to promote innovation among students and equip them to be successful future entrepreneurs.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO I:

Apply computer science theory blended with mathematics and engineering to model computing systems.

PEO II:

Design, implement, test and maintain software systems based on requirement specifications.

PEO III:

Communicate effectively with team members, engage in applying technologies and lead teams in industry.

PEO IV:

Assess the computing systems from the view point of quality, security, privacy, cost, utility, etiquette and ethics.

PEO V:

Engage in lifelong learning, career enhancement and adapt to changing professional and community needs.

Program outcome: At the end of the program the student will be able to:

PO I:

Design algorithms for real world computational problems and analyze their complexities.

PO II:

Design, develop and maintain computing systems using concepts from mathematics, engineering and program's core courses.

PO III:

Design and develop computing applications with professional expertise to solve complex problems of the computer and information technology

PO IV:

Design and develop interfaces among subsystems of computing.

PO V:

Analyze large data samples and discover knowledge to provide solutions to engineering problems.

PO VI:

Assess security, privacy, quality and cost parameters in developing software systems.

PO VII:

Communicate effectively and practice professional ethics with societal responsibilities.

PO VIII:

Engage in lifelong learning through independent study of new techniques and tools.

PO IX:

Work in teams using common tools and environment to achieve project objectives.

ACADEMIC REGULATIONS
(UNDER-GRADUATE COURSES)

The students admitted in 2020-21 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 availing the permission for Special Mid-Term examination.

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:

$$\text{SGPA} = \frac{\sum C_i G_i}{\sum C_i}$$ 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
I with Distinction	7.50 and above
I	6.00 – 7.49
II	5.00 – 5.99

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 will be allowed to repeat two courses of his/her choice for improvement of OGPA, in the entire degree programme, provided that the course is being offered as regular course in the current semester.

(b) The Student should apply for improvement and submit the original mark sheet of the course for which he is applying for improvement along with application form.

(c) If a student does not appear in the improvement examination, his/her original marks will be retained and the fee deposited by him/her would not be refunded. Further, this will not be treated as his/her improvement attempt.

(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 examination fee for courses offered for improvement will be as prescribed by the University per paper irrespective of whether it is a regular course or a special paper.

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

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

(k) The marks for the sessional component of a practical part of course, if any, shall be awarded proportionately on the basis of the assessment of exercise conducted during the practical 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) Special examination of even semester backlog papers will be conducted along with regular first (odd) semester examination for those students who have completed 8th semester and have got backlogs upto 6 courses irrespective of semester.

(ii) Special fee per paper as prescribed by the university will be charged for the course(s) not listed for examinations in the first semester and normal fee per paper will be charged for the course(s) which are scheduled for regular examination in the first semester.

C. If the student is not eligible to appear in any of the above (as per clause 3.8.A and 3.8.B) special examinations or does not clear one or more backlog course in the special examination(s), he/she will have to clear the backlog courses by appearing as ex-student in the regular (main) examination of the semesters in which such courses are regularly offered within the maximum permissible duration as prescribed under 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.

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 is given below:

(i) For CE, EE, ME, MI, CSE, ECE branches

S. N.	Duration of training	Mode	After	Exam Sem.	Credit	Course Code
1	15 Days (2 wks)	In house	I year	III	1	BR239 (PSI)
2.	30 Days	In house/ Industry	II year	V	3	BR359 (PSI)
3.	30 days	In house/ Industry	III year	VII	3	BR479 (PSI)
				Total	07	

(ii) For Agriculturral Engineering branch

S. N.	Duration of training	Mode	After	Exam Sem.	Credit	Course Code
1	15 Days (2 wks)	In house	I year	III	1	AE 239 (PSI)
2.	Four weeks	In house/ Industry	II year	V	5	AE 351 (PSI
3.	Four weeks	In house/ Industry	III year	VII	5	AE 471 (PSI)
				Total	11*	

* *In addition to the above the agricultural engineering graduates have to undergo "Student READY Rural and Entrepreneurship Awareness Development Yojana",which includes 8 weeks Industrial attachment/ Internship (Student READY) and 8 weeks Experiential learning on campus (Student READY) in the first semester of final year B.Tech. (Ag.). Also, a student has to undergo an educational tour.*

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 elective courses and experiential learning/project.

Senior most Head of the Department	-	*Convener*
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.

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/YOGA 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(s) will be detained form appearing in the final examination of all such courses only in which he/she is short of attendance. All such course(s) in which a student is detained on account of shortage of attendance shall be treated as backlog. The student has to appear in both the theory and practical examination by regularly offering the courses as regular courses or as a contact course, if time table adjustment is not possible.

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 The registration of the student shall be cancelled if he/she remains absent from the college in any one subject (i.e. any particular course for which a student is registered in that semester) for more than seven days without prior permission. He/she would be re-registered on tendering apology to the effect that he/she will not repeat such absence in future within seven days of the cancellation of the registration by paying a fine of ₹s . 250/- or within 15 days by paying a fine of Rs.500/- or within one month by paying ₹s . 1000/-, respectively. The period of cancellation of registration shall be considered 'Absent' in the attendance record of the student and fulfillment of attendance requirement will be his/her responsibility.

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.

6.7 A student would not be allowed to appear in mid-term test(s) if his attendance in a particular course falls short of 50 percent.

6.8 For the purpose of calculating attendance, the date of registration in the course/programme in the semester/academic session should be taken as base date.

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 marks sheet 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) However, student will not be permitted to withdraw in the first semester of the programme.

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

(d) 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.

The distribution of marks shall be as follows :

Particulars	Total
Day-to-day assessment by the major advisor	35
Seminar	25
Viva-voce	40
TOTAL	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 the following rules:-

1. The student must have passed B. Tech. 1st and 2nd semesters examination in all subjects in one attempt with at least 6.0 OGPA or 60% of marks in the aggregate.
2. The student with back papers or whose result of 1st and 2nd semesters has not been declared due to any reason will not be considered eligible for change of branch.
3. Foreign students, sponsored by ICAR / other Agency etc., to study in a specific branch, will not be eligible for change of branch.
4. In case, any student has applied for re-valuation of his/her marks of 1st and 2nd semesters B.Tech. and the result has not been received upto the time of change of branch then such a student will not be entitled for change of branch on the basis of his/her revised result (received after the change of branch has been affected).
5. The change of branch will be allowed strictly on the merit by considering the marks obtained in theory paper only by the student in the B.Tech. first year first and second semester examination.
6. A student will be allowed to change branch only if a vacancy exists in the desired branch. However, if no vacant seat exists in a branch, then a supernumerary seat would be created as an incentive to compete and study more.
7. Not more than 10% students of the sanctioned strength from branch would be allowed to leave a branch.
8. No branch change is permitted against TFWS seat. However, a TFWS seat, surrendering Tuition Fee Waiver Seat.
9. Application for change of branch will be invited by the Dean, College of Technology and Engineering, Udaipur immediately after the declaration of first year final result.
10. In case of any ambiguity, the decision of the Dean, CTAE, Udaipur will be final and binding on all concerned.

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.

SCHEME OF TEACHING AND EXAMINATION

(Computer Science & Engineering)

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

I-SEMESTER

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 111 (BSC)	Mathematics -I	2	1	0	2	1	0	80	0	20
2	ESC	ME 112 (ESC)	Mechanical Engineering	3	0	0	3	0	0	80	0	20
3.	ESC	ME 113 (ESC)	Workshop Practice	0	0	1.5	0	0	3	0	80	20
4	ESC	CE 114 (ESC)	Engineering Drawing	0	0	1.5	0	0	3	0	80	20
			NCC/NSS/NSO/ Yoga/Scout	-	-	-	0	0	2	-	-	-
			Total	**5**	**1**	**3**	**5**	**1**	**8**			
			GROUP I									
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
			Total	**9**	**0**	**3**	**9**	**0**	**6**			
			GROUP II									
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
			Total	**6**	**1**	**5**	**6**	**1**	**10**			
			Total Credits	**21**								

Note :

1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.
2. The courses BS 100P, CE 100, EE 100, REE 100, BS 100C, 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 opt all the eight courses in first year.

SEMESTER – II

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 121 (BSC)	Mathematics -II	2	1	0	2	1	0	80	0	20
2	ESC	CE 122 (ESC)	Civil Engineering	1	0	1	1	0	2	50	30	20
3.	ESC	ME 123 (ESC)	Mechanical Drawing	0	0	1	0	0	2	0	80	20
4	ESC	ME 124 (ESC)	Workshop Technology	2	0	1	2	0	2	50	30	20
			NCC/NSS/NSO/ Yoga/ Scout	-	-	-	0	0	2	-	-	-
Total				**5**	**1**	**3**	**5**	**1**	**8**			
GROUP I												
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
Total				**6**	**1**	**5**	**6**	**1**	**10**			
GROUP II												
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
Total				**9**	**0**	**3**	**9**	**0**	**6**			
Total Credits				**21**								

Note :

1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.
2. Students have to undergo in house practical summer training [Branch Code 239 (PSI)] of 15 days at the end of II semester and will be assessed in III semester.

SECOND YEAR B.TECH. (III SEMESTER)

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	BSC	BS 231 (BSC)	Mathematics –III	2	1	0	2	1	0	80	0	20
2.	HSMC	BS 232 (HSM)	Human Values	2	0	0	2	0	0	80	0	20
3.	ESC	EE 232 (ESC)	Electrical Measurements	2	0	1	2	0	2	50	30	20
4.	ESC	EC 234 (ESC)	Analog Electronics	2	0	1	2	0	2	50	30	20
5.	PCC	CS 235 (PCC)	Object Oriented programming	3	0	2	3	0	4	50	30	20
6.	PCC	CS 236 (PCC)	Digital Logic Design	3	0	2	3	0	4	50	30	20
7.			NCC/NSS/NSO/ yoga/Scout	-	-	-	0	0	2	-	-	-
8.	PSI	CS 239 (PSI)	Training –I	0	0	1	0	0	0	0	100	0
Total				**22**			**14**	**1**	**14**			

SECOND YEAR B.TECH. (IV SEMESTER)

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	BSC	BS 242 (BSC)	Discrete Mathematical structure	2	1	0	2	1	0	80	0	20
2.	ESC	EC 243 (ESC)	Communication Systems	3	0	0	3	0	0	80	0	20
3.	ESC	EC 244 (ESC)	Pulse, digital and wave shaping	3	0	0	3	0	0	80	0	20
4.	PCC	CS 245 (PCC)	Data Structure & algorithms	3	0	2	3	0	4	50	30	20
5.	PCC	CS 246 (PCC)	Computer Organization & Architecture	3	0	1	3	0	2	50	30	20
6.	PCC	CS 247 (PCC)	Unix and Shell Programming	0	1	2	0	1	4	0	80	20
7.	PCC	CS 248 (PCC)	Programming with Java	3	0	2	3	0	4	50	30	20
			NCC/NSS/NSO/ Yoga/ Scout	-	-	-	0	0	2	-	-	-
Total Credits				**26**			**17**	**2**	**16**			

NCC/NSS/NSO/YOGA/SCOUT is compulsory non-credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: Students have to undergo a Practical Training-II of 30 days (In house/ Field) at the end of IV Semester for which assessment will be made at the beginning of next semester as CS359 (PSI)

THIRD YEAR B.TECH. (V SEMESTER)

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	CS 351 (PCC)	Database Management System	3	0	2	3	0	4	50	30	20
2.	PCC	CS 352 (PCC)	Computer Networks	3	0	2	3	0	4	50	30	20
3.	PCC	CS 353 (PCC)	Systems Administration	0	1	2	0	1	4	0	80	20
4.	PCC	CS 354 (PCC)	Formal Languages & Automata Theory	3	1	0	3	1	0	80	00	20
5.	PCC	CS 355 (PCC)	Microprocessor Interfacing and micro controllers	3	0	1	3	0	2	50	30	20
6	PSI	CS 359 (PSI)	Training –II	0	0	3	0	0	0	0	100	0
Total Credits				24			12	2	14			

THIRD YEAR B.TECH. (VI SEMESTER)

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	CS 361 (PCC)	Operating Systems	3	0	2	3	0	4	50	30	20
2.	PCC	CS 362 (PCC)	Design & Analysis of Algorithms	3	0	2	3	0	4	50	30	20
3.	PCC	CS 363 (PCC)	Complier Design	3	0	2	3	0	4	50	30	20
4 .	PCC	CS 364 (PCC)	IT Workshop	0	1	2	0	1	4	0	80	20
5.	PCC	CS 365 (PCC)	Software Engineering	3	0	1	3	0	2	50	30	20
6.	PEC	CS 366 (PEC)	Professional Elective –I (PE-1)	0	1	2	0	1	4	0	80	20
Total Credits				25			12	2	22			

Note: Students have to undergo a Practical Training-III of 30 days (In house/ Field) at the end of VI Semester for which assessment will be made in the next semester as CS 479 (PSI)

Professional Elective –I (PE - I)

PE-I (a): CS 366 (PEC)-(a)	Mobile Application Development
PE-I (b): CS 366 (PEC)-(b)	Web Technology
PE-I (c): CS 366 (PEC)-(c)	Data Analysis with Python

FOURTH YEAR B.TECH. (VII SEMESTER)

S. No.	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	PCC	CS 471 (PCC)	Distributed Systems	3	0	2	3	0	4	50	30	20
2	PCC	CS 472 (PCC)	Information Security	3	0	2	3	0	4	50	30	20
3	PEC	CS 473 (PEC)	*Professional Elective –II (PE-III)	3	0	1	3	0	2	50	30	20
4	PEC	CS 474 (PEC)	**Professional Elective –III (PE-III)	3	0	0	3	0	0	80	0	20
5.	OE	__478* (OE)	***Open Elective-I	3/2	0	0/1	3/2	0	0/2	80/50	0/30	20
6.	PSI	CS 479 (PSI)	Training –III	0	0	3	0	0	0	0	100	0
Total Credits				23			15	0	10			

*Professional Elective –II (PE – II)

PE-II (a): CS 473(PEC)-(a)	Information Security Assurance and Forensics
PE-II (b): CS 473(PEC)-(b)	Internet of Things
PE-II (c); CS 473(PEC)-(c)	Embedded Systems
PE-II (d): CS 473(PEC)-(d)	Cloud computing
PE- II (e): CS 473(PEC)-(e)	Artificial Intelligence
PE-II (f): CS 473(PEC)-(f)	Soft Computing
PE-II (g): CS 473(PEC)-(g)	Computer Graphics

**Professional Elective –III (PE – III)

PE-III (a): CS 474(PEC)-(a)	Data analytics
PE-III (b): CS 474(PEC)-(b)	Machine learning
PE-III (c): CS 474(PEC)-(c)	Neural Networks
PE-III (d): CS 474(PEC)-(d)	Data Warehousing & Mining
PE-III (e): CS 474(PEC)-(e)	Graph Theory
PE-III (f): CS 474(PEC)-(f)	Real Time Systems
PE-III (g): CS 474(PEC)-(g)	Object Oriented Analysis and Design

****OPEN ELECTIVE**

Note: The students have to take one open elective out of the list given below:

Offering Department	Course Code	Course Title	Credit		
			Th.	T	P
Civil Engineering	CE478a (OE)	Urban Waste Management	2	0	1
	CE478b (OE)	Ground Improvement Techniques	2	0	1
Mining Engineering	MI 478 (a) (OE)	Engineering Geology	2	0	1
	MI 478 (b) (OE)	Earth Moving Machinery	2	0	1
	MI 478 (c) (OE)	Tunnelling Engineering	2	0	1
Mechanical Engineering	ME 478(a) (OE)	Entrepreneurship And Industrial Management	2	0	1
	ME 478(b) (OE)	Bio Energy System Design	2	0	1
	ME 478(c) (OE)	Energy Conservation And Management	2	0	1
Electronics & Comm. Engg.	EC 478(a)(OE)	Intellectual Property Rights	3	0	0
	EC 478(b) (OE)	E-Commerce	3	0	0
Electrical Engg.	EE 478(a) (OE)	Knowledge Based System	3	0	0
	EE 478(b) (OE)	Advanced Power Converters	3	0	0
	EE 478(c) (OE)	Power Electronics In Renewable Energy Systems	3	0	0
Renewable Energy Engineering	REE 478(OE)	Renewable Energy Technologies	2	0	1
Soil & Water Engineering	SWE 478(OE)	Aerial Photography, RS and GIS	2	0	1
Farm Machinery & Power Engineering	FMP 478(OE)	Machinery For Land Development	2	0	1
Processing & Food Engineering	PFE 478(OE)	Packaging Materials And Methods	2	0	1

FOURTH YEAR B.TECH. (VIII SEMESTER)

S. No.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PSI	CS 481	Seminar	0	0	3	0	0	-	0	100	0
2.	PSI	CS 482	Project**	0	0	15	0	0	-	0	100	0
Total Credits				18								

Project :** Project can be done by the student in house or in industry as the case may be and as per the norms and guidelines of the college.

COURSE CONTENT

FIRST YEAR B.TECH. (I SEMESTER)

BS111 (BSC) MATHEMATICS – I

Cr. Hrs. 3(2+1+0)

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

Course Outcome: At the end of the course, the student will be able to:

CO1 : Expand function in Taylor's and Maclaurin's series.

CO2 : Trace the Cartesian and Polar curves.

CO3 : Apply the partial differentiation to compute the minima and maxima of functions of two variables.

CO4 : Compute areas and volumes by integration.

CO5 : Solve linear differential equations of higher order and homogenous differential equations with constant coefficients.

Unit-I

Differential Calculus: Taylor's and Maclaurin's expansions, Asymptotes and Curvature (Cartesian Coordinates only), Curve tracing (Cartesian and standard Polar Curves-Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral).

Unit-II

Differential Calculus: Partial Differentiation, Euler's Theorem on Homogeneous Functions, Maxima & Minima of Two Independent Variables, Lagrange's Method of Multipliers, Jacobians.

Unit-III

Integral Calculus: Double Integral, Areas & Volumes by Double Integration, Change of Order of Integration, Triple integrals, Beta Function and Gamma Function (Simple Properties), Relation between Beta and Gamma functions.

Unit-IV

Differential Equations: Linear Differential Equations of Higher Order with constant coefficients, Homogeneous Linear Differential Equations with constant coefficient.

Text Books/ References

1. Guar, Y.N. and Koul, *C.L, Engineering Mathematics*, Vols. I & II, Jaipur Publishing House, Jaipur (2013).
2. Babu Ram, *Engineering Mathematics-I*, Pearson Education, India (2011).
3. B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill, India (2012).
4. J.L. Bansal and H.S. Dhami, *Differential Equations*, Vols. I & II, Jaipur Publishing House, Jaipur (2012).
5. M.Ray and Chaturvedi, *A Text Book of Differential Equations*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati, *Engineering Mathematics*, New Age International (P) Ltd, New Delhi (2012).
7. Gupta C.B., Malik A.K., Engineering Mathematics –I, New Age international Publisher.

ME 112 (ESC) MECHANICAL ENGINEERING

Cr. Hrs. 3(3+0+0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcome: Upon completion of this course the students will be able to:

CO1: Apply the principles of conservation of mass, first and second laws of thermodynamics to analyse closed steady state systems and processes involving heat and work interactions.

CO2: Show understanding of concepts of reversibility, entropy and Carnot cycle.

CO3: Demonstrate knowledge of properties of steam and ability to compute them from steam tables and Mollier chart.

CO4: Understand construction and working of steam boilers, steam engines and their specific applications.

CO5: Compute efficiency, power output, etc. of various vapour and gas cycles.

CO6: Demonstrate knowledge about construction and working of IC engines.

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 only.

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

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.

Unit-III

Vapour Power Cycles: Introduction to Carnot Cycle, Rankine cycle and modified Rankine cycle.

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.

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. Comparison of petrol and diesel engines. Simple carburettor.

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: Foundation of Mechanical Engineering, Scientific Pub. (India), Jodhpur.
3. P.K. Nag: Engineering Thermodynamics, TMH.

ME113 (ESC) WORKSHOP PRACTICE

Cr. Hrs.	**1.5 (0 + 0 + 1.5)**		
	L	**T**	**P**
Credit	**0**	**0**	**1.5**
Hours	**0**	**0**	**3**

Course Outcome: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of characteristics of various types of woods used in engineering applications.

CO2: Demonstrate knowledge of tools and operations in carpentry work, black smithy, fitting, sheet metal and plumbing works in engineering practice.

CO3 : Identify and use measuring instruments in workshop practice and pipe fittings.

CO4: Learn use of tools in the carpentry, fitting, smithy, sheet metal and plumbing shop to make simple jobs.

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, tenon 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 books/References

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

CE 114 (ESC) ENGINEERING DRAWING

Cr. Hrs.	**1.5 (0+0+1.5)**		
	L	**T**	**P**
Credit	**0**	**0**	**1.5**
Hours	**0**	**0**	**3**

Course Outcome: At the end of the course, the student will be able to:

CO1 : Select, Construct and Interpret appropriate drawing scale as per the situation.

CO2 : Draw simple curves like ellipse, cycloid and spiral.

CO3 : Draw Orthographic projections of points, lines and planes.

CO4 : Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.

CO5 : Layout development of solids for practical situations.

CO6 : Draw isometric projections of simple objects.

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 Books / Reference

1. N.D. Bhatt. Elementary Engg. 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 (BSC) ENGINEERING PHYSICS

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome: At the end of the course, the student will be able to:

CO1 : Apply vector calculus approach to problems in electric field and magnetic field.

CO2 : Apply laws of physics to simple LRC circuits.

CO3 : Learn physics behind various types of lasers and their characteristics.

CO4 : Understand the interference and diffraction from wave optics concepts and know its applications.

CO5 : Understand polarization of light and its applications.

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), Spectra 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 Fraunhoffer diffraction pattern, Fraunhoffer 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 polarimeter and its use for determination of specific rotation of sugar solution.

Practical

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 (ESC) ENGINEERING MECHANICS

Cr. Hrs.	**3(2+0+1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 : Draw free body diagrams and determine the resultant of forces and/or moments.

CO2 : Determine the centroid and second moment of area of sections.

CO3 : Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.

CO4 : Analyse statically determinate planar frames.

CO5 : Analyse the motion and calculate trajectory characteristics.

CO6 : Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

(A) STATICS

Unit-I

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

Moment and couples: Moment and parallel forces, Couples, Genera 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 horizonta planes, Friction on inclined planes, Wedge and block, Screw Jack

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.

(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.

Practical

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 (ESC) ELECTRICAL ENGINEERING

Cr. Hrs.	**4(3+0+1)**		
	L	**T**	**P**
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 : Proficiency in solving DC network.

CO2 : Know-how of single phase AC circuits.

CO3 : Competency in solving three phase balanced AC circuits.

CO4 : Dexterity in using basic electrical instruments.

CO5 : Comprehension of transformer working principles.

Unit-I

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses.

Kirchoff's law, Delta-star and star-delta conversion, source conversion

Network theorems: Thevenin's, Norton's, superposition, and Maximum Power Transfer theorem.

Unit-II

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, parrallel, series-parrallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

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.

Fundamentals of DC machines: Working principle, operation and performance of DC machines (Motor and generator)

Unit-IV

Three phase A.C. circuits: Three phase EMF generation, delta and star connection, methods of three phase power measurement; power factor, reactive and apparent power, Series and parallel resonance.

Concept of Three phase induction motor: Construction and operation. Basic introduction of single phase induction motor.

Practical

1. To Establish the Voltage-Current Relationship in an Electric Circuit and to Measure the Unknown Resistance by Ammeter-Voltmeter Method (Ohm's Law).
2. Experimentally Verify the Number of Resistance Connected in Series and parallel in an Electric Circuit can be replaced by in Equivalent Resistance without Disturbing the Circuit Condition.
3. Verify Kirchhoff's Current Law and voltage law for a DC Circuit.
4. Verify Superposition Theorem For A DC Circuit.
5. Verify Thevenin's Theorem for a Dc Circuit.

6. To Measure Power and power factor in a Single Phase A.C. Series R-L Circuit.
7. Determination of Choke Coil Parameter Resistance (R) and Inductance (L).
8. To Study The Characteristics of an L-C-R Series Circuit.
9. Testing of Single Phase Energy Meter by Direct Loading Method.
10. Determination of Percentage Regulation of a Single Phase Transformer by Direct Loading Method.
11. Determination of Efficiency of a Single Phase Transformer By Direct Loading Method
12. To perform open circuit and short circuit test for single phase transformer
13. To obtain load characteristics of D.C. shunt/series /compound generator
14. To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent circuit parameters
15. To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent circuit.

Text Books / References

1. B.L. Therja. Electrical Technology, S. Chand.
2. M.E. Van Valkenberg. Network analysis, PH.I
3. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher.
4. Dr. R.A. Gupta and Dr. Nikhal Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH.
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.

REE 100 (HSM)
ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Cr. Hrs.	**2(2+0+ 0)**		
	L	**T**	**P**
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1 : Develop an understanding of different natural resources including renewable resources.

CO2 : Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

CO3 : Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.

CO4 : Demonstrate an appreciation for need for sustainable development and role of science.

CO5 : Aware of important acts and laws in respect of environment.

Unit-I

Environmental Studies: Definition, scope and importance. Natural Resources: Renewable and non-renewable resources and associated problems.

Forest resources: Use and over-exploitation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

Unit-II

Ecosystems: Concept, Structure and function. Energy flow in an ecosystem. Ecological succession, Food chains, food webs and

ecological pyramids. Introduction, types, characteristic features, structure and function of the various ecosystems.

Biodiversity and its conservation: Introduction, definition, genetic species & ecosystem diversity and biogeographical classification of India.

Value of biodiversity. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation.

Unit-III

Environmental Pollution: definition, cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Social Issues and the Environment: Urban problems related to energy; Water conservation, rain water harvesting, watershed management.

Environmental ethics: Issues and possible solutions; Wasteland reclamation, Consumerism and waste products. Environment Protection Act.

Issues involved in enforcement of environmental legislation. Public awareness, Human Population and the Environment: population growth, 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.

Unit-IV

Natural Disasters: Meaning and nature, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, accidents.

Disaster Management: Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept

of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Armed forces in disaster response; Disaster response; Police and other organizations.

Text Books / References

1. Agarwal K.C., Environmental Biology, Nidi Publications, Bikaner, 2001.
2. Bharucha Erach. 2005. Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission, University Press, Hyderabad.
3. Chary Manohar and Jaya Ram Reddy. 2004. Principles of Environmental Studies, BS Publishers, Hyderabad.
4. Chaudhary, B.L. and Jitendra Pandey: Environmental Studies, Apex Publishing House, Udaipur, 2005
5. Climate Change.1995: Adaptation and mitigation of climate change-Scientific Technical Analysis Cambridge University Press, Cambridge.
6. Gupta P.K. 2004, Methods in Environmental Analysis – Water. Soil and Air. Agro bios, Jodhpur.
7. Husain Majid. 2013, Environment and Ecology: Biodiversity, Climate Change and Disaster Management, online book.
8. Jhadav, H. & Bhosale, V.M.: Environmental Protection & Laws, Himalaya Pub. House, Delhi
9. Kaul S.N., Ashuthosh Gautam. 2002. Water and Waste Water Analysis, Days Publishing House, Delhi.
10. Rao, M.N. and A.K. Datta, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
11. Sharma J.P. 2003, Introduction to Environment Science, Lakshmi Publications.
12. Sharma, B.K., Environmental Chemistry, Goel Publishing House, Meerut
13. Sharma, R.K. & Sharma, G. 2005, Natural Disaster, APH Publishing Corporation, New Delhi.
14. Singh Pratap, N.S. Rathore and A.N. Mathur: Environmental Studies, Himanshu Publications, Udaipur, 2004.
15. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno Science Publications.

BS 100C (BSC) ENGINEERING CHEMISTRY

Cr.Hrs. 3(2+0+1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Demonstrate knowledge of science behind common impurities in water and methods to treat them.

CO2 : Describe the purpose and operational steps of key water treatment processes used to improve water quality including: Coagulation, Sedimentation, Filtration, Disinfection, Corrosion Control, Taste and Odour Control

CO3 : Know the methods to determine the calorific value of fuels, perform flue gas analysis and combustion analysis.

CO4 : Apply the science for understanding corrosion and its prevention.

CO5 : Apply the knowledge of Kinetics of Reactions.

Unit-I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sterilization, break point chlorination. Hardness, determination of hardness by Complex metric (EDTA) method, degree of hardness, 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, Proximate and Ultimate analysis of coal, significance of constituents, theoretical method for calculation of Gross and net calorific values. Liquid fuels- Petroleum origin, Refining of Petroleum, knocking, octane number, anti knocking agents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit-III

Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.

Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

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, Numerical of first and second order reactions.

Practical

1. Determination of viscosity of a liquid.
2. Estimation of free chlorine in a water sample.
3. Determination of temporary and permanent hardness by EDTA method.
4. Determination of Copper Sulphate iodometrically.
5. Estimation of Potassium dichromate iodometrically.
6. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
7. Estimation of available chlorine in Bleaching Powder sample.
8. Analysis of Brass.
9. Determination of Strength of Ferrous Ammonium Sulphate (FAS) using Potassium Ferricyanide as an external indicator.
10. Analysis of Common Salt.

Text Books / References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry,Jaipur Publishing House,Jaipur
3. B.K. Sharma. Engg. Chemistry(General), Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand & Co., New Delhi.
5. M.M. Uppal. A Text Book of Engineering Chemistry,Khanna Publishers, New Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations in Engg.Chem. S.Chand & Co., New Delhi.
7. Ameta and Yasmin. Practical Engineering Chemistry, Himanshu Publications, New Delhi.

EC100 (ESC) ELECTRONICS AND INSTRUMENTATION

Cr.Hrs. 3(2+0+1)

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

Course Outcome: At the end of course, the students will be able to

CO1 : Analyze characteristics of various passive components (such as diode, LED, BJT, JFET etc.) commonly used in electronic devices.

CO2 : Understand basics of power amplifier and voltage regulators.

CO3 : Conceptualize feedback amplifier and different types of oscillator.

CO4 : Demonstrate functioning of basic electronic instruments (CRO, transducers etc.).

Unit-I

Passive Components: Construction and characteristics of various types of resistors, capacitors & inductors for electronic circuits, color coding of resistors. Semiconductor Devices: Basic theory of semiconductors, constructions and characteristics of PN diode, Zener diode, photodiode, LED, BJT & JFET.

Unit-II

Bipolar Junction Transistor: Introduction to BJT biasing circuits, Basic concept of class-A, class-B, class-AB, class-C amplifiers.

Power supply: Rectifier circuits and filters. Concept of voltage regulators, Zener diode voltage regulators, Transistor series regulator.

Unit-III

Feedback & Oscilloscopes: Concept of positive and negative feedback. Introduction to Oscilloscope. Barkhausen criteria. Working principle of RC- phase shift, Wien bridge, Hartley, Colpitts and Crystal Oscilloscopes.

Unit-IV

Transducers: Active and Passive transducers. Working principle of Thermocouple, LVDT, Strain Gauge and Tacho Generator. Instrumentation: Introduction to data acquisition system. Working principle of Electronic Multimeter, Cathode Ray Oscilloscope, Digital Storage Oscilloscope and Spectrum Analyzer.

Practical

1. Identification and testing of different types of passive and active electronic components: Resistors, Capacitors, Inductors, Diodes, Transistors.
2. Plot the V-I characteristics in forward and reverse bias mode for
   (a) PN junction diode
   (b) ZENER diode and find the cut- in and breakdown voltage respectively.
3. Plot the V-I characteristics of LED diode in forward bias mode and find the glow voltage.
4. Determine the R.M.S value of output voltage and check the waveform on CRO for:
   (a) Half wave rectifier with and without filter.
   (b) Full wave centre tapped rectifier with and without filter.
   (c) Full wave bridge rectifier with and without filter.
5. Plot the input and output characteristics for two configurations of transistors:
   (a) NPN/PNP transistor in CE configuration.
   (b) NPN/PNP transistor in CB configuration.
6. Determine both theoretically and practically the frequency of oscillation for R-C Phase shift Oscilloscope.
7. Determine the output voltage of an amplifier: (a) with feedback (b) without feedback.
8. Study and perform basic measurement of Digital Multi Meter.
9. Study and perform basic measurement of Cathode Ray Oscilloscope/ Digital Storage Oscilloscope.
10. Study of Spectrum Analyzer and perform basic measurements.

NOTE: *The actual number of experiments may be more than the above mentioned list.*

Text Books / References

1. Millman and Halkias. Integrated electronics: Mc Grew Hill
2. W.D Cooper. Electronics Instrumentation and Measurement : PHI
3. M.L.Gupta. Electrical Engineering Materials
4. Melvin,o Principles of Electronics
5. John D. Ryder. Electronics Fundamentals

CS 100 (ESC)
COMPUTER PROGRAMMING FOR PROBLEM SOLVING

Cr. Hrs. 3(0+1+2)

	L	T	P
Credit	0	1	2
Hours	0	1	4

Course outcome: At the end of the course, the student will be able to:

CO1 : Design, implement, test, debug, and document programs in C using conditional branching and iteration.

CO2 : To use arrays, understand how to write and use functions, how the stack is used to implement function calls, and parameter passing options.

CO3 : Implement recursion functions & use of pointers and structures to formulate programs.

CO4 : To be able to create, read and write to/from files and to write simple searching and sorting algorithms.

Unit-I

Introduction to Programming, Algorithm, Flowchart, Arithmetic expressions and precedence: The Character set, constants, variables and keywords, data types, Type Conversion, Hierarchy of Operations, Conditional Branching: The if Statement, if-else Statement, Nested if-else, Ladder if-else, The Conditional Operators. Loops: While Loop, do-while loop, for Loop, Nesting of Loops, Multiple Initializations in for Loop, break Statement, continue Statement, Decisions using switch, Go to Keyword, finding roots of an equations.

Unit-II

Arrays: Array Initialization, Bounds Checking, One and Two Dimensional Arrays, Memory Map of a 2-Dimensional Array, Strings: String Functions-strlen( ), strcpy( ), strcat( ), strcmp( ), Two-Dimensional Array of Characters. Function: Function Declaration and Prototypes, Parameter passing in functions: Call by Value and Call by Reference, Passing Array Elements to a Function, Passing an entire Array to a Function.

Unit-III

Recursion: Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Structures: Declaring a Structure, Array of Structures. Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures.

Unit-IV

File handling: Create, open, insert, update, search and display operations. Basic Algorithms: Searching: linear & binary, Basic Sorting Algorithms (Bubble, Quick sort and Merge sort), Notion of linked list.

Text books / References

1. "Let us C", Yashwant Kanetkar, Allied Publishers.
2. "The C programming language", Kernighan and Ritchie, Prentice Hall of India.
3. "Programming in ANSI C", E. Balaguruswamy, Tata McGraw Hill.

BS100E (HSM)
COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

Cr. Hrs. 3 (2 + 0 +1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome: At the end of the course, students will be able to:

CO1 : Understand basic grammar principles, and apply them to synthesise and transform sentences and identify common errors in writing

CO2 : Demonstrate enhanced communicative ability in English, and develop sensitivity to cultural differences in communication

CO3 : Write structured paragraphs and essays, CVs, letters and professional emails

CO4 : Understand their personality type, develop leadership qualities and time-management techniques

CO5 : Understand the process and types of communication and the barriers to effective communication

CO6 : Show improved vocabulary and pronunciation

CO7 : Practice skills required for oral presentations, group discussions and interviews

Unit-I

Sentence and its types, Parts of Speech, Articles, Tenses, Concord Modals, Narration and Voice.

Unit-II

Nissim Ezekiel: Goodbye Party for Miss Pushpa T.S. – Poem (Introduction to Indianisms and Difference between Indian English and Standard English).

George Orwell: Politics and the English Language – Essay (Writing process and what constitutes good or bad writing; rules of writing for effective communication).

Unit-III

C.V and Resume Writing, Letter Writing, E-mail Writing, Paragraph Writing (Topic sentence, inductive and deductive logic), Essay Writing (Narrative, Descriptive, Expository and Persuasive).

Unit-IV

Personality Traits (Big Five Model), *Skills of a Good Leader,* Effective Time Management Techniques, Communication: Process and Types (Verbal/Non-Verbal/Para-Verbal, Intrapersonal/Interpersonal, Upward/ Downward/Horizontal/Diagonal), Barriers to Effective Communication.

Practical (Language Lab)

Phonetics, Group Discussions, Mock Interviews, Presentations, Vocabulary Building (Synonyms, Antonyms, One-Word Substitutes, Idioms and Phrases), Listening Comprehension, Everyday Conversations.

Text books / References

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007
3. High School English Grammar and Composition. Wren and Martin. S. Chand. 2018
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
7. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
8. The Ultimate Book of Common Errors. Terry O'Brien. Rupa Publications. 2015.
9. Technical Writing for Engineers and Scientists. Barry J. Rosenberg. Addison-Wesley Professional. 2005.
10. Spoken English: A Manual of Speech and Phonetics. R.K. Bansal & J.B. Harrison. Orient Longman. 2013.
11. English Phonetics & Phonology: A Practical Course. P. Roach. Cambridge University Press, London. 2010.
12. Handbook of the International Phonetic Association: A Guide to the Use of the International Phonetic Alphabet. Cambridge University Press.
13. Communicating Your Way to Success: The Success Stories. Dale Carnegie. Manjul Publishing House. 2018.
14. Talk like TED: The Public-Speaking Secrets of the World's Top Minds. Carmine Gallo. St. Martin's Press. 2014.
15. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Gopalaswamy Ramesh and Mahadevan Ramesh. Pearson Education. 2013.

FIRST YEAR B.TECH. (II SEMESTER)

BS121 (BSC) MATHEMATICS – II

Cr. Hrs. 3(2+1+0)

	L	T	P
Credit	2	1	0
Hours	2	1	0

Course Outcome: At the end of the course, the student will be able to:

CO1 : Show knowledge of vector calculus and its applications in engineering.

CO2 : Solve second order differential equations for application in their field of engineering.

CO3 : Solve partial differential equations of first order and higher orders (with constant coefficients).

CO4 : Solve simultaneous equations by matrix methods.

CO5 : Determine eigen values and eigenvectors.

CO6 : Diagonalise a matrix and invert a matrix.

Unit-I

Vectors Calculus: Scalar and Vector field, Differentiation of vector functions, Gradient, Divergence, Curl and Differential Operator, Integration of vector functions, Line, Surface and volume Integrals, Green's Theorem in a Plane, Gauss's and Stoke's Theorem (without proof) and their Applications.

Unit-II

Differential Equations: Second Order Ordinary Differential Equations with Variables Coefficients, Exact Forms, Part of Complimentary Function is known, Change of Dependent Variable, Change of Independent Variable, Normal Forms, Method of Variation of Parameter.

Unit-III

Partial Differential Equations: Formation of partial differential equations, Partial Differential Equations of First Order, Lagrange's Form, Standard Forms Higher order linear partial differential equations with constant coefficients.

Unit-IV

Matrices: Rank of a matrix, Inverse of a matrix by elementary transformations, Consistency and Solution of simultaneous linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), Diagonalization of matrix.

Text Books / References

1. Guar, Y.N. and Koul, C.L.(2013), *Engineering Mathematics,* Vols I and II, Jaipur Publishing house.
2. Bansal, J.L. and Dhami, H.S.(2012), *Differential Equation* Vols I and II, Jaipur Publishing house.
3. Babu Ram (2011), *Engineering Mathematics –I* , Pearson Education India.
4. B. V. Ramana (2012), *Heigher Engineering Mathematics*, Tata McGrew Hill, India.
5. M. Ray and Chaturvedi, *A text book of Differential Equation*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati (2012), *Engineering Mathematics*, New Age International (p) Ltd., New Delhi.
7. Gupta C.B., Malik A.K., *Engineering Mathematics –II,* New Age international Publisher.

CE 122 (ESC) CIVIL ENGINEERING

Cr. Hrs. 2(1+0+1)

	L	T	P
Credit	1	0	1
Hours	1	0	2

Course Outcome: At the end of the course, the student will be able to:

CO1 : Demonstrate knowledge of various surveying methods.

CO2 : Conduct a compass survey.

CO3 : Conduct levelling survey and be able to do RL calculations.

CO4 : Demonstrate knowledge of properties of various building materials.

CO5 : Plot work profile.

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Introduction of Chain Surveying: Instrument for chaining, Direct & indirect ranging. Introduction of laser based distance measurement

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

Introduction of plane table Surveying: Accessories and working operation.

Unit-II

Level and leveling: Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy level, 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 compaction of concrete.

Timber: Properties of good quality timber. Decay and preservation of timber.

Practical

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Study of prismatic compass and taking bearings..
4. Study of Dumpy level, temporary adjustment and R.L. calculations.
5. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
6. Longitudinal sectioning.
7. Cross sectioning.
8. Fly leveling operation.
9. Plotting of working profile.
10. Introduction of laser based distance measurement.
11. Properties of good quality bricks.
12. Properties of good quality stone.
13. Properties of good quality timber.
14. Physical test of cement.

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.
3. Kanetkar T. P., 'Surveying and leveling', Vol. I & II.
4. Duggal S. K., 'Text book-Surveying', Vol. I & II.

ME123 (ESC) MECHANICAL DRAWING

Cr. Hrs. 1(0+0+1)

	L	T	P
Credit	0	0	1
Hours	0	0	2

Course Outcome: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of conventional representation employed in machine drawing.

CO2: Make detailed drawings of simple machine parts in first/third angle projection by proper choice of sectioned views as per need.

CO3 Read, interpret and visualize machine parts from a given drawing.

CO4: Demonstrate knowledge of riveted, welded, threaded and screwed joints and fastenings.

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.

ME124 (ESC) WORKSHOP TECHNOLOGY

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome: Upon completion of this course the students will be able to:

CO1: Understand welding principles, equipment and tools of arc-, gas and resistance welding, brazing and soldering.

CO2: Describe construction, operations and tools of lathe, shaper and drilling machines.

CO3 Understand basic hot and cold forming operations.

CO4: Demonstrate knowledge of types of patterns, cores, moulding sands and tools.

CO5: Understand sand, permanent mould and investments castings and casting defects.

Unit-I

Welding: Introduction to types of welding. Principle of electric arc welding, welding tools and safety devices, welding positions, welding joints, types of welds, Resistance welding. Oxyacetylene gas welding, types of flames. Soldering and Brazing.

Unit-II

Lathes: Constructional details of centre lathe. Main operations and tools used on centre lathes.

Shaper: Types of shapers. Constructional details of standard shape shaper tools and main operations.

Unit-III

Drilling Machines: Types of drilling machines. Constructional details o pillar type and radial drilling machines. Main operations. Twist drills, dri angles and sizes.

Forming: Basic descriptions and applications of hot and cold workin processes, forging, bending, shearing, drawing and forming operations.

Measurement and Inspection: Classification of measuring instruments linear and angular measurement, comparators.

Unit-IV

Foundry & Casting Practices: Introduction, types of patterns Mouldings, moulding materials, cores, moulding tools and equipments Moulding sands, properties of moulding sands. Casting defects. Castin methods: Permanent mould casting, investment casting.

Practical

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

Text Books / References

1. Mathur Mehta and Tiwari: Elements of Mechanical Engineering, Jain Brothers, New Delhi.
2. S.K. Hajra Choudhury and A.K. Hajra Choudhury: Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

III SEMESTER

BS231 (BSC) MATHEMATICS – III

Cr. Hrs. 3 (2 + 1 + 0)

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

Course Outcome: At the end of the course, the student will be able to:

CO1 : Understand Finite differences, various difference operators and their relationships, factorial notation.

CO2 : Use numerical methods in modern scientific computing.

CO3 : Find the Inverse Laplace Transform by Partial Fractions.

CO4 : Use the Laplace Transform to solve differential equation with constant coefficients.

CO5 : Numerically integrate any function by Trapezoidal and Simpson's rule.

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 Book/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.
5. Bansal, Bhargava, *Numerical Analysis*, JPH, Jaipur.

BS232 (HSM) HUMAN VALUES

Cr. Hrs. 2 (2 + 0 + 0)

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

Course Outcome: At the end of the course, the students will be able to:

CO1 : Distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.

CO2 : Engage in a process of self-reflection and know what they 'really want to be' in their life and profession

CO3 : Understand the meaning of happiness and prosperity for a human being.

CO4 : Understand harmony at all the levels of human living, and live accordingly.

CO5 : Apply the understanding of harmony in existence in their profession, develop commitment and courage to act in order to lead an ethical life.

Unit-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for value education; Self Exploration - content and process; 'Natural Acceptance' and Experiential Validation; Continuous Happiness and Prosperity with respect to Human Aspirations; Method to fulfil human aspirations: understanding and living in harmony at various levels.

Unit-II

Understanding Harmony in the Human Beings and their Relationships - Harmony in Myself, Family and Society

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha; Understanding the Body as an instrument of 'I' ,Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Swasthya;

Understanding harmony in the Family; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman);

Understanding harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family.

Unit-III

Understanding Harmony in Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive Space; Holistic perception of harmony at all levels of existence.

Unit-IV

Implications of the above - Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, and develop appropriate technologies and management models; Strategy for transition from the present state to Universal Human Order at the level of individual and society.

Note: In each unit, relevant practice exercises and case studies to be taken up. Mode of conduct should be through group discussions.

Text Books/ References

Textbook:

R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009. ISBN: 978-9-350-62091-5

Other reference books:

1. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Annie Leonard, 2010, The Story of Stuff, Free Press
4. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
5. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
6. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
7. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
8. A Nagraj, 1998, Jeevan Vidya: Ek Parichay, Divya Path Sansthan, Amarkantak.
9. A N Tripathy, 2003, Human Values, New Age International Publishers.
10. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co.
13. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

EE 232 (ESC): ELECTRICAL MEASUREMENTS

Cr. Hrs. 3 (2 +0+ 1)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Ability to comprehend for the measurement of circuit quantities.

CO2: Capacity to deal with minimization of errors in measurement.

CO3: Capacity for understanding of most useful techniques in a particular case of measurement.

CO4: Ability to understand electronic instruments and related losses.

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.

Lab/Practicals

Lab experiments based on theory.

Text Books/References

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

EC 234 (ESC) ANALOG ELECTRONICS

Cr. Hrs. 3 (2 +0+ 1)

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

Course outcome: At the end of the course, the student will be able to:

CO1: To develop fundamental concepts of analog electronics.

CO2: To enhance the knowledge of feedback concepts and their effects on amplifier performance.

CO3: To master the basic ideas of power amplifiers and tuned amplifiers.

CO4: To understand the concept of oscillator using positive feedback systems.

CO5: To develop an knowledge of operational amplifier and various analog computation using operational amplifiers.

Unit–I

Response of Transistor Amplifier: Review of biasing, classification of amplifiers, distortion in amplifiers, frequency & phase response of an amplifier, cascaded amplifiers responses, transistors model at high frequencies for CE and Emitter follower configuration, high frequency response of two cascaded CE transistor stages.

Unit–II

Feedback Amplifier: Classification of amplifier, feedback concept, general characteristics of negative feedback amplifiers, analysis of a feedback amplifier, various types of feedback and their effects on amplifier performance.

Unit–III

Power Amplifiers: Class A large signal amplifier, second and higher harmonic distortion, transformer coupled amplifiers Efficiency of amplifiers, Push-pull amplifiers (Class A & Class B). Tuned Amplifiers: Single tuned capacitively coupled amplifier & its steady state response determination of Gain, Band width product. Tapped tuned, inductivity coupled single tuned.

Unit–IV

Oscillator: Criteria of oscillations, sinusoidal oscillators, Hartley, Colpits, Wains bridge, Phase shift. General form of oscillators, crystal oscillator, frequency stability. Operational Amplifiers: Basic op-amp, differential amplifier, IC Op-amp & its characteristics, Linear applications of IC Op-amp, Inventor, Adder, Intergrator, Differentiator, Analog computation.

Lab/ Practicals

Lab experiments based on theory.

Text Books/References

1. "Integrated Electronics", Millman & Halkias, McGraw Hill publication.
2. "Engineering Electronics", Alley & Ahwood, John Wiley & Sons Inc, New York London.

CS 235 (PCC): OBJECT ORIENTED PROGRAMMING

Cr. Hrs. 5 (3 + 0+2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Modularize computing problems into classes, objects and functions for implementing OOPs concepts.

CO2: Design, develop and analyze C++ programs with various concepts and constructs of OOP such as constructors, destructors, polymorphism, inheritance etc.

CO3: Demonstrate the ability to model simple data structures like arrays, strings, linked lists etc. with efficiency using suitable memory allocation concepts.

CO4: Apply various advance features of C++ such as exception handling, templates, built-in Standard Template Library, I/O streams etc. for making the program more organized, reusable and user-friendly.

CO5: Analyze a given programming problem and design its corresponding object-oriented programming solutions.

Unit-I

Concept of Object Oriented Programming, Objects Classes, Encapsulation, Inheritance, Polymorphism. C/C++. C++ core language. Program structure, Functions. Primitive Data types, Variables, Header and Pre-Processor Directives, cin, cout, iomanip.h. for, while, do-while loops, if, if-else, nested if-else, switch, logical and, or and not operators, break, continue, goto and exit statements, functions, declarations, definitions, returns, Parameters by values by reference, default arguments, Inline functions, Automatic, external, static, variables. Const function arguments. Structures, Defining, Accessing Members, Structure within Structure, Class, Classes and Objects, Objects as Data Types.

Unit-II

Constructors, Overloading, Copy Constructors, Objects and Memory allocations, const and Classes, Objects as Arguments to functions. Arrays and Strings, Arrays as parameters to functions, C++ String class, Operator Overloading: Arithmetic, Logical, Assignment. Pointers, pointer to void, pointers and arrays, pointers and functions, new and delete operators, pointers to objects, Array of pointers to objects, A Linked List example, Pointers to pointers.

Unit-III

Inheritance, Derived class and base classes, Derived class constructors, Overriding member functions, Class Hierarchies, Multiple Inheritances. Virtual Functions, Friend Functions, Static functions, Dynamic Type Information.

Unit–IV

Ios, istream, ostream, iostream classes, stream errors, Disk I./O with streams, file pointers, overloading cin, cout operators, multi file programs and projects, Exceptions, Exceptions with arguments, Templates, Linked List using templates. Introduction to Standard Template Library.

Lab/ Practicals

- Write C++ programs to exhibit the uses and implementation of classes, objects, static member function and array of objects, friend functions, copy constructor, function & operator overloading, Inheritance, uses of pointers, data conversion between objects of different classes, uses of ios and input output operations on files, stack, queue, circular queue and linked list using classes and objects, stack and queue using dynamic memory allocation, exception handling, templates, compile time polymorphism, run time polymorphism using virtual functions and abstract classes.

Text Books/References

1. "The C++ Programming Language", Bjarne Stroustrup, Addison-Wesley.
2. "Object Oriented Programming with C++", Robert Lafore, Techmedia Publications.

CS 236 (PCC): DIGITAL LOGIC DESIGN

Cr. Hrs.	**5 (3 +0+2)**		
	L	**T**	**P**
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course Outcome: At the end of the course the student will be able to:

CO1: Demonstrate the principles of number system, binary codes and logic families.

CO2: Analyze and design combinational circuits using standard gates and minimization methods.

CO3: Efficiently optimize and minimize logic function using k-maps.

CO4: Design common digital circuit such as - decoders, multiplexers, encoder, demultiplexer etc.

CO5: Analyze and design sequential circuit such as flip-flops, counters, registers etc.

Unit-I

Computer Number Systems and Codes: Number Systems and their conversion, Negative Numbers representation, Codes; Binary Coded Decimal number (BCD), Excess-3 BCD Code, Gray Codes representation.

Logic families: Characteristics of digital ICs, Diode-Transistor Logic (DTL) Transistor- Transistor Logic (TTL) TTL output structures: Totem pole output, Darlington Output, Open-Collector Outputs. Wired Logic, Tri-State Logic, Emitter-Coupled Logic, Metal-Oxide Semiconductor (MOS) Logic, Complementary metal oxide semiconductor (CMOS) Logic.

Unit-II

Logical Operations, Logic Gates, and Boolean Algebra: Truth Table, Logical Operations and logic gates, Logic Circuits, Realizing Circuits From Boolean Expressions, Derived Logical Functions and Gates: The NAND Gate, The NOR Gate, The Exclusive-OR or XOR Gate, The

Exclusive-NOR, or XNOR Gate, Boolean Algebra, Boolean Algebra Theorems, De Morgan's Theorems, Duality Theorem, Universal Gates, Deriving the XOR Function, Reducing Boolean Expressions by Algebraic reduction.

Unit-III

Principles of Combinational Logic Circuits: Minterm and Maxterm designations, Canonical Forms, Karnaugh Map: Karnaugh Map upto six variables. Prime implicant (PI), Essential Prime implicant (EPI), Simplification of Boolean expressions using K-map in POS and SOP form, Incompletely Specified Functions (Don't Care Terms), Quine-McCluskey Minimization Method, Mixed (Bubble) logic Combinational Circuits. Arithmetic Circuits: Adders, Subtractor, 2-bit Full-Adder/Subtractor, Binary Parallel Adder, BCD Adder, Multiplier, Digital comparator, Decoders, Encoders, Priority Encoder, Multiplexers, Implementation of Boolean Function with Multiplexer, Demultiplexer.

Unit-IV

Sequential Logic Circuits: Latches, Flip-flops: SR (Set-Reset) Flip-Flop, Edge-Detector Circuits, Master-Slave S-R Flip-Flop, J-K flip-flop, Master-Slave J-K Flip-flop, D Flip-Flop, T Flip-flop, Conversions of flip-flops, Mealy and Moore Machines. Counters: Asynchronous (Ripple) Counters, Propagation Delay in Ripple Counter, Asynchronous Counters with Mod Numbers, Synchronous (Parallel) Counters, Design of Synchronous Counters.

Registers: Serial- in/serial- out, Serial- in/parallel- out, Parallel- in/serial-out, Parallel- in/parallel- out, Bi-directional shift register, Shift-registers counters (Ring Counter, Johnson Counter).

Lab/ Practicals

- Design and implement various logic gates such as derived and universal logic gates.
- Design and implement combinational circuits such as adders, Subtractor, encoder, decoder, multiplexer, demultiplexer, comparators.
- Design and implement sequential circuits such as flip flops, counters, and registers.

Text Books/References

1. "Digital Logic and Computer Design", M. Morris Mano, Prentice-Hall.
2. "Digital Fundamentals", Thomas L. Floyd., Pearson Education.

BS 242 (BSC): DISCRETE MATHEMATICAL STRUCTURE

Cr. Hrs. 3 (2 +1+ 0)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Know Permutation, Combinations & logical operations.

CO2: Understand properties of relations & digraphs.

CO3: Manipulate, represent the relation & digraphs on computer.

CO4: Distinguish paths and circuits and about Boolean Alzebra.

CO5: Know about group, semi groups, products and quotients of group.

Unit-I

Fundamentals: Sets & Subsets, operation on sets, sequence, division in the integers, Matrices, mathematical structures, Logic: proposition & logical operations, conditional statements, method of proof, mathematical induction, Counting: Permutation, Combinations, pigeonhole principle, elements of probability, recurrence relations.

Unit-II

Relations & Digraphs: Product sets and partitions, relation & digraphs, paths in relation & digraphs, properties of relations, equivalence relations, computer representation of relation & digraphs, manipulation of relations, transitive closure and Warshall's algorithm, Functions: Functions for computer science, permutation of functions, growth of functions.

Unit-III

Graphs, Eular paths & Circuits: Hamiltonian paths and circuits, coloring graphs, Relations & Structures: Partially ordered sets, extremal elements of partially ordered sets, lattices, finite Boolean algebras, Boolean functions as Boolean polynomials.

Unit-IV

Semigroups & groups: Binary operation, semigroups, products & quotients of semigroups, groups, products and quotients of group.

Text Books/References

1. "Discrete Mathematical Structures", Koloman and Busby, P.H.I, New Delhi.
2. "Discrete Mathematical Structure with Application to Computer Science", Trembley Manohar, Tata McGraw Hill.
3. "S. Lipschutz and N.L. Lipson. Discrete Mathematics", Tata Mc-Graw Hill Publication Co. Ltd.

EC 243 (ESC) COMMUNICATION SYSTEMS

Cr. Hrs. 3 (3 +0+ 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1 Understand the fundamental concepts of communication systems.

CO2 Understand and compare different analog modulation schemes.

CO3 Understand and compare different digital modulation schemes.

CO4 Understand the design tradeoffs and performance of communications systems.

CO5 Learn about practical communication systems

Unit-I

Modulation of Signals: Principles of Analog modulation techniques like FM, PM, SSB, Generation and Detection (Block schematics only). Frequency Division Multiplexing and Time Division Multiplexing. Pulse Modulation: Pulse transmission over Band limited signals, sampling theory, PAM, DYE diagram.

Unit-II

Digital Communication: PCM, DPCM, DM ADM, comparison of the above on the basis of criteria such as bit transmission, signaling rate, error probability, S/N ration, bandwidth requirement. Digital Modulation Techniques: Data transmission such as PSK, FSK, QPSK (QAM) MSK, Inter system comparison.

Unit-III

Coding for communications: Information theory, Capacity, Shannon's theorem, Source coding error control coding Error detection and correction, Block codes, Cyclic coder, Line code, Channel throughput and efficiency.

Modem: Principles of modems, function operation. Short and long modems Digital modems, multiplexers, and concentrators.

Unit-IV

Broad View of Communication Channel: Transmission Line, Primary and secondary line constant, telephone line and cables, Public switch telephone network (Electronics). Fiber Optic Communication: Principles of

light communication in fiber, losses in fiber, dispersion, light sores and detectors. Satellite Communications Orbits, satellite altitude, multiple access method.

Text Books/References

1. "Modern Digital Communication", B.P.Lathi, Oxford.
2. "Introduction to Communication system", Tube and Schilling, McGraw Hill.
3. "Electronic Communication", R. Coolen, PHI.

EC 244 (ESC) PULSE, DIGITAL AND WAVE SHAPING

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: To develop fundamental concepts of pulse digital and wave shaping.

CO2: To enhance the knowledge of linear wave shaping using high frequency and low frequency response of RC and RL circuits.

CO3: To master the basic ideas of diode switching and application of diode in clipper and clamper circuit.

CO4: To understand the concept transistor switching design the various multivibrator circuits practical as well as theoretically.

CO5: To develop a knowledge of time base generators and designing of blocking oscillators.

Unit–I

Linear wave Shaping: High frequency and low frequency response of RC and RL circuits to step pulse, ramp and exponential wave form inputs, Attenuators, RL A and RLC circuits, Ringing circuit pulse Transformer (Application equivalent circuit and characteristics).

Unit–II

Non-Linear wave shaping: Steady state switching characteristics of semiconductor, devices, clipping circuits, diode clippers, OPAMP. Clippers, Transistor clippers, clipping at two levels, diode comparators, Application of voltage comparators, clamping operation, Diode Clamping circuit, Clamping circuit theorem.

Unit–III

Transistor as switch, capacitively and inductively loaded transistor switch. Generation of waveforms: Multivibrators – Bistable , Monostable and Astable multivibrators, A Fixed- Bias and self Bias transistor binaries, commutating capacitors Methods of improving resolution, Symmetrical and non- symmetrical triggering of Binaries.

Unit–IV

Schmitt trigger circuit: Voltage time base generator, methods of generating a time base wave from: A transistor constant current sweep generator Miller and Boot surpa time base generators, Linearity improvement of current sweep: Blocking oscillators- An astable and monostable blocking oscillators, Application of Blocking oscillator.

Text Books/References

1. "Functional Electronics", K.V. Ramanan , Tata Mcgraw Hill.

CS 245 (PCC): DATA STRUCTURE & ALGORITHMS

Cr. Hrs. 5 (3+0 + 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze the basic concepts of data structures and algorithms.

CO2: Understand and analyze the concepts about searching and sorting techniques.

CO3: Understand and analyze the basic concepts about stacks, queues, lists, trees, hashing and graphs.

CO4: To enable them to write algorithms for solving problems with the help of fundamental data structures.

Unit-I

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique and their complexity analysis.

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit-II

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Unit-III

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit-IV

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Lab/ Practicals

- Write C++ Programs to implement the concepts of Data Structures along with all the operations of the respective data structure such as 1-dimensioanl Array, 2-Dimensional Array, Singly Linked list, Circular Linked List, Doubly Linked List, Stacks, Queues, Binary Trees, Binary Search Trees, Graph, Searching, Sorting, and Hashing and other associated data structure concepts.

Text Books/References

1. "Fundamentals of Data Structures", Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. "Algorithms, Data Structures, and Problem Solving with C++", Mark Allen Weiss, Addison-Wesley Publishing Company.
3. "How to Solve it by Computer", R.G. Dromey, Pearson Education
4. "Schaum's Outline Data Structures", Seymour Lipschutz, Tata McGraw Hill, Education.

CS 246 (PCC): COMPUTER ORGANIZATION AND ARCHITECTURE

Cr. Hrs. 4 (3 +0+1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the fundamental concepts of Computer Organization and Architecture.

CO2: Understand the operations of Bus & Memory.

CO3: Understand the operations of Central Processing Unit.

CO4: Understand the working of Control Unit, I/O and parallel Processing.

Unit-I

Overview: General organization and architecture, Structural / functional view of a computer, Evolution / brief history of computers. System Buses: Computer Functions and flow control, Interrupts and Interconnection, Bus Design and Timings, Hierarchy and Arbitration.

Unit-II

Memory Organization: Internal Memory: Characteristics, Hierarchy, Semiconductor Main Memory: Types of RAM, Chip Logic, Memory module organization, Cache Memory: Elements of cache design, Address mapping and translation, Replacement algorithms, Advanced DRAM Organization, Performance characteristics of two – level memories, External Memory: Magnetic disk, Tape, Raid, Optical memory, High Speed memories: Associative memory, Interleaved memory.

Unit-III

Data Path Design: Fixed Point Arithmetic, Floating Point Arithmetic, Design of basic serial and parallel high speed adders subtractors, multipliers, Booth's algorithm, ALU: Combinational and Sequential ALU.

The Central Processing Unit: Basic instruction cycle, Instruction sets, formats and addressing, Processor Organization, Register Organization, Instruction Pipelining, Co-processors, pipeline processors, RISC computers, RICS computers Versus CISC computers.

Unit-IV

The control Unit: Micro operations, Hardwired Implementation, Micro programmed control, Micro–instruction format, Applications of microprogramming.

Input and Output Unit: External devices: Keyboard, monitor, disk drive and device driver, I/O modules: Programmed I/O, interrupt driven I/O, DMA,I/O Channels and I/O processors, Serial transmission and synchronization.

Multiprocessor Processor Organizations: Flynn's classification of parallel processing systems, Pipelining concepts.

Lab/Practicals

Practical on 8085 programming and interfacing.

Text Books/References

1. "Computer Organization and Architecture: Designing for Performance", William Stallings, Pearson Education.
2. "Computer Architecture and Organization", John P. Hayes, Tata Mc-Graw Hill.
3. "Structured Computer Organization", Andrew Tannenbaum, Todd Austin, Prentice-Hall.
4. "Computer Organization", V. Carl Hamacher and Zaky, Tata Mc-Graw Hill.

CS 247 (PCC): UNIX AND SHELL PROGRAMMING

Cr. Hrs. 3 (0 +1+2)

	L	T	P
Credit	0	1	2
Hours	0	1	4

Course outcome: At the end of the course, the student will be able to:

CO1: Apply knowledge of programming constructs & logic to solve problems.

CO2: Design, analyze and interpret combination of system commands available to solve a problem and simulate them.

CO3: Identify, formulate and provide effective system commands or build shell scripts for solving engineering problems.

CO4: Analyze user & administrator needs to automate some of the day to day tasks like initializing environment variables, initial system screen, maintenance, repetitive sequences etc through shell scripts.

Syllabus

Editor & File System: VI editor concepts; modes; commands; File Structure; Handling Files & Directories; File Attributes: Ownership, Permission; file & directory related commands; I/O Redirection; Wildcards; Quotes.

Security & Filters: Users and Groups; Security Levels; Changing Permissions; User Masks; Filters & Pipes; Concatenating Files; Displaying start & end of files; cut and paste; sorting; count & comparing files; regular expressions & grep.

Shell Programming (Bourne Shell): Variables; Arithmetic operators, hierarchy of Logical operators; Decisions: if, case, file tests, string tests, Numerical tests; Loops: for, until, while, break, continue; nested loops; shell metacharacters; system variables; functions; command line arguments, positional parameters; read, echo, eval, expr.

Text Books/References

1. "Unix Shell Programming", Yashwant Kanetkar, BPB Publications,
2. "Unix and Shell Programming", Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning.
3. "Unix and Shell Programming", Sunitabha Das, Tata Mc-Graw Hill,
4. "Advanced Programming in the Unix Environment", W. Richard Stevens, Stephen A. Rago, Pearson Education.

CS 248 (PCC): PROGRAMMING WITH JAVA

Cr. Hrs. 5 (3+0+2)

	L	T	P
Credit	3	0	2
Hours	3	0	4

Course outcome: At the end of the course, the student will be able to:

CO1: Understand java programming environment and fundamentals.

CO2: Apply object oriented concepts to write java programs.

CO3: Implement exception handling using Java.

CO4: Develop GUI program using java.

Unit-I

Java Fundamentals and Environment Object Oriented Programming, Revisited, Using Blocks of code, Lexical Issues, Java Class Libraries. Programs Using : Data types, Variables, Arrays, Operators, Control Statements. Programs Using Classes: Class Fundamentals, Declaring Objects, Constructors, Garbage Collection, finalize( )

Unit-II

Programs Using Inheritance: Inheritance Basics, Super, method overriding, using abstract classes, using final with inheritance. Programs Using Packages and Interfaces: Packages, Access Protection, Importing packages, Interfaces.

Unit-III

Programs using Exception Handling: Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, throw, throws, finally, Java's built-in exceptions, creating your own exceptions. Programs using String Handling : String Constructors, Special String operators, Character Extraction, String Comparison, Searching Strings. Applets: Applet basics, applet architecture, simple applet display methods, requesting repainting, HTML applet tag, Passing parameters to applets.

Unit-IV

Abstract Window Toolkit: Introduction to AWT: Working and Windows, Using AWT controls, Layout Managers. Event Handling: Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.

Lab/ Practicals

- Write Java Programs to demonstrate and implement the various features of Java including but not limited to class, object, finalize, Garbage Collection, inheritance, packages and interfaces, exception handling, string handling, applet, AWT and event handling

Text Books/References

1. "Core Java vol I and II", Addison Wesley, Sun Publications.
2. "Java The complete reference", Herbert Schildt, Tata McGraw Hill.

CS 351 (PCC): DATABASE MANAGEMENT SYSTEM

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: To understand and analyze the different issues involved in the design and implementation of a database system & design EER

CO2: To understand and use queries using relational algebra and SQL DDL and DML commands to manage the database. Design Normalized tables.

CO3: To understand the file storage , indexing structures and query optimizations algorithms

CO4: To develop an understanding of essential DBMS concepts such as: database security, transaction processing and recovery.

Unit-I

Database system architecture: Data Abstraction, Data Independence, Data Definition, Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit-II

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Unit-III

Disk storage, Indexing, Query Processing: Disk storage, Basic File Structures and Hashing, indexing structures for files, Algorithms for Query Processing and Optimization: algorithms for external Sorting, select, join, project and set operations, heuristics in query optimization.

Unit-IV

Transaction processing: Introduction and concepts, ACID property, Schedules: recoverability and serializability. Concurrency control techniques: locking and timestamp, Multi-version and optimistic concurrency techniques. Database recovery Techniques: deferred and immediate update shadowing paging, ARIES algorithm.

Introduction to Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Lab/Practicals

- Create Sample database to understand the basics of relations, attributes and understand the importance database design with and without constraint (primary key and foreign key). Design a database of your choice by collecting requirements, finalise the database design and draw EER diagram and implement the same using SQL DDL commands.
- Perform the SQL queries using DML commands: Ambiguous Attribute Names, Aliasing, Unspecified WHERE Clause and Use of (*) Asterisk, union compatible operations, substring pattern matching and Arithmetic Operators. Ordering, nested queries, Exists and Not Exists functions, Joined tables (with explicit Join, Natural join), Aggregate functions, Group by and Having Clauses, Update , Drop and Delete Command.
- Implement Trigger, optimized queries and concurrency control techniques, write queries for SQL injection.
- Implement database connectivity using ADO/ADO.NET/ODBC/ JDBC/RDBMS etc for sample table and design an interface for Sample database with insert, display, and update and delete options using triggers.

Text Books/References

1. "Fundamentals of Database Systems", Ramez Elmasri and Shamkant Navathe, Pearson Education.
2. "Database Systems Concepts", Silberschatz, Korth, Sudarshan, McGraw Hill Publications.

CS 352 (PCC): COMPUTER NETWORKS

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze the various modern network architectures from a design and performance perspective.

CO2: Understand and analyze the various concepts, issues and protocols pertaining to Data Link Layer and Medium Access Sub Layer.

CO3: Understand and analyze the various concepts, issues, protocols and routing algorithms pertaining to Network Layer.

CO4: Understand and analyze the various features of Transport layer such as TCP, UDP, QoS.

CO5: Understand some important and popular functionalities of application layer.

Unit-I

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, TCP/IP model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit-II

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC; Flow Control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

Unit-III

Network Layer: Switching, Logical addressing – IPV4, IPV6; fragmentation, Address mapping –ARP, RARP, BOOTP and DHCP– Delivery, Forwarding and Unicast Routing protocols, ICMP.

Unit-IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Lab/Practicals

- Write NS2 programs to create various network topologies, connections, data flow among nodes using different agents like UDP, TCP and different traffic generators like FTP, CBR.
- Write NS2 programs to implement various routing algorithms like Distance Vector, Link-state routing algorithms.
- Configure and connect multiple LANs in packet tracer simulator to understand different concepts like static routing, dynamic routing, DHCP, DNS, HTTP, Classful addressing, VLSM, VOIP, Wireless LAN.
- Write various awk scripts to understand different parameters to be considered in networking like Packet delivery ratio, throughput, routing overhead etc.

Text Books/References

1. "Data Communication and Networking", Behrouz A. Forouzan, McGraw-Hill.
2. "Data and Computer Communication", William Stallings, Pearson Prentice Hall India.
3. "Computer Networks", Andrew S. Tanenbaum, Pearson Education.
4. "Internetworking with TCP/IP", Douglas Comer, Prentice Hall of India.
5. "TCP/IP Illustrated", W. Richard Stevens, Addison-Wesley.

CS 353 (PCC): SYSTEMS ADMINISTRATION

Cr. Hrs. 3(0+1+2)

	L	T	P
Credit	0	1	2
Hours	0	1	4

Course outcome: At the end of the course, the student will be able to:

CO1: The student will learn to add new network host and do network testing and troubleshooting.

CO2: The student will learn to manage DNS servers and configure DHCP server.

CO3: The student will learn to backup and restore files and file systems.

CO4: The student will learn to write scripts to automate administrative tasks.

Syllabus

Introduction to System Administration: System Administration Basics, Becoming super user, Communicating with users, Essential Administrative Tools and Techniques.

TCP/IP Networking: Adding a New Network Host, Network Testing and Troubleshooting.

Managing Users and Groups: Managing User Accounts, User Authentication with PAM, LDAP

Security: Protecting Files and File System, Role Based Access Control, Network Security.

Managing Network Services: Managing DNS Servers, Routing Daemons, Configuring DHCP Server.

Backup and Restore: Planning for Disasters and Everyday needs, Backing Up Files and File Systems, Restoring Files from Backups, Making Table of Contents Files.

Automating Administrative Tasks: Creating Effective Shell Scripts, Automating Complex Configuration Tasks with Cfengine, Stem: Simplified Creation of Client-Server Applications, Adding Local Man Pages.

Managing System Resources: Monitoring and Controlling Processes, Managing CPU Resources, Managing Memory, Disk I/O Performance Issues, Monitoring and Managing Disk Space Usage, Network Performance.

Text Books/References

1. "Essential System Administration: Tools and Techniques for Linux and Unix Administration", Frisch AEllen, O'Reilly Media.
2. "The Practice of System and Network Administration", Thomas A. Limoncelli, Pearson Education.
3. "Unix and Linux System Administration Handbook", Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Pearson Education.

CS 354 (PCC): FORMAL LANGUAGES & AUTOMATA THEORY

Cr. Hrs. 4 (3 + 1+ 0)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the need and significance of computational theory, formal machines, languages and computations in computer engineering.

CO2: Understand, design and analyze the role of finite automaton in recognizing a regular language.

CO3: Understand, analyze and apply the Context Free Grammar and Push-Down automaton with its advantages and limitations

CO4: Understand, analyze and design Turing machine model for computable languages with its strength and limitations.

CO5: Understand and analyze Universal Turing Machine and its undecidability issues.

Unit-I

Mathematical preliminaries: Strings, alphabet, languages; Graphs and Trees; Inductive proofs, set notation, Relations, Finite automata.

Unit-II

Regular expressions, Properties of regular sets: Pumping lemma, closure properties and decision algorithm for regular sets.

Unit-III

Context Free Grammars. Properties of Context free languages (CFLs): Greibach's theorem, Pumping lemma, closure properties and decision algorithms for CFLs. Pushdown automata.

Unit-IV

Turing machines: Turing machine model, computable languages and functions, techniques for turing machine construction, modification of turing machines, Halting problem of turing machine, church's hypothesis, turing machine as enumerators. Undecidability: Problems, properties of recursive and recursively enumerable languages, universal turing machines and undecidable problem, Rices' theorem, Post's correspondence problem, introduction to recursive functions theory.

Tutorial

- Practice on questions related to Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Push Down Automata (PDA), Non-Deterministic Push Down Automata (NPDA), Turing Machine (TM), Non-Deterministic Turing Machine (NTM), etc.

Text Books/References

1. "Introduction to Automata Theory, Languages and Computation", John E. Hopcroft and Jeffrey D. Ullman, Pearson Education Asia.
2. "Theory of Computer Science (Automata, Languages and Computation)", K.L.P. Mishra, N. Chandrasekaran., Prentice Hall India.
3. "Elements of the Theory of Computation", Harry R. Lewis and Cristos H. Papadimtriou., PHI.
4. "Introduction to Languages and the Theory of Computation", J.C. Martin, McGraw-Hill Publication.

CS 355 (PCC): MICROPROCESSOR INTERFACING AND MICRO CONTROLLERS

Cr. Hrs. 4 (3 +0+ 1)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and demonstrate 8086 memory organization and role of co-processor 8087.

CO2: Understand and demonstrate interfacing of 8086 with 8255, 8254, 8237, 8251, 8279, RS-232.

CO3: Understand the architecture of 8051 microcontroller with its pin diagram and internal registers

CO4: Understand and demonstrate the assembly language programming and interfacing for 8051.

Unit-I

8086 Memory Organization and Interfacing, Memory mapped and Isolated I/0's,Co-processor 8087, Programmable Peripheral Interface 8255, Programmable Interval Timer 8254.

Unit-II

Programmable Direct Memory Access Controller 8237, Serial Communication Interface RS-232, Programmable Communication Interface Controller (8251 USART), Programmable Keyboard and Display Interface and Controller 8279.

Unit-III

8051 Microcontrollers: Introduction, Comparison of Microprocessor and Microcontroller, Architecture and Pin Functions of 8051 Single Chip Microcontroller. 8051 Flag Bits and PSW register. Register Banks and Stack.

Unit-IV

8051 Assembly Language Programming and Interfacing: Data Types and Directives, 8051 Assembly Programming, Jump loop and Call Instruction, I/O Port Programming: Addressing modes. Arithmetic Instructions and Programs, Logic Instructions and Programs, Timers/counters of 8051, interfacing of 8051 Microcontroller: LCD and ADC.

Lab/Practicals

- Assembly language programming and interfacing with 8086
- 8051 programming and interfacing

Text Books/References

1. "Microprocessors and Interfacing, Programming and Hardware", Doughlas V Hall, McGraw Hill.
2. "Microprocessor Systems: The 8086/8088 Family", Liu Yu-Cheng, A.G. Gibson, Prentice-Hall.
3. "The 8051 Micro-controller and Embedded Systems", Muhammad A Mazidi, Pearson Education Asia

CS 361 (PCC): Operating Systems

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze the significance and basic architecture of operating systems.

CO2: Understand and analyze the various processor management issues and challenges of operating system such as process synchronization, concurrency and deadlocks.

CO3: Understand and analyze the various memory management issues and challenges including virtual memory management, paging and thrashing.

CO4: Understand and analyze the various file system management, I/O management, secondary storage management issues and challenges in an operating system.

Unit-I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Concept of Virtual Machine.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of Multithreads. Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit-II

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Unit-III

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures –Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU), Thrashing.

Unit-IV

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Lab/Practicals

- Write C programs to exhibit the uses of various linux system calls such as uname(), getpid(), getppid(), groupid(), getenv(), getrlimit() and atexit(), fork(), zombie processes, dup(), dup2(), mkdir(), rmdir(), getcwd(), and readdir(), stat(), pipe(), mkfifo(),uses of signals, getpwuid(), getgegid(),read(), write(), open() and close() for file handling. Do OS resource management using generic OS simulator.

Text Books/References

1. "Operating System Concepts Essentials", AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. "Operating Systems: Internals and Design Principles", William Stallings, Prentice Hall of India.
3. "Operating Systems: A Modern Perspective", Gary J. Nutt, Addison-Wesley.

CS 362 (PCC): DESIGN & ANALYSIS OF ALGORITHMS

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	3	0	2
Hours	3	0	4

Course outcome: At the end of the course, the student will be able to:

CO1: Analyze the asymptotic performance of algorithms.

CO2: Write rigorous correctness proofs for algorithms.

CO3: Demonstrate a familiarity with major algorithms and data structures.

CO4: Apply important algorithmic design paradigms and methods of analysis.

CO5: Synthesize efficient algorithms in common engineering design situations.

Unit-I

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Master's theorem.

Unit-II

Fundamental Algorithmic Strategies: Divide and Conquer, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.

Unit-III

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit-IV

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Cook's theorem, Approximation algorithms.

Lab/Practicals

- Using any high level language(C/C++/ Java) Programs to implement Divide and Conquer, Greedy algorithm, Dynamic programming, Branch and Bound, backtracking algorithms, Approximation algorithms and other associated algorithms.
- Programs to understand the concept of graph and tree algorithms such as DFS, BFS, Shortest path first algorithms, Minimum spanning tree algorithms (Prim's and kruskal), network flow algorithms and other associated algorithms.

Text Books/References

1. "Introduction to Algorithms", Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. "Fundamentals of Computer Algorithms", Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Universities Press publication.

CS 363 (PCC): COMPLIER DESIGN

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze various phases of compiler and implement the lexical analyzer to recognize the tokens.

CO2: Understand context free grammar and apply the top-down and bottom-up approaches to design various types of parsers such as predictive parser and LR parser.

CO3: Analyze the translations on syntax directed definitions; evaluate the S-attributed, L-attributed definitions and inherited attributes.

CO4: Analyze the type checker using its specifications.

CO5: Understand storage allocation strategies and apply them to design code generator.

CO6: Understand the code optimization techniques to improve the performance of code in terms of time and space complexity.

Unit-I

Introduction to Compiling: Compilers; Analysis of the source program; The Phases of a compiler; Cousins of the Compiler; The grouping of phases; Compiler-construction tools. Simple Compiler. Lexical Analysis: The role of the lexical analyzer; Input buffering; Specification of tokens; Recognition of tokens.

Unit-II

Parsing: The role of the parser; Context-free grammars; Writing a grammar; Top-down parsing, Bottom-up parsing, Operator-precedence parsing, LR parsers, Parser generators.

Unit-III

Syntax directed translations: Construction of syntax trees; Bottom-up evaluation of S-attributed definitions; L- attributed definitions; Top-down translation; Bottom-up evaluation of inherited attributes. Type checking: Type systems; Specification of a simple type checker.

Unit-IV

Run-time Environments: Source language issues, Storage organization, Storage-allocation strategies. Code Generation: Issues in the design of

code generator. The target machine. Run-time storage management; Basic blocks and flow graphs. Introduction to Code optimization.

Lab/Practicals

- Tools to used: LEX & YACC
- Implementation of analyzers such as Lexical, Syntax, Semantic and also find out first and follow.
- Implementation of Parsers such as LL(1), LR(0), SLR(1), CLR(1), LALR(1), operator precedence.
- Implementation of various code optimization techniques such constant folding, strength reduction, Loop jamming and other optimization concepts.

Text Books/References

1. "Compliers Principles, Techniques and Tools", Alfered V. Aho, Ravi Sethi, Jeffrey D. Ullman, Addison-Wesley Publication.
2. "Modern Compiler Implementation in C/ML/Java", Andrew Appel, Cambridge University Press.
3. "Modern Compiler Design", Dick Grune, Henri E. Bal, Cerial J.H. Jacobs and Koen G. Langendoen:, John Wiley & Sons.

CS 364 (PCC): IT WORKSHOP

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	0	1	2
Hours	0	1	4

Course outcome: At the end of the course, the student will be able to:

CO1: Develop programs in Scilab/MATLAB

CO2: Evaluate, analyze and plot results.

CO3: Perform mathematical Modelling in Scilab/MATLAB

Syllabus

Scilab/matlab environment, Scilab/matlab as an interactive calculator, Scilab/matlab workspace and working directory, Creating matrices and some simple matrix operations, Sub-matrices, Statistics, Working with polynomials, Plotting graphs, Scilab/matlab programming language, Script files and function files, Writing Scilab/matlab functions, File operations, Reading Microsoft Excel files, Data Structures.

Text Books/References

1. "Scilab – A hands on Introduction", Satish Annigeri, Lulu publishing.
2. "Introduction to Scilab: For Engineers and Scientists", Sandeep Nagar, Apress.
3. "SCILAB (A Free Software to MATLAB)", Achuthsankar S Nair and Hema Ramchandran, S. Chand.
4. "Scilab by Example", M. Affouf, CreateSpace Independent Publishing Platform.
5. "An Engineer's Introduction to Programming with MATLAB 2017", Shawna Lockhart, Eric Tilleson, SDC Publications.
6. "MATLAB: Easy Way of Learning", S. Swapna Kumar, S. V. B. Lenina, PHI Learning.
7. "MATLAB: A Practical Introduction to Programming and Problem Solving", Stormy Attaway Butterworth-Heinemann.

CS 365 (PCC): SOFTWARE ENGINEERING

Cr. Hrs. 4 (3+0 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Understand different views of software process, process models including difference between prescriptive and agile process.

CO2: Understand and analysis the requirement engineering task and validating requirements.

CO3: Understand and evaluate procedures, technique and methods to assess software quality (SQA), review software engineering work products, and apply an effective testing strategy.

CO4: Understand and apply relevant software management skills to plan, manage and control a software development project.

Unit-I

Software Engineering, Software process, Introduction to CMM. Software process models – Waterfall model, Incremental, prototyping, RAD, Spiral, concurrent development, Component based development. Introduction to Unified and Agile development-Agile Process- Extreme Programming and other agile Process models. Requirement Engineering: requirement engineering tasks, requirement engineering process, eliciting

requirements, requirement analysis and documentation, validating requirements. Analysis modelling–approaches, data modelling.

Unit-II

Design Engineering: Concepts, architecture, patterns, modularity, information hiding, functional independence, refinement. Pattern based software design, Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Modelling component level design, class based components, design guidelines, cohesion and coupling.

Unit-III

Software Project Management concepts: The management spectrum, People, product, process, project, W5HH principles. Software Process and Project Metrics: software measurements and metrics, metrics for software quality. Software project planning: Observations on estimating, Project planning objectives, Software scope, Resources, Software project estimation, Decomposition techniques, Empirical estimation models: COCOMO Model, Software equation, The Make buy decision, Automated estimation tools. Project Scheduling: concepts, task sets, defining a task network, scheduling, earned value analysis

Unit-IV

Software Configuration Management: Repository, SCM Process, configuration management for Webapps, Software Quality Assurance: Quality concepts, Quality movement, Software quality assurance, tasks, goals and metrics, Formal approaches to SQA, Statistical software quality Assurance, Software reliability, the ISO 9000 Quality Standards, The SQA plan. Software Testing: Software Testing Fundamentals, Black box and white box testing, object oriented testing methods, testing documentation, testing patterns. Risk Management: Software risks, risk identification, projection, refinement, mitigation, monitoring, and management.

Lab/Practicals

- Each student will submit a written report on a mini project as per software engineering practice. Develop use case model, analysis model and design model for project using various UML diagrams like Structure Diagrams (Diagram, Component, Diagram, Object, Diagram, Profile, Composite Structure Diagram) Behavioral Diagrams (Diagram, Activity, Diagram, Sequence, Diagram, Interaction, Timing Diagram).

Text Books/References

1. "Software Engineering", Roger S. Pressman., McGraw Hill.
2. "An Integrated approach to software Engineering", Jalote Pankaj, Narosa Publishing House, New Delhi.

CS 366 (PEC): PE-I(a): MOBILE APPLICATION DEVELOPMENT

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the basics of mobile application development using Android.

CO2: Understand to make use of various basic components such as widgets, layouts, dialogs, etc for designing the mobile application.

CO3: Understand and implement the database handling with a mobile application.

CO4: Understand the packaging and deployment of a mobile applications, integrating APIs such as Google Maps, GPS, etc., and interaction with social media

Syllabus

Basic Android Concepts: Introduction to Android, Android SDK installation, Android SDK & their codenames, Advantages of android, The Android O/S Architecture, Overview of IDE for Android application, AVD (android virtual device), launch and start the AVD Managing application resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus); Android Application Components: Activities & its life cycle , Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter.

Widgets: User Interface Elements Form Widgets: Text View, basic Button, Toggle Button, Check Box, Checked Text View, Radio Buttons, Radio Group, Spinner Control, Date Picker, Time Picker, Chronometer, Progress bar, Rating bar, Option menu, Image View Text Fields -Various type of Text Fileds (Plain text, Password Text, Numeric Text, Email Text, Phone Text, Multiline Text, etc); Working with various type of dialog : Simple dialog, alert dialog, character picker dialog, date picker dialog, progress dialog, List Dialog, Custom Dialog Toast –(Custom Toast); Features of android Styles and Themes : Basic Styles & Themes in XML layout Various Layouts: layout, Layouts common attribute, Types of Layout (Linear layout, Relative layout, Table layout, Frame layout, Tab layout); Using Data-Driven Containers: List View, Grid View, and Gallery

View (Using the Array Adapter); App widgets: Introduction to app widget, Use of App Widgets, Creating app widget configuration activity.

Data Storage: Introduction to data storage, Introduction to various storage options available in android system; Working with Application Preferences: Creating Private and Shared Preferences, Manipulating with Shared Preferences; Read/Write Data on the Android File System; Storing Structured Data Using SQLite Databases; Creating a SQLite Database, Creating Tables and other SQLite Schema Objects, Creating, Updating, and Deleting Database Records, Querying SQLite Databases, Working with Cursors, Closing and Deleting a SQLite Database.

Packaging and Deployment: Interaction with server side application, Using Google Maps, GPS and Wi-Fi, Integration with social media applications.

Text Books/References

1. "Android Application Development", Rick Rogers, John Lombardo, O"Reilly.
2. "Professional Android 2 application development", Reto Meier, Wrox.
3. "Android Wireless Application Development", Lauren Darcey and Shane Conder, Pearson Education.

CS 366 (PEC): PE-I (b): WEB TECHNOLOGY

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	0	1	2
Hours	0	1	4

Course outcome: At the end of the course, the student will be able to:

CO1: Apply knowledge of client/server architecture & the HTTP protocol usage of get & post transactions for building web applications on Internet.

CO2: Design web pages using CSS for standard appearance; add dynamism in the web page using Java Script & DHTML.

CO3: Design & implement a web application by building a web site using the client and server side technologies for database connectivity and maintain sessions.

CO4: Understand the impact of using XHTML over HTML for standardizing web pages.

Mark-up languages: HTML Introduction, Basic Tags, Attributes, Heading, Paragraphs, Formatting, Styles, Links, Images, Tables, Lists, Forms, Colors, Layout, Frames, Font, CSS, Entities, Head, Meta tags, URLs, Scripts, Events, URL Encode, Web Server (ITS and Apache).

Cascading Style Sheets: Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types, Drop-Downs, User Style Sheets.

XHTML Introduction, Headings, Linking, Images, Lists, Special Characters and Horizontal Rules, Internal Linking, Meta Elements, Forms, Tables.

JAVA Script: Introduction, Decision Making, Control Statements, Functions, Objects, Arrays, Event Handling.

PHP: Introduction, Decision, Looping, Arrays, Functions, Forms, Methods, Cookies, Sessions, Error, Exception, Filter, References.

MySQL: Introduction, Connect, Create, Insert, Select, Where clause, order by clause, Update, Delete and ODBC.

Text Books/References

1. "Programming the World Wide Web", Robert W. Sebesta Pearson Education.
2. "Internet and World Wide Web", Dietel & Dietel, Pearson Publication.
3. "Web Technologies", Achyut Godbole, TMH.
4. "PHP 6 and MySQL5 for Dynamic WebSites: Visual Quick Pro Guide", Ullman, Pearson Publication.
5. "An Introduction to Web Design & Programming", Paul S. Wang, Cengage Learning.
6. "The Complete Reference to HTML & XHTML", Thomas A. Powell, TMH.
7. "HTML Black Book", Steven Holzner, Dreamtech Press.

CS 366 (PEC): PE-I(c): DATA ANALYSIS WITH PYTHON

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand different decision making statements and functions.

CO2: Understand object oriented programming in python.

CO3: Understand different file handling operations.

CO4: Understand exception and its handling in python.

Syllabus

Introduction to Python, The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration; Functions, Scoping and Abstraction, Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters; Structured Types, Mutability and Higher-Order Functions, Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects; Testing, Debugging, Exceptions and Assertions, Debugging, Handling Exceptions.

Text Books/References

1. "Introduction to Computation and Programming Using Python", John V Guttag. Prentice Hall of India.
2. "Core Python Programming", R. Nageswara Rao, dreamtech
3. "Core Python Programming ", Wesley J. Chun., Prentice Hall
4. "Data Structures and Algorithms in Python", Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley
5. "Fundamentals of Python – First Programs", Kenneth A. Lambert, CENGAGE Publication
6. "Professional Python", Luke Sneeringer, Wrox.

CS 471 (PCC): DISTRIBUTED SYSTEMS

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the distributed system architecture, design challenges & issues.

CO2: Evaluate & implement RPC and RMI along with data marshalling.

CO3: Understand the role of DNS, directory & discovery services, logical, physical, vector clocks in distributed systems.

CO4: Evaluate replication and concurrency control measures, for distributed systems.

Unit-I

Characterization of Distributed Systems, Challenges & Examples of Distributed System, Interprocess Communication, Internet Protocol APIs, External Data Representation and Marshalling, Client Server Communications, group communications, IPC in UNIX.

Unit-II

Distributed Objects and Remote Method Invocation, Communication between distributed objects, distributed object model, design issues of RMI, Implementation of RMI, Distributed Garbage collection, Remote Procedure Call, Sun RPC, and Java RMI.

Unit-III

Name Services and Domain Name System, Directory & discovery services, Time & Global states, clocks, events, process states, synchronizing physical clock, Logical time & logical clocks, Coordination and Agreement: Distributed Mutual exclusion, Elections.

Unit-IV

Replication: System Model and Group communication, Fault tolerance services, Distributed Shared Memory: design and implementation issues, Sequential consistency and Ivy: The System Model, Write Invalidation, Invalidation protocols; Release consistency and Munin.

Lab/Practicals

- Programs related to socket programming, RPC, RMI.
- Practical implementation of different clocks in distributed system.
- Programs related to group communication, distributed shared memory.

Text Books/References

1. "Distributed Systems, Concepts and Design", George Coulouris, Jean Dollimore, Tim Kindberg, Addission Wesley.
2. "Distributed System – Principles and Paradigms", A.S. Tanenbaum, M.S. Steen, Pearson Education.
3. "An Introduction to Parallel and Distributed Computations Through JAVA", Bala Dhandayuthapani Veerasamy, Penram International Publishing (India) Pvt. Ltd.
4. "Distributed Computing", Sunita Mahajan and Seema Shah, Oxford University Press.

CS 472 (PCC): INFORMATION SECURITY

Cr. Hrs. 5 (3+0 + 2)

	L	T	P
Credit	3	0	2
Hours	3	0	4

Course outcome: At the end of the course, the student will be able to:

CO1: Identify common network security vulnerabilities/attacks.

CO2: Understand and design cryptographic algorithms of different types and modes.

CO3: Understand and implement symmetric, asymmetric cryptographic and Digital Signature algorithms.

CO4: Understand and use different Authentication Mechanisms and Internet Security Protocols.

CO5: Understand and identify the key aspects of Cyber Crime and Cyber law.

Unit-I

Need for security, security approaches, principle of security, Types of attacks, Cryptography Techniques: Plain Text and Cipher text, Substitution techniques, Transposition techniques, Encryption & decryption, symmetric

& asymmetric cryptography, Diffie-Hellman Key Exchange, steganography, key range and key size, possible types of attacks.

Unit-II

Computer: Based Symmetric key Cryptography Algorithms: Algorithms types and modes, overview of symmetric key cryptography, data encryption standards (DES), Advance encryption standards (AES), Shannon's theory of confusion and diffusion. Computer- based Asymmetric key Cryptographic Algorithms: RSA algorithms, MD5 Digital Signature.

Unit-III

Public Key Infrastructure (PKI): Digital Certificates, private key management- Distribution of Public Keys, Distribution of Secret keys using Public Key Cryptosystems, Authentication: password, authentication tokens, certificate based authentication, biometric authentication, Kerberos. Internet Security Protocols: Secure socket layer (SSL), Secure hyper text transfer protocol (SHTTP), Time stamping protocol (TSP), Secure electronic transaction (SET), electronic money, E-Mail Security, Single Sign on (SSO).

Unit-IV

Introduction to Cyber Crime and Cyber law: Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Digital Forensics, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT. Intellectual property rights (IPR), Legal System of Information Technology, Firewall, Social Engineering, Mail Bombs, Bug Exploits, SQL injection.

Lab/Practicals

- Practical's to understand the basic concepts of symmetric cryptosystem, public key cryptosystem and digital signature scheme. Use of basic security tools to enhance system security and develop basic security enhancements in stand-alone applications.

Text Books/References

1. "Cryptography and Network Security", Atul Kahate, Tata McGraw-Hill Publishing Company Ltd.
2. "Cryptography and Network Security", William Stallings, Pearson Asia.
3. "Cyber Security Essentials", James Graham Richard Howard Ryan Olson, CRC press.
4. "Cyber Security", Nina Godbole, Sunit Belapure, Wiley India, New Delhi.
5. http://meity.gov.in/content/information-technology-act - INDIA IT ACT.

CS 473 (PEC): PE-II(a):

INFORMATION SECURITY ASSURANCE AND FORENSICS

Cr. Hrs. 4 (3+0 + 1)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Understand motivation of a hacker and various techniques used by the hacker.

CO2: Understand ethical issues related to hacking.

CO3: Perform forensic operations on a given media.

CO4: Understand various cyber crimes and related legal issues.

Unit-I

Introduction: Ethics of hacking, hacking process, types of hackers. Footprinting, Scanning and Enumeration, Sniffers, Encryption and password cracking, Spoofing, Session Hijacking, DoS, Buffer Overflows.

Unit–II

Mail Vulnerabilities, Web Application Vulnerabilities, Windows and Linux Vulnerabilities. Overview of computer forensics, types of cyber crime. The forensics process, disk imaging, forensics tools, Hardware and OS fundamentals, Disk geometry, partitions, Windows and Linux file systems.

Unit–III

File signatures, string searching, File types, regular expressions, grep, egrep, and fgrep commands. Data hiding techniques Deleted file recovery, recycle bin, alternate data streams, cryptography, steganography, anti-forensics tools.

Unit–IV

Investigative Techniques: Windows registry files, Email analysis, Internet activity analysis, Live system forensics and incident response, Static and dynamic analysis of executable file, Documentation and reports. Legal Issues: The justice system, Indian IT act and case studies.

Lab/Practicals

- Various tools can be explored such as FTK, ProDiscover, Caine, Exiftool, Last Activity view, HxD and other associated information security and forensics tools .

Text Books/References

1. "Computer Security Concepts, Issues and Implementation", Alfred Basta and Wolf Halton, Cengage Learning.
2. "Gray Hat Hacking The Ethical Hackers Handbook", Shon Harris et al., TMH.
3. "CEH Study Guide Exam 312-50 Exam", Kimberly Graves, Wiley India.
4. "Computer Forensics and Investigations", Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Cengage Learning.
5. "Hacking Exposed Computer Forensics", Chris, Philipp, TMH.
6. "Incident Response & Computer Forensics", Kevin Mandia, Chris Prosise, TMH.
7. "Real Digital Forensics: Computer Security & Incident Response", Richard Bejtlich, Keith Jones, Curtis W. Rose, Pearson Higher Education.
8. "The Official CHFI Study Guide(Exam 312-49)", Dave Cleiman et al., Syngress.
9. "Computer Evidence Collection and Preservation", Brown, Laxmi Publications.

CS 473 (PEC): PE-II(b): INTERNET OF THINGS

Cr. Hrs. 4 (3+0 + 1)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Apply IoT solutions to specific problems.

CO2: Analyze routing protocols, flow control mechanisms and application layer protocols r for IoT.

CO3: Analyze physical and data link layer standards applicability to IoT.

CO4: Apply cloud solutions and data analytics frameworks for IoT.

Unit-I

Introduction to Internet of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates.

Applications of IoT: Home Automation, Smart Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyles.

Unit–II

IoT and Machine 2 Machine: Introduction, M2M, Difference between IoT and M2M, Software Defined Networks and Network Function Virtualization for IoT, hardware and software for IoT.

Application and Transport Layer: Application layer-Representational State Transfer (REST) with HTTP and CoAP, transport Layer- CoAP, UDP, congestion control mechanism for CoAP.

Unit-III

Network Layer: IPv6, 6LoWPAN, IPv6 Routing Protocol for Low Power and Lossy Networks (RPL).

Physical Layer and Data Link Layer: IEEE 802.15.4, IEEE 802.11 and WiFi.

Unit–IV

IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models & Communication APIs, Web Application Messaging Protocol (WAMP), Web Application Framework for Internet of things, cloud based solutions.

Data Analytics for IOT: Introduction, frameworks for data analysis, case study.

Lab/Practicals

- Exposure with different families and architectures of Internet of things and tools such as ARM Microcontrollers, Embedded operating systems, Wireless sensor networks, IoT architecture and protocols etc.

Text Books/References

1. "Interconnecting Smart Objects with IP: The Next Internet", Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, Elsevier publication.
2. "Internet of Things (A Hands-on-Approach)", Bahga & Madisetti, VPT.

3. "Building the internet of things with IPv6 and MIPv6", Daniel Minoli, Wiley publication.
4. "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers.
5. "The Internet of Things: From RFID to the Next-Generation Pervasive Networked", Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning, Auerbach Publication.
6. "Getting Started with Raspberry Pi", Matt Richardson and Shawn Wallace, O'Reilly Media.

CS 473 (PEC): PE-II(c): EMBEDDED SYSTEMS

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Characterize the requirement, challenges and formalism of embedded system design.

CO2: Implement embedded program in ARM assembly Language.

CO3: Design standard single purpose processor peripherals.

CO4: Design Control Data Flow Diagram and Control Flow diagram of embedded systems.

CO5: Optimize execution time, energy, power consumption and program size of a program in embedded system.

Unit-I

Embedded Computing Requirements: Characteristics and applications of embedded systems; Components of Embedded Systems; challenges in Embedded System, performance in embedded computing, Design and design process; Formalism for system design.

Unit-II

Embedded Processor: Computer Architecture taxonomy; ARM processor - processor architecture and memory organization. Instruction set, data operations and flow control; Input and output devices & Primitives, supervisor mode, exception and traps; Memory system – caches, MMU & Address translation. Pipelining and superscalar execution.

Unit-III

Embedded Computing Platform: CPU Bus - Bus protocols, DMA, system bus configurations. ARM bus; Timers and counters, A/D and D/A converters, Keyboards, LEDs, displays and touch screens; Design example – Alarm Clock.

Unit-IV

Embedded Software Analysis and Design: Components for Embedded Programs; Model programs - data flow graphs and control/data flow graphs; Assembly and linking; Compilation techniques; Program Optimization, Analysis and optimization of execution time, energy, power and program size. Embedded System Accelerators: Processor accelerators, accelerated system design.

Lab/Practicals

- Designing UML diagrams for Structural and Behavioural designs of embedded systems like microwave oven, vending machine, lift , washing machine etc
- Programs in ARM Assembly language to implement arithmetic, logical, shift/rotate, compare, move and load store instruction, flow control, conditional and unconditional loops, functions, recursive functions, finite impulse response filter and SWI (software interrupt) codes.
- Study, analyze and implement Serial Communication Protocols, Parallel Communication Protocols and Wireless Communication Protocol.

Text Books/References

1. "Computer as Components", Wayne Wolf, Elsevier.
2. "ARM System Developer's Guide", Andrew S. Loss, Elsevier.
3. "Embedded System Design", Steve Heath, Elsevier.
4. "Embedded System design: A unified hardware/software Introduction", Frank Vahid & Tony Givagi, John Wiley & Sons.

CS 473 (PEC): PE-II (d): CLOUD COMPUTING

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

- **CO1:** Understand cloud computing and role of virtualization in it
- **CO2:** Analyze data management and evaluate different data measures in cloud computing.
- **CO3:** Understand information storage systems in cloud computing.
- **CO4:** Understand security and Privacy issues in cloud computing.

Unit-I

Introduction: Objectives, From collaborative to the Cloud, A short history Client–Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing, Introducing Virtualization, Cloud Computing Services, Cloud Computing and Business Value, Functioning of Cloud Computing, Cloud Storage, Industrial Applications.

Unit-II

Data Management: Introduction, Objectives, Data Security, Data Location, Data Control, Securing data for transport, Scalability and Cloud Services, Large Scale Data Processing, Databases and Data Stores, Data Archival.

Unit-III

Information Storage in Cloud Computing: Introduction, Objectives, Storage as a Service, Storage Providers, Amazon Simple Storage Service, Nirvanix, Google Bigtable Datastore, MobileMe- Live Mesh, Storage Security, Merits and Demerits of Storage.

Unit-IV

Discovery of Private and Hybrid Clouds: Introduction- Objectives, Need for Privacy, Defining a private cloud, Public, Private, and Hybrid Clouds: A Comparison, Research trend in Cloud Computing, Fog Computing, Cloud Security.

Lab/Practicals

- Experiments to understand various virtualization platforms.
- Practicals related to data management in cloud using any cloud platform.

- Evaluate different network security tools to understand security and privacy issues in cloud computing.

Text Books/References

1. "Cloud Computing: Principles and Paradigms", Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley.
2. "Cloud Computing Black Book", Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, KLSI, Dreamtech Press.
3. "Enterprise Cloud Computing - Technology, Architecture, Applications", Gautam Shroff, Cambridge University Press.
4. "Cloud Computing Bible", Barrie Sosinsky, Wiley-India.
5. "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Ronald L. Krutz, Russell Dean Vines, Wiley-India.

CS 473 (PEC): PE-II(e): ARTIFICIAL INTELLIGENCE

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Understand artificial intelligence and role of intelligent agents.

CO2: Evaluate problem solving techniques and explore knowledge representation and reasoning approaches.

CO3: Understand an apply logic based approaches for problem solving

CO4: Explore decision making problems and applications of AI.

Unit-I

Overview: Foundations, scope, problems, and approaches of AI.

Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents, Artificial Intelligence programming techniques.

Unit-II

Problem-solving through Search: Forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Knowledge Representation and Reasoning: Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

Unit-III

Planning: Planning as search, partial order planning, construction and use of planning graphs.

Representing and Reasoning with Uncertain Knowledge: Probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference, sample applications.

Unit-IV

Decision-Making: Basics of utility theory, decision theory, sequential decision problems, elementary game theory. AI Applications: Natural Language Processing, Computer Vision, Robotics.

Lab/Practicals

- Programming intelligent agents
- Programs related to different searching techniques
- Experiments related to probabilistic methods
- Practical examples of AI applications

Text Books/References

1. "Artificial Intelligence: A Modern Approach", Stuart Russell and Peter Norvig , Pearson Education.
2. "Artificial Intelligence (SIE)", Kevin Night and Elaine Rich, Nair B., Mc Graw Hill.
3. "Introduction to AI and ES", Dan W. Patterson, Pearson Education.
4. "Artificial Intelligence", Deepak Khemani, Tata Mc Graw Hill Education.

CS 473 (PEC): PE-II(f): SOFT COMPUTING

	L	T	P
Cr. Hrs. 4 (3 +0+ 1)			
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Understand soft computing techniques

CO2: Explore neural network applications

CO3: Explore fuzzy logic applications

CO4: Explore genetic algorithm and hybrid soft computing approaches applications

Unit-I

Introduction: Artificial neural network: Introduction, characteristics, learning methods, taxonomy, Evolution of neural networks, basic models, important technologies, applications. Fuzzy logic: Introduction, crisp sets, fuzzy sets, crisp relations and fuzzy relations: cartesian product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm, Introduction, biological background, traditional optimization and search techniques, Genetic basic concepts.

Unit-II

Neural Networks: McCulloch-Pitts neuron, linear separability, hebb network, supervised learning network: perceptron networks, adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN, associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self organizing feature maps, LVQ, CP networks, ART network.

Unit-III

Fuzzy Logic: Membership functions: features, fuzzification, methods of membership value assignments, Defuzzification: lambda cuts, methods, fuzzy arithmetic and fuzzy measures: fuzzy arithmetic, extension principle, fuzzy measures, measures of fuzziness, fuzzy integrals, fuzzy rule base and approximate reasoning : truth values and tables, fuzzy

propositions, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems, overview of fuzzy expert system, fuzzy decision making.

Unit-IV

Genetic Algorithm: Genetic algorithm and search space, general genetic algorithm, operators, Generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization, real life problem, advances in GA

Hybrid Soft Computing Techniques & Applications: Neuro-fuzzy hybrid systems, genetic neuro hybrid systems, genetic fuzzy hybrid and fuzzy genetic hybrid systems, simplified fuzzy ARTMAP, Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach.

Lab/Practicals

- Practical applications of neural network, fuzzy logic, genetic algorithm and hybrid soft computing techniques

Text Books/References

1. "Principles of Soft Computing", S.N.Sivanandam and S.N.Deepa, Wiley India Pvt Ltd.
2. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T. Sun and E.Mizutani, PHI / Pearson Education.
3. "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", S.Rajasekaran and G.A.Vijayalakshmi Pai, Prentice-Hall of India Pvt. Ltd.
4. "Fuzzy Set Theory: Foundations and Applications", George J. Klir, Ute St. Clair, Bo Yuan, Prentice Hall.
5. "Genetic Algorithm in Search Optimization and Machine Learning", David E. Goldberg, Pearson Education India.
6. "Neural Networks Algorithms, Applications and Programming Techniques", James A. Freeman, David M. Skapura, Pearson Education India.
7. "Neural Networks Comprehensive Foundation", Simon Haykin, Second Edition, Pearson Education.
8. "Fuzzy Logic Engineering Applications", Timothy J.Ross, McGraw Hill, New York.
9. "Fundamentals of Neural Networks", Laurene Fauseett, Prentice Hall India, New Delhi.

CS 473 (PEC): PE-II(g): COMPUTER GRAPHICS

Cr. Hrs. 4 (3+0 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the role of computer graphics, different graphics systems and their applications.

CO2: Understand and implement various algorithms for scan conversion and filling of basic objects.

CO3: Demonstrate and implement different basic geometric transformation including composite transformation techniques on graphical objects.

CO4: Understand and analyze various three dimensional geometric and modelling transformations.

CO5: Demonstrate and implement clipping and view-ports object representation for images.

Unit-I

Introduction to computer graphics, application areas, display devices, raster scan, random scan, color monitor, display file, frame buffer, 3-D display technique, input devices, hard copy devices.

Unit-II

Points, lines, plane and coordinate, character vector, circle generation algorithm, antialiasing techniques, representation of polygons, Interfacing and filling polygon, 2-D transformation, translation, rotation, scanning, shearing, reflection, composite transformation, raster transformations.

Unit-III

Windows, multiple windowing, view port, viewing transformation, clipping algorithm for points, line using Sutherland and Cohen, polygon, text clipping. Segment and segment operations. Interactive graphics, user dialogue, input modes, interactive picture construction techniques, curves and curved surface, interpolation and approximation curve, continuity of curve.

Unit-IV

Concept of 3-D, representation of 3-D object, 3-D transformation, translation, rotation, reflection, scaling. Parallel perspective, Isometric Projections. 3-D clipping Sutherland and Cohen algorithm. Hidden lines and surface removal techniques. Back face, Z-buffer, painter algorithm.

Lab/Practicals

- Implementation of algorithms for drawing 2D primitives such as line & all slopes circle (midpoint). Programs to implement 2D geometric transformations such as translation, rotation, scaling, reflection, shear, window-viewport also implementing composite 2D transformations. Programs to implement clipping of various geometrical shapes.

Text Books/References

1. "Computer Graphics: C Version", D. Hearn and M.P. Baker 2nd Ed, Pearson Education.
2. "Interactive Computer Graphics", James D. Foley; Andries Van Dam; Steven K. Feiner; John F. Hughes, Addison Wesley.

CS 474 (PEC): PE-III(a): DATA ANALYTICS

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand statistics and its role in data analytics.

CO2: Understand regression and its importance in machine learning.

CO3: Explore supervised regression and classification techniques.

CO4: Explore unsupervised clustering and association rule mining techniques.

Unit-I

Descriptive Statistics: Introduction to Data Analytics, Descriptive Statistics, Probability Distributions, Inferential Statistics: Inferential Statistics through hypothesis tests.

Unit-II

Regression & ANOVA: Regression ANOVA (Analysis of Variance) Machine Learning: Introduction and Concepts: Differentiating algorithmic and model based frameworks.

Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification

Unit-III

Supervised Learning with Regression and Classification techniques: Bias-Variance Dichotomy, Model Validation Approaches, Logistic

Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines, Ensemble Methods: Random Forest, Neural Networks, Deep learning.

Unit-IV

Unsupervised Learning and Challenges for Big Data Analytics: Clustering. Associative Rule Mining, Challenges for big data analytics, Prescriptive analytics: Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning

Text Books/References

1. "The elements of statistical learning", Hastie, Trevor, et al., New York: Springer.
2. "Applied statistics and probability for engineers", Montgomery, Douglas C., and George C. Runger, John Wiley & Sons.
3. "Data Analytics", Anil Maheshwari, McGraw Hill Education.

CS 474 (PEC): PE-III(b): MACHINE LEARNING

Cr. Hrs. 3 (3+0 + 0)

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

Course outcome: At the end of the course, the student will be able to:

CO1: Understand learning systems with inductive classification

CO2: Explore learning approaches such as decision tree and ensemble

CO3: Explore probabilistic learning with ANN

CO4: Explore classification and clustering techniques such as SVM, Bayesian and kNN

Unit-I

Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.

Unit - II

Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pruning.

Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting, and decorate. Active learning with ensembles.

Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

Unit-III

Computational Learning Theory: Models of learnability: Learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. PAC results for learning conjunctions, kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

Unit-IV

Support Vector Machines: Maximum margin linear separators. Quadractic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest neighbour algorithm. Case-based learning.

Text Books/References

1. "Machine Learning", Tom Mitchell, McGraw Hill.
2. "Pattern Recognition and Machine Learning", Bishop, C., Berlin: Springer-Verlag.
3. "The Elements of Statistical Learning", T.Hastie, R.Tibshirani, J.Friedman.

CS 474 (PEC): PE-III(c): NEURAL NETWORKS

Cr. Hrs. 3 (3 +0+ 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze artificial neural system concepts, applications, models, neural processing and learning rules.

CO2: Understand, apply and implement back propagation training algorithm and perceptrons along with linearly non-separable pattern classification and various delta learning rules of multilayer feed forward networks.

CO3: Understand and analyze concepts of dynamic systems and hopfield networks for single layer feedback networks and concepts of associative memory.

CO4: Understand and analyze matching and self-organizing networks such as hamming net, counter propagation network, cluster discovery network.

Unit-I

Artificial Neural System: Preliminaries: Basic Concepts of Neural networks, computation: Some examples and applications, History of Artificial Neural systems development. Fundamental Concepts and Models of Artificial Neural Systems: Biological Neurons and their artificial models, Models of Artificial Neural networks, Neural processing, Learning and adaptation, Neural network learning rules. Learning: Supervised and Unsupervised.

Unit-II

Back propagation: Introduction, back propagation training algorithm. Perceptron: Single and Multi-Layer Preceptrons. Multilayer Feedforward Networks: Linearly nonseparable pattern classification, Delta learning rule for multiperceptron layer, Generalized delta learning rule.

Unit-III

Single-Layer Feedback Networks: Basic concepts of dynamical systems, Hopfield networks. Associative Memories: Basic concepts, Linear associator, Basic concepts of recurrent auto associative memory, Bidirectional associative memory.

Unit-IV

Matching and Self-organizing Networks: Hamming net and MAXNET, Unsupervised learning of clusters, Counter propagation network. Cluster discovery network (ARTI).

Text Books/References

1. "Introduction to artificial neutral systems", Jacek M. Jurada, Jaico Publishing house.
2. "Neural Networks", Simon Haykin, Pearson Education; Indian Branch.
3. "Neural Network in Computer Intelligence", LiMin Fu., Tata McGraw-Hill Publishing Company Ltd. New Delhi.

CS 474 (PEC): PE-III(d): DATA WAREHOUSING & MINING

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand the primitives of data warehousing and data mining along with issues, challenges and applications.

CO2: Understand and analyze the algorithms based on association rules

CO3: Understand and compare various classification technologies particularly bayesian, two class and generalized class classification.

CO4: Evaluate and analyze various clustering and decision tree algorithms for efficient extraction and classification.

CO5: Analyze and apply various techniques like genetic algorithms, text and content mining for data and web mining.

Unit-I

Data Warehousing: Introduction, Definition, Multidimensional data transformation, OLAP operations, Ware house schema, Ware house Server. Data Mining: Introduction, Definition, KDD vs. DM, DBMS vs. DM, DM Techniques, Issues and Challenges in DM, DM Applications. Association Rules: A Prior Algorithm, Partition, Pincer search, Incremental, Border, FP-tree growth algorithms, Generalized association rule.

Unit-II

Classification: Parametric and non-parametric technology: Bayesian classification, two class and generalized class classification, classification error, Decision boundary, Discriminant functions, Non-parametric methods for classification.

Unit-III

Clustering: Hierarchical and non-hierarchical techniques, K-MEDOID Algorithm, Partitioning, Clara, Clarans. Advanced Hierarchical algorithms. Decision Trees: Decision tree induction, Tree pruning, Extracting classification rules from decision trees, Decision tree construction algorithms, Decision tree construction with presorting.

Unit-IV

Data mining using neural networks, Genetic algorithms. Web Mining: Web mining, Text mining, Content mining, Web structure mining.

Text Books/References

1. "Data Mining: Concepts and Techniques", Jiawei Han, Micheline Kamber, Harcourt India Pvt.
2. "Data Warehousing, Data Mining and OLAP", Alex Berson, Stephen J. Smith, McGraw Hill.
3. "Principles of Data Mining", D.Hand, H.Mannila, and P.Smyth, MIT Press.

CS 474 (PEC): PE-III (e): GRAPH THEORY

Cr. Hrs. 3 (3 +0+ 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and analyze the basic concepts of graph theory and apply them to implement Euler and Hamiltonian graphs and solve travelling salesman problem.

CO2: Apply and analyze the use of tree data structure; basic properties of cut sets and cut vertices and its applications.

CO3: Understand and analyze the applications of various graphs like planar graph, dual graph with their attributes and representations.

CO4: Understand and analyze various coloring, covering and partitioning problems with their applications and representations.

Unit-I

Introduction: Graph, application of graph, finite & infinite graphs, incidence & degree, isolated vertex, pendant vertex & null graph, *Paths & Circuits*: isomorphism, sub-graphs, walks, paths, Circuits, connected graphs, disconnected graphs, & components, Euler graphs, operation on graphs, Hamiltonian paths & circuits, travelling salesman problem.

Unit-II

Trees: Properties of trees, pendent vertices in a tree, distance & centers in a tree, rooted & binary trees, on counting trees, spanning trees, fundamental circuits, finding all spanning trees of a graph, spanning trees in a weighted graphs. *Cut sets & cut vertices*: Cut- sets, properties of cut-sets, cut sets in a graph, fundamental circuits and cut – sets, connectivity & Separability, networks flows, 1- isomorphism, 2- isomorphism.

Unit-III

Planar & Dual graphs: Planar graphs, kuratowski's two graphs, different representation of planar graphs, detection of planarity, geometric dual, Combinatorial Dual, *Matrix representation of graph*: Incidence Matrix, circuit matrix, cut-set matrix, path matrix, adjacency, matrix.

Unit-IV

Coloring, covering & partitioning: Chromatic number, chromatic partitioning, chromatic polynomial, matching, covering, the four color problem, Directed graphs: types of digraphs, binary relations, Euler digraphs, trees with directed edges, fundamental circuits in digraphs, adjacency matrix of a digraph, Acyclic digraph and Decyclization.

Text Books/References

1. "Graph Theory", Narsingh Deo, Prentice- hall of India Pvt. Ltd.
2. "Procedural Elements of Computer Graphics", Rogers, McGraw Hill
3. "Computer Graphics", Asthana, Sinha, Addison Wesley

CS 474 (PEC): PE-III(f): REAL TIME SYSTEMS

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand concepts of real time systems and its application in digital control, high-level control and signal processing.

CO2: Understand and analyze various attributes of processes and resources as well as the implementation of various real time task scheduling approaches.

CO3: Analyze clock-driven and priority driven scheduling algorithms for periodic tasks.

CO4: Understand and analyze the implementation of algorithms for scheduling aperiodic and sporadic jobs in terms of bandwidth and resource utilization.

Unit-I

Real time application: Digital Control, High–Level control, Signal Processing. Hard versus Soft Real time system: Jobs & Processors, Release times, Deadlines, Timing constraints, hard & soft timing constraints, Hard Real Time Systems, Soft Real Time Systems.

Unit-II

Reference Model: Processors & Resources, Temporal Parameters, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters, Resources Parameters, Scheduling Hierarchy. Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven approach, Dynamic Versus Static System, Effective Release Time and Deadlines, Optimality of the EDF and the LST Algorithms, Off Line versus Online Scheduling.

Unit-III

Clock–Driven Scheduling: Static, Timer Driven Scheduler, Cyclic schedules, Cyclic Executive, Scheduling Sporadic Jobs, Generalization, Algorithm for Static Schedules, Pros & Cons of Clock – Driven Scheduling. Priority - Driven Scheduling of Periodic Tasks: Fixed Priority versus Dynamic Priority Algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM Algorithms, Sufficient Schedulability Conditions for the RM and DM algorithms, Practical Factors.

Unit-IV

Scheduling A periodic and Sporadic Jobs in Priority – Driven Systems: Deferrable Servers, Sporadic servers, Constant Utilization, Total Bandwidth, and Weighted Fair – Queuing Servers, Slack Stealing in Deadlines driven Systems, Slack Stealing in Fixed Priority Systems, Scheduling of Sporadic Jobs. Resources and Resource Access Control: Effects of Resources Contention and resource Access Control, Non-preemptive Critical Sections, Basic Priority–Inheritance Protocol, Basic priority–Ceiling Protocol, Stack–Based, Priority–Ceiling (Ceiling Priority) Protocol, preemption Ceiling Protocol, Accesses of Multiple–Unit Resources, Concurrent Accesses to Data Objects.

Text Books/References

1. "Real Time Systems", Jane W. S. Liu., Pearson Education.
2. "Real Time Systems", Krishna C. M., McGraw Hill Publication.

CS 474 (PEC): PE-III (g): OBJECT ORIENTED ANALYSIS AND DESIGN

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome: At the end of the course, the student will be able to:

CO1: Understand and be able to differentiate how the object-oriented approach differs from the traditional approach to systems analysis and design.

CO2: Understand and analyze the importance of modeling and how the Unified Modeling Language (UML) represents an object-oriented system using a number of different modeling views.

CO3: Understand and Construct various UML models including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams using the appropriate notation.

CO4: Apply the Rational Software Suit for the construction of UML models and expressing the appropriate notation associated with each model.

Unit-I

Introduction: Object oriented approach, Object oriented themes, and Object oriented methodologies, Overview of OOL, Object classes; Meta Types, Object Oriented Methodologies, the Uniform Approach Modeling; Need of Modeling, Static and Dynamic Models, Functional Models. Object Modeling: Modeling concepts, Modeling techniques, Objects and classes, Links and association, multiplicity, Advanced link and association concepts, Generalization and inheritance, Grouping constructs, Aggregation, Abstract classes, Generalization *as* an extension and restriction, Multiple inheritance, Metadata, Candidate key, Constraints, Homomorphism, problems on object modeling and Advanced Object Modeling, Advantages of Object Modeling

Unit-II

Analysis: Problem Analysis, Problem Domain Classes, Identity classes, Object of Real World Problems using use case analysis and Recording Analysis. Dynamic Modeling: Events, Modeling scenarios, Mapping

Events to Object, Interface, Discovering attributes scenarios and event trace diagrams, Modeling simple collaboration, Modeling Logical Database schema, Activity Diagram, Modeling workflow, Advanced Dynamic Modeling concepts, Relation of object and dynamic models.

Unit-III

Class and State Diagram: Test scenarios, Interfaces, classes, Methods, Stress Testing, System Testing, Scalability Testing, and Regression Testing, Behavioral Modeling, State Chart diagrams, operations, Nested state diagrams, concurrency. Functional Modeling: Functional models, Data Flow Diagrams, Specifying Operations, Relation of functional to object and dynamic models, Problems on functional modeling.

Unit-IV

Design: Architectural Design, Refining the Model, Refactoring, Coupling and cohesion. Ownership of the attribute and the operations Process and Threads, Classes visibility, user interface, Subsystem interfaces. Deployment Diagram: Modeling source codes, Physical Database, Modeling in AC/S system, Distributed system and embedded systems. Case Study: Designing a static and dynamic model using diagram for Banking System, Student Information System, Examination System, Air Ticket Reservation System and Inventory System etc.

Text Books/References

1. "Object Oriented Modeling and Design with UML", James Rumbaugh, Pearson Education.
2. "Object Oriented Analysis and Design with Applications", Grady Booch, Pearson Education.

****OPEN ELECTIVE**

Note: The students have to take one open elective out of the list given except the subjects offered by their own branch.

CE 478a (OE) URBAN WASTE MANAGEMENT

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: At the end of the course, the student will be able to:

CO1: Demonstrate knowledge of Problems & National & global scenario of solid waste management.

CO2: Demonstrate knowledge of solid waste seperation, collections, transfer and transport.

CO3: Analysis of solid waste & chemical characteristic of refuse.

CO4: Understand composting and incineration.

CO5: Understand sanitary land filling.

CO6: Monitor effects of solid waste on environment.

Unit-I

General: Problems associated with Solid Waste Disposal. National & global scenario of solid waste management.

Generation of Solid Waste: Objectives of solid waste management, Classification of solid waste. Activities associated with generation of solid waste, quantity of waste generation, factors affecting solid waste generation.

Unit-II

Types of Solid Waste: Sources of solid waste. Food & biodegradable waste, recyclable waste, hazardous waste.

Waste Collections, Transfer and Transport: Storage of waste at source & source separation of waste. Primary collection of waste, secondary storage of waste. Waste storage depot. Transportation of waste..

Unit-III

Analysis of Solid Waste: Need for physio-chemical analysis of municipal solid waste. Physical characteristic of refuse : specific weight & category analysis.

Chemical Characteristic of Refuse: Determination of moisture content, volatile solid, pH, carbon, nitrogen, phosphorus, potassium & calorific value.

Composting & incineration, their advantages & disadvantages.

Unit-IV

Sanitary Land Filling: Introduction, approach to design of sanitary land filling. Typical component of land-fill cover. Various guide lines for design of land-fill. Trench of municipal solid waste disposal. Environmental quality monitoring at land-fill site. Recommendation for problems of municipal solid waste.

Practical: As per theory syllabus.

Suggested Books & References

1. G. Techobanogious, H. Theisen & R. Blassen, 'Solid Waste Engineering, Principles and Management Issues', McGraw Hills, Book Co. New York.
2. C.L. Mentell, 'Solid Waste Management, 'John Whely, New York.
3. Bhide & Sundrashen, 'Solid Waste Management in Developing Countries'.

CE 478b (OE) GROUND IMPROVEMENT TECHNIQUES

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: At the end of the course, the student will be able to:

CO1: Ground Improvement Techniques & Methods of soil stabilization.

CO2: Understand soil cements stabilization.

CO3: Stabilize dune sand by lime fly ash

CO4: Demonstrate knowledge of Soil Bituminous stabilization and Thermal stabilization.

CO5: Understand Granular column and soil reinforcement.

CO6: Demonstrate knowledge of Dynamic compaction.

Unit-I

Ground Improvement Techniques: Shallow and deep techniques. Soil stabilization; Purpose, mechanical mixing of different types of soils, grading land plasticity charcteristics,.

Soil Lime Stabilisation: Base exchange, Pozzolinic reaction, curing, Types of soils, stabilised, density, effect on consistency properties. Effect of lime on liquid limit, plastic limit, plasticity index and shrinkage limit. Relationship of strength with curing period & density.

Unit-II

Soil Cement Stabilisation: Soil cement stabilisation, Mechanism of soil cement stabilisation. Various theories; Modified soil cement & plastic soil cement. Effect of density, curing period and surface area on strength.

Soil Fly-Ash Stabilisation: Soil-lime fly ash stabilisation, principles of pozzolanic reaction. Proportions used in practice. Stabilisation of dune sand by lime fly ash.

Unit-III

Soil Bituminous Stabilisation: Soil bituminous stabilization Intimate mix theory & plug theory. Effect of mixing, moisture, aerating, density & compaction.

Thermal Stabilisation: Theory of thermal stabilisation, Electroosmotic drainage. Double layers, 'Ke' electro osmotic coefficient of permeating, Full scale field test, Electro osmotic chemical hardening Field construction methods and equipment.

Dynamic compaction of soil Equipments used, tests performed in field, Pre compression and Vertical Drains.

Unit -IV

Granular Columns: Methods of construction, bearing capacity of composite soil. Empirical methods/charts, Theory of determination of settlement of composite soil. Vibro-flotation &vibro-compaction.

Soil Reinforcement: Geosynthetics, Geomembrane,

Practicals : As per theory syllabus.

Suggested Books & References

1. Purushotham, P. Raj, 'Ground improvement Techniques'.
2. Venkaramiah, C., 'Ground Improvement'.
3. Madhav, M.R., 'Development in Reinforcement of Ground and Slopes'.

MI 478 (a) (OE) ENGINEERING GEOLOGY

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: At the end of course, the students will be will able to:

Identify the structure of earth; Distinguish between different rocks and their properties; Select sites for different structures in different zones and Explore subsurface using different techniques.

Unit-I

General Geology: Subdivision of Geology. Importance of Geology in Civil Engineering. Internal Structure of the Earth, physical properties of minerals, weathering and erosion. Geological work of wind, river and ocean. Stratigraphic aspects of rocks for civil engineers. Geological Time Scale, rock provinces.

Unit-II

Petrology: Origin & classification of rocks. Texture & Structures of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of rocks. Rocks and dimensional stones as a construction material. Suitability of rocks for different Civil Engineering purposes. Structural Geology: Causes & Classification of fold, fault, joints & unconformities. Outcrop pattern. Recognition of structure from rock outcrops.

Unit-III

Natural Disasters and Geological Investigations (in reference to Civil Engineering): Earthquake, its causes, intensity scale and seismic zone of India. Site selection for dam, tunnels, multistoried buildings, reservoirs and bridge structures Improvement Techniques: Sites improvement techniques practiced in different civil engineering projects. Introduction to drilling methods.

Unit-IV

Geophysical Methods for Subsurface Exploration: Electrical resistivity, Seismic refraction & Ground Penetrating Radar method of civil engineering importance. Remote Sensing: Introduction and applications in Civil Engineering. Image acquisition, image interpretation (visual and digital, digital terrain model, airborne lithological identification). Remote sensing software used in civil engineering interpretation.

Practical: As per theory part

Text Books/References

1. Goodman, R. E., 'Engineering Geology - Rock in Engineering Construction', John Wiley and Sons.
2. Parbin Singh, 'Text Book Engineering Geology'.
3. Blyth, F.G. and De Freitas, M.H., 'A Geology for Engineers', (7th Edition), Edward Arnold.
4. N.Chenna Kesavulu, 'Text Book of Engineering Geology'.
5. Leggot R.F., 'Geology for Engineers'.
6. Kryinine & Judd, 'Engineering Geology and Geo-techniques'.
7. John Pitts, 'Manual of Geology for Civil Engineers'.
8. Tony Waltham, 'Foundations of Engineering Geology.

MI 478 (b) (OE) EARTH MOVING MACHINERY

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: At the end of course, the students will be will able to:

Understand construction and working of various heavy earth moving machinery, pumping system used in mines, maintenance aspects.

Unit-I

Construction and operation of blast hole drills, rippers, shovels, hydraulic excavators, scraper, dragline, dumpers, wheel loaders, dozers, graders, surface miners, BWE, spreader, stacker & reclaimer.

High capacity belt conveyors: Constructional detail and selection procedures; High angle conveyor, Cable belt conveyor;

Unit-II

Aerial rope ways: Classification, layout and constructional features.

Classification, application and constructional features of crushers, breakers and feeders; In pit crushers.

Compressors: Basic theory, classification and application of compressors used in mines; Construction and operation of centrifugal and axial flow compressors; Performance characteristics of compressors; Selection of compressors for mining application.

Unit-III

Centrifugal Pumps: Principle of operation; theoretical and actual head, construction of impeller, multistage centrifugal pumps, axial thrust balancing, performance characteristics, parallel and series operations of pumps, capacity, selection of mine pumps; Pumping system layout for mines.

Construction and operation of slurry, submersible, air lift and mono pumps; installation and maintenance of pumps

Unit-IV

Recent trends and development of surface mining equipment: Automation and control in HEMM. Selection criteria of open cast mining equipment. Safety aspects related to open cast mining equipment: Fire protection system used in HEMM.

Faults and their rectification in HEMM and their maintenance.

Practical: As per theory syllabus

Text Books/References

1. Surface Mining Technology– S. K. Das;Geeta Book Stores
2. Elements of Mining Technology– D.J.Deshmukh; Vidyasewa Prakashan.
3. Mine, Pumps, Haulage & Winding– S.Ghatak; Coalfield Publishers, Asansol.
4. Conveying machines; Part I & II – A. Spivakovsky, V. Dyachkov; Mir Publishers, Moscow
5. Recent Development of Heavy earth Moving machineries – A. De, Lovely Prakashan
6. Moving the Earth – Nicholes
7. On and with the Earth – J. Singh
8. Drilling Technology Handbook– C. P. Chugh

MI 478 (c) (OE) TUNNELING ENGINEERING

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: At the end of the course, the student will be able to:

Understand various methods of tunneling, use of latest numerical techniques for tunnel design, stability analysis and ground control measures with various steel support and rock reinforcement, maintenance of tunnels, provision of facilities such as ventilation, illumination etc in tunnels.

Unit-I

Introduction to tunneling; geological concept of tunneling. Influence of geological aspects on design & construction of tunnels.

Unit-II

Tunnelling Methods: Conventional and special Drill & blast roadway drivage machines, tunnel boring machines (TBM)

Unit-III

Stresses and displacements associated with excavating tunnels, Ground control or treatment in tunneling and drivages. Design of Supports of Tunnels; Steel supports, rock enforcements, new Australian tunneling methods (NATM)

Unit-IV

Design of Tunnels: Rock conditions, RMR, Q-system, RSR, rock mass behavior, stress strain behavior, and stress analysis of tunnels. Maintenance: Dewatering, ventilation and illumination drivages tunnels. Numerical techniques: Introductory use of FLAC, PLAXIS etc

Practical: As per theory.

Text Books/References

1. Richards E. Bullock–Tunnelling and Underground Construction Techniques
2. Stack Barbara – Hand Book of Mining and Tunnelling Machinery, John Wiley & Sons.
3. R.V. Proctor – Rock Tunneling with Steel Supports
4. J. Johnsen – Modern Trends in Tunneling and Blast Design.

ME478(a) (OE)
ENTREPRENEURSHIP AND INDUSTRIAL MANAGEMENT

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: Upon completion of this course the students will be familiar with:

CO1: Selection and development of a small or medium business idea

CO2: Make and Implement project proposals and reports to hunt for venture capital etc.

CO3: Market competition and innovation in products and processes.

CO4: Develop managerial skills to achieve goals, & Plan and implement projects applying management techniques.

CO5: Understand social responsibility as a modern management concept.

Unit-I

Entrepreneurship: Definition and Meaning; Characteristics of Entrepreneurship/Traits of an Entrepreneur; Functions of Entrepreneurship - Job Creation, Innovation, Inspiration, Economic Development; Types of Entrepreneurship, Entrepreneurship and Intrapreneurship, Entrepreneurship Strategy

The Business Plan: Creating and Starting the Venture: The Marketing Plan, The Financial Plan, Sources of Capital; Legal Issues for the Entrepreneur: Patents, Trademarks, Copyrights, Trade Secrets, Licensing, Product Safety and Liability, Insurance; Contracts, Advertising, Supply Chain Management, Retail & FDI

Proposals & risks: Project Report Preparation (Feasibility, Cost Estimation, CVP Analysis, Detailed Project Report, Concept of Risk and decision making, Risk Management-SWOT etc

Unit-II

Entrepreneurship and Innovation: The Innovation Concept, Importance of Innovation for Entrepreneurship, Source of Innovation for Opportunities, The Innovation Process, Product life cycle, new product development process, mortality curve, Creativity and innovation in product modification/ development.

Entrepreneurship and Economic Development: Role of Entrepreneurship in Modern Economy, Managers Vs Entrepreneurship: Characteristic of Managers, Characteristic of Entrepreneurs, Similarities and differences between Managers and Entrepreneurs

Unit-III

Industry, Commerce and Business: Types of ownership in the organization- Definition, characteristics, Merits & Demerits; Single ownership, Partnership, Cooperative Organizations, Joint Stock Companies, Government owned, Differences between Management and Administration, Leadership Models.

Industry Size & Current schemes: Micro, Small, Medium- Industry; Registration Process, Current Promotional Schemes for new Enterprise

Unit-IV

Function of Management: Planning- Types of Planning - Strategic Plan, Tactical Plan and Operation Plan; Organizing- Definition and Meaning, Types of Organizing; Staffing- Definition and Meaning, Types of Staffing – Internal & External, The Basic Steps in the Staffing Process; Directing (Leading)- Definition and Meaning; Controlling- Definition and Meaning, Relationship between Planning and Controlling.

Social Responsibility: Social Obligation, Social Responsiveness and Social Responsibility, Managerial Ethics

Practical: As per theory.

Text Books/References

1. Entrepreneurship Development and Management, A. K. Singh, Jain Book Agency (JBA) publishes, New Delhi
2. Small Scale Industries and Entrepreneurship, Vasant Desai, Himalaya 2008
3. Industrial Engineering and Management, O.P.Khanna, Dhanpat Rai and Sons, Delhi
4. Industrial Management and Entrepreneurship, V. K. Sharma, Scientific Publishers, New Delhi.
5. Entrepreneurship, Roy Rajeev, Oxford Latest Edition.

ME478(b) (OE) BIO-ENERGY SYSTEMS DESIGN

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: Upon completion of this course the students will be familiar with:

CO1: Classify bioenergy fuels and their conversion technologies.

CO2: Describe the knowledge for operation of biomass gasifier, biomass pyrolysis and biogas plant.

CO3: Design system for biomass gasification, pyrolysis and biogas production.

CO4: Demonstrate production of biodiesel and bioethanol, and their application power generation and transportation.

CO5: Demonstrate socio-economic aspects and cost-economics analysis of biomass conversion technologies.

Unit–I

Introduction: Introduction to bio-energy from, classification of biomass as fuel – Agro based, Forest, residue. Bio-energy systems/Conversion devices – Incinerators, gasifiers, digestors. Design objectives for sustainable bio-energy systems. Bio-mass bricketing machine.

Biomass conversion processes: Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion.

Unit–II

Bio-mass Combustion: Basics of combustion, Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation-Operation of all the above biomass combustors.

Unit–III

Bio-mass Gasification: Working principle, Gasifiers – Fixed bed system – Downdraft and updraft gasifiers,Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Bio-mass Pyrolysis: Pyrolysis – types, slow, fast; Manufacture of charcoal: methods -yields and application; Manufacture of pyrolytic oils and gases, yields and applications.

Unit–IV

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status, Design and constructional features; Biomass resources and their classification for biogas.

Review of mechanical Design: Materials of Construction, corrosion damage, testing and inspection.

System modelling: Basics and its mathematical model, Use of Software in system design. Economics analysis of bio-energy systems.

Practical: As per theory

Text books/ References

1. Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction: Practical Design and Theory, Academic Press, Elsevier, 2018.
2. John Rezaiyan, Nicholas P. Cheremisinoff, Gasification Technologies, Taylor & Francis, 2005.
3. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
4. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
5. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
6. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ME478(c) (OE) ENERGY CONSERVATION AND MANAGEMENT

Cr. Hrs. 3 (2+0+1)

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

Course Outcome: Upon completion of this course the students will be familiar with:

CO1: To understand the basic knowledge of different terms & principles of energy conservation, audit and management

CO2: To understand efficient heat utilization, saving and recovery in different thermal system

CO3: To prepare energy audit report for different energy conservation instances

CO4: To Evaluate the energy saving &conservation in different mechanical utilities

Unit-I

Energy Scenario: Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy and Environment: Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.

Unit-II

Energy Management & Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple pay back period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs.

Unit-III

Energy Monitoring and Targeting: Defining monitoring & targeting, Elements of monitoring & targeting, Data and information-analysis, Techniques-energy consumption, Production, Cumulative sum of differences (CUSUM).

Global Environmental Concerns: United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Fund (PCF), Sustainable Development.

Unit-IV

Energy Efficiency in Thermal Utilities and systems: Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas, Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, Condensate and flash steam recovery system, identifying opportunities for energy savings, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace, hot air generators, Feed water treatment, blow down, energy conservation opportunities, Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, Soot blowing and soot deposit reduction,

reasons for boiler tube failures, start up, shut down and preservation, Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, Steam utilization, Performance assessment more details, installation, Temperature control, draft control, waste heat recovery. Forging furnace heat balance, Thermic fluid heaters, super critical boilers, Thermo-compressor, steam pipe insulation, condensate pumping, steam dryers.

Cogeneration: Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. Heat Exchangers: Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc. Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential. Insulation and Refractories: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation. Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, ice bank system, and performance assessment of window and split room air conditioners, Star labeled pumps, cold storage refrigeration, and humidification system.

Practical: As per theory

Text Books/References

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication.
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring and Regulation dited by E J Wilson and D Gerard, Blackwell Publishing
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994.

EC 478(a) (OE) INTELLECTUAL PROPERTY RIGHTS

Cr. Hrs. 3(3+0+ 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcome: The student will be able to

CO1: Understand the concept of Intellectual Property Rights and Patents.

CO2: Understand the concept of Trademark and its related Statutory authorities.

CO3: Apprehend the idea of Copyright and register ability of a design.

CO4: Understand International IPR, Case laws and World intellectual property organization.

Unit-I

Introduction: Concept of IPR, Historical development , kinds of IPR, brief description of patent, trademark, copyright, industrial design, importance of IPR, IPR authorities.

PATENTS: Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.

Unit-II

Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration, licensing in trademark.

Unit-III

Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright, term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies

Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs.

Unit-IV

International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.

Text Books/References

1. Law Relating to Intellectual property, fourth edition by B.L.Wadehra. Universal law publishing co. pvt. Ltd, 2007.
2. Intellectual property: Patents, copyright, trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher, 2003.
3. Law and practice of intellectual property in India by Vikas Vashishth, 2006.
4. Patents ,copyrights, trademarks and design by B L Wadhera, 2014.
5. Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing 2002.

EC 478 (b) (OE) E-COMMERCE

Cr. Hrs. 3(3+0+ 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcome: The student will be able to

CO1: Understand the concept of Electronic Commerce and its need.

CO2: Understand the idea of Network Infrastructure for E- Commerce.

CO3: Apprehend the notion of security issues on web and importance of Firewall.

CO4: Understand Electronic Payments, SET protocol and E- Commerce Law.

Unit-I

Introduction: Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models

Unit-II

Network Infrastructure for E-Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure,

Network Access Equipments, Broadband telecommunication (ATM, ISDN, and FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.

Unit-III

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

Unit-IV

Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

Text Books/References

1. Goel, Ritendra "E-commerce", New Age International, 2007.
2. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison- Wesley. 1996.
3. Vinod Kumar Garg and Venkita krishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI 2004.

EE 478(a) (OE) KNOWLEDGE BASED SYSTEM

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcome:

CO1: Know-how of Artificial neural networks.

CO2: Proficiency in learning techniques of artificial neural networks.

CO3: Know-how of fuzzy control techniques.

CO4: Capability to Adaptive Fuzzy control design.

Unit-I

Artificial Neural Networks: Neural Networks- an overview, Introduction to Artificial Neural Networks (ANN), Historical Development of Neural

Networks, Biological Neural Networks, Comparison Between Artificial and Biological Neural Network. Basic Building Blocks of ANN: Network Architecture, , Activation Function.

Unit-II

Fundamental Models of Artificial Neural Networks: Introduction, McCulloch-Pitts Neuron Model. Learning Rules: Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square (LMS) Rule), Back Propagation Rule

Unit-III

Fuzzy Logic: Fuzzy logic concepts and application areas, classical and fuzzy Sets, fuzzy relation and membership functions, fuzzification and defuzzification methods, fuzzy rule base system.

Unit-IV

Neural Network and Fuzzy Logic application in load forecasting, fault detection, economic load dispatch, voltage and reactive power control, load flow and electric drive control.

Text Books/References

1. S N Sivanandanm, S Sumathi and S N Deepa. Introduction to Neural Networks Using MATLAB- Tata McGraw- Hill Publishing Company Limited.
2. J.M. Zurada. Introduction of artificial neural systems - Jaico Publication House.
3. D. Driankov, H. Hellendoorn and M Rein frank. An introduction to fuzzy control - Narosa Publication House, 2nd reprint.

EE 478 (b) (OE) ADVANCED POWER CONVERTERS

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course outcome:

CO1: Competency in Single-Switch Isolated Converters design.

CO2: Proficiency in Dynamic Analysis of DC-DC Converters

CO3: Know-how of resonant converter.

CO4: Know-how of Multilevel Converters.

Unit-I

Single-Switch Isolated Converters: Requirement for isolation in the switch-mode converters, Forward and flyback converters, Push-Pull Converters Power circuit and steady-state analysis,.

Unit-II

Dynamic Analysis of DC-DC Converters: Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model and converter transfer functions.

Unit-III

Resonant Converters: Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits-Resonant switches. Concept of Zero voltage switching.

Unit-IV

Multilevel Converters: Basic concept, classifications, working principle, applications.

Text Books/References

1. Switched Mode Power Conversion, Course Notes, CCE, IISc, 2004.
2. Issa Batarseh, 'Power Electronic Circuits', John Wiley, 2004.
3. Philip T Krein,' Elements of Power Electronics ',Oxford Press.
4. Fundamentals of Power Electronics – Robert Erickson and Dragon Maksivimovic.
5. Springer Publications. Power Electronics–Issa Batarseh- John Wiely.
6. Elements of Power Electronics-Philip T.Krein–Oxford University Press.

EE 478(c) (OE)
POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcome :

CO1: Learning of Basics Renewable Energy Systems.

CO2: Proficiency in dynamic modelling of Power Electronics converter.

CO3: Know-how of power electronics in Wind Power Plants.

CO4: Know-how of power electronics in Solar PV.

Unit-I

Basics Renewable Energy Systems: Modern power electronics technology for the integration of renewable energy sources. Challenges for grid integration, energy needs of India and energy consumption patterns, worldwide potentials of these sources.

Unit-II

Power electronics converters: Various topologies of power electronics converters (PECs), power electronics converters (PEC) classifications, Dynamic modelling of Power Electronics converter

Unit-III

Power electronics in Wind Power Plants: Grid interconnection requirements for wind farms, integration issues, operational issues, grid integration issues in India, wind power integration standards, super grid strategy, Applications of PEC in wind power plants, Modern PEC in wind power plants.

Unit-IV

Solar Photo Voltaic (PV) Technology: Solar cell characteristics, parameters of solar cell and its equivalent circuit, PV Module and arrays, perturb and observe maximum power point tracking (MPPT) technique, components of PV system, design of a standalone PV system. Solar constant, solar radiation at the earth's surface, solar radiation geometry, solar radiation measurements, estimation of average solar radiation. Solar Thermal Systems: Types of collectors, collection systems and efficiency.

Text Books/References

1. Wind power plants and projects developments, Joshua Earnest and T Wizelius, PHI, New Delhi, 2011.
2. Handbook of renewable energy technology, World Scientific, Singapore, 2011.

REE 478(OE) RENEWABLE ENERGY TECHNOLOGIES

Cr. Hrs. 3 (2+0 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome:

This course is undertaken to introduce basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar, wind energy, bio energy, etc.) and principles of related technical systems (photovoltaic, wind, biomass power generation, etc.). In a further step an economic analysis of supply technologies will be undertaken. Students will learn to acquire a basic understanding of issues related to renewable energy supply systems.

Unit-I

Conventional and Alternative Energy Sources: Effect on environment of fossilfuels, nuclear energy and hydroelectric power. Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization.

Unit-II

Solar Energy: Solar thermal and Photovoltaic System for power generation. Flat plate collectors & Focusing collectors. Solar water and air heaters, solar distillation, solar cooker, drying of materials, application in industries.

Unit-III

Wind Energy: Nature and potential, wind mill types, their merits and demerit. Wind farms. Brief description of geothermal energy, ocean thermal energy, tidal and wave energy.

Unit-IV

Biomass: Nature and potential, different bio conversion techniques, biogas, biodiesel. Power generation from biomass (gasification & dendro thermal) and fuel cell technology.

Practical

1. To study solar drying system.
2. To study solar water heating system.
3. To study box type solar cooker.
4. To study solar distillation system.
5. To study different biogas plants.
6. To study wind energy conversion systems.
7. To study downdraft biomass gasifier for thermal application.

Suggested Readings

1. G.D. Rai. Non Conventional Energy Sources, 2013, Khanna Publishers.
2. Twidell, J., & Weir, T. (2015). Renewable energy resources. Routledge.
3. Basu, Prabir. Biomass gasification and pyrolysis: practical design and theory. Academic press, 2010.
4. Rathore N. S., Kurchania A. K., Panwar N. L.;Non Conventional Energy Sources, Himanshu Publications, 2000.

SWE478(OE) AERIAL PHOTOGRAPHY, RS and GIS

Cr. Hrs. 3 (2 +0+ 1)

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

Course Outcome: At the end of the course, the student will be able to:

Familiarize with aerial photographs and its interpretation. Developing skill of use of various hardware and software in use of satellite data, GPS technology. Development of resource mapping and planning studies using RS and GIS.

Unit-I

Aerial photography: Aerial photograph, their classification, map v/s aerial photograph, photogrammetry and its application. Elements of aerial photo interpretation, aerial photo interpretation and its use.

Unit-II

Remote sensing: Definition, electromagnetic radiations, Interactions with the Atmosphere, Passive v/s Active Sensing, Characteristics of Images, Satellite and Sensors-Satellite Characteristics, Resolution, Multi-spectral Scanning, Thermal Imaging, Satellite missions, microwave sensing, Image Analysis- Visual interpretation, Digital image processing, image, Enhancement and Classification.

Unit-III

GIS: Definition, basic components, data types- spatial, non- spatial, GIS data modeling, vector and raster representation, GIS data base management, GIS data file management.

Unit-IV

GIS data input and editing: Data input methods, scanning, digitization, GPS data, data editing, errors and data reduction, Data analysis- format conversion, spatial measurement, overlay analysis and data output.

Practical

1. Study of aerial photographs under mirror stereoscope.
2. Preparation of stereo model of aerial photograph.
3. Land use/cover studies through aerial photograph.
4. Use of optical scanners and digitizers. U
5. Use of GPS in mapping and GIS data input, satellite data product.
6. Familiarization with image processing and GIS software's and their applications.

Suggested Readings

1. K.K. Rampal. (1999) Hand Book of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi
2. M. A. Reddy (2002) Remote Sensing and Geographical Information Systems, B.S. Publications, Hyderabad
3. Lillisand and Kiefer (1987) Remote sensing and Image Interpretation, John Weiley and sons.

FMP 478(OE) : MACHINERY FOR LAND DEVELOPMENT

Cr. Hrs. 3 (2 +0 + 1)

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

Course Outcome: At the end of the course, the student will have the knowledge of different earth moving machineries used for land development operation.

Unit-I

Land leveling: Criteria for land leveling, plane profile and inspection, engineering fundamentals related to earth-moving machinery.

Unit-II

Earth moving and excavation machines classification and application of bulldozers, advantage and disadvantage, straight and angle bulldozers, moving earth with bulldozers and estimation of output of a bulldozer numerical problems.

Land clearing equipments, Power shovel: Construction and operation of power shovel size selection of power shovel factors affecting the output of a power shovel.

Unit-III

Scraper: Types, construction and operation of scrapers, size of the scraper, cycle time production rates of scrapers, numerical problems, load-growth curve and estimation of output of a scraper.

Dragline: Types of dragline, size basic parts and operation of a dragline, output of a dragline, estimation of output, effect of different factors on output, numerical problems.

Clam shell: Basic parts and operation of a clam shell, application, size and output of a clam shell.

Motor grader: Construction and operation of motor grader, application, basic adjustment parameters of major grader, output of motor grader,

Unit-IV

Trenching machines: Types, construction and operation of wheel and ladder type trenching machines, selection of suitable equipment for excavating trenches and production rates of trenching machines.

Practical

1. Study of various components of bulldozers.
2. Study of various components of Scraper.
3. Study of various components of Dragline .
4. Study of various components of Clam shell.
5. Study of various components of Scraper: Motor grader.
6. Study of various components of Scraper: Trenching machines.

Suggested Readings

1. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
2. Mahesh Verma. Construction equipment and its planning and application.
3. Jagman Singh. Heavy construction, planning, equipment and methods.
4. A.M. Michael. Irrigation theory and practices.

PFE 478(OE):PACKAGING MATERIALS AND METHODS

Cr. Hrs. 3 (2 +0+ 1)

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

Course Outcome: At the end of the course, the student will be able to acquaint with various packaging materials, various aspects of packaging methods and technology.

Unit-I

Factors affecting package material, Packaging, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging.

Unit-II

Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

Unit-III

Labeling on packages, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

Unit-IV

Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile/compressive strength of given material/package.
3. Vacuum packaging of agricultural produces.

4. Determination of tearing strength of paper board.
5. Measurement of thickness of packaging materials.
6. To perform grease-resistance test in plastic pouches.
7. Determination of bursting strength of packaging material.
8. Determination of water-vapour transmission rate.
9. Shrink wrapping of various horticultural produce.
10. Testing of chemical resistance of packaging materials.
11. Determination of drop test of food package and visit to relevant industries.

Suggested Readings

1. Coles R., McDowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Blackwell Publishing Co.
2. Gosby, N.T. 2001. Food Packaging Materials, Applied Science Publication
3. John, P.J. 2008. A Handbook on Food Packaging, Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata McGraw Hill
5. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide, Narendra Publishing House.
6. Robertson, G. L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and Francis Pub.

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